Original Article

ความชุกของการฉีดวัคซีนป้องกันมะเร็งปากมดลูก Human Papillomavirus (HPV) ในนักศึกษาหญิงมหาวิทยาลัยขอนแก่น

Prevalence of Human Papillomavirus (HPV) Vaccination among Female Students at Khon Kaen University

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บทคัดย่อ

หลักการและวัตถุประสงค์: การติดเชื้อไวรัสแปปิโลมา หรือเอชพีวี human papillomavirus (HPV) เป็นสาเหตุสำคัญของมะเร็งปากมดลูกทั่วโลก การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาความชุกของการฉีดวัคซีนป้องกันมะเร็งปากมดลูก human papillomavirus (HPV) ในนักศึกษาหญิงมหาวิทยาลัยขอนแก่น ซึ่งเป็นมหาวิทยาลัยที่ใหญ่ที่สุดในภาคตะวันออกเฉียงเหนือของประเทศไทย

วิธีการศึกษา: เป็นการศึกษาเชิงพรรณนาสำรวจภาคตัดขวาง ใช้วิธีสุ่มตัวอย่าง แจกแบบสอบถามภาษาไทยจำนวน 11 ข้อ ให้กับนักศึกษาหญิงปริญญาตรี และปริญญาโท ที่ศึกษาอยู่ในมหาลัยขอนแก่น ในช่วงเดือนมีนาคม พ.ศ. 2567 โดยรวบรวมข้อมูลทางสังคมวิทยาและการฉีดวัคซีน HPV โดยเฉพาะ

ผลการศึกษา: มีการรวบรวมแบบสอบถามที่ครบถ้วนสมบูรณ์จำนวน 201 ชุด ของผู้ตอบแบบสอบถาม อายุของเฉลี่ยอาสาสมัคร 20.56 ปี (ส่วนเบี่ยงเบนมาตรฐาน 20.56±1.41 ปี) ส่วนใหญ่เป็นนักศึกษาระดับปริญญาตรี (ร้อยละ 99.50) และ มาจากภาคตะวันออกเฉียงเหนือ (ร้อยละ 86.07) ความชุกของการฉีดวัคซีน HPV ร้อยละ 20.40 (41/201) อายุเฉลี่ยของการฉีดวัคซีน HPV คือ 18.24 ± 3.22 ปี ส่วนใหญ่นักศึกษาได้รับการฉีดวัคซีน (ร้อยละ 68.29) ได้รับการ

รับต้นฉบับ 24 มีนาคม 2567 | แก้ไขต้นฉบับ 23 พฤษภาคม 2567 | รับต้นฉบับตีพิมพ์ 23 พฤษภาคม 2567

จ่ายค่าฉีดวัคซีนจากแหล่งภายนอก ผู้ตอบแบบสอบถาม (ร้อยละ 53.66) ไม่ทราบประเภทของวัคซีน HPV ที่พวกเขาได้รับ (2, 4 หรือ 9 สายพันธุ์) และนักศึกษาที่ได้รับวัคซีน HPV 1, 2 และ 3 เข็ม เท่ากับร้อยละ 58.54, 26.83 และ 14.63 ตามลำดับ ที่สำคัญนักศึกษาหญิงทราบความเกี่ยวข้องระหว่างการติดเชื้อไวรัส HPV และมะเร็งปากมดลูก ร้อยละ 86.57

สรุป: นักศึกษาหญิง มหาวิทยาลัยขอนแก่น ร้อยละ 86.57 ทราบว่า HPV เป็นสาเหตุหลักของมะเร็งปากมดลูก แต่มีนักศึกษาเพียงร้อยละ 20.40 เท่านั้นที่รายงานว่าได้รับการฉีดวัคซีนป้องกันการติดเชื้อ HPV จึงจำเป็นต้องดำเนินการเพิ่มเพื่อเพิ่มเติมอัตราการฉีดวัคซีน HPV ให้กับนักศึกษาหญิงมหาวิทยาลัยขอนแก่น

คำสำคัญ: ความชุก, การฉีดวัคซีนป้องกันมะเร็งปากมดลูก, Human Papillomavirus (HPV), นักศึกษาหญิง มหาวิทยาลัยขอนแก่น

Abstract

Background and objective: Human papillomavirus (HPV) infection is the leading cause of cervical cancer worldwide. The aim of this study was to investigate the prevalence of human papillomavirus (HPV) vaccination among female students at Khon Kaen University (KKU) - the largest university in Northeastern Thailand.

Methods: The cross-sectional survey study was conducted using the convenience sampling method, an 11-item Thai language questionnaire was distributed to female undergraduate/graduate students on/around the KKU campus during March 2024. Sociodemographic and HPV vaccination-specific data were collected.

Results: A total of 201 fully completed questionnaires were analyzed. The mean ± standard deviation age of overall respondents was 20.56±1.41 years. The vast majority of respondents (99.50%) were undergraduate students, and 86.07% of overall students were from the Northeastern region of Thailand. The prevalence of HPV vaccination in this study was 20.40% (41/201); the mean age at HPV vaccination was 18.24±3.22 years; most vaccinated women (68.29%) had their vaccine paid for by an outside source; the majority of respondents (53.66%) did not know the type of HPV vaccine they received (2-, 4-, or 9-strain); and, the percentage of vaccinated women who had 1, 2, and 3 doses of HPV vaccine was 58.54%, 26.83%, and 14.63%, respectively. Importantly, 86.57% of overall study women reported knowing the association between HPV infection and cervical cancer.

Conclusions: Despite the fact that 86.57% of overall female KKU students reported knowing that HPV is the main cause of cervical cancer, only 20.40% of students reported being vaccinated against HPV infection. More needs to be done to increase the rate of HPV vaccination among female students at Khon Kaen University.

Keywords: Prevalence, Human Papillomavirus (HPV) Vaccination, Female students, Khon Kaen University

Introduction

Cervical cancer is the fourth most diagnosed cancer and the fourth leading cause of cancer death in women worldwide[1], and human papillomavirus (HPV) infection is the leading cause of cervical cancer.[2] There are more than 150 strains of HPV. Although most HPV strains pose no significant risk to human health, there are oncogenic or HPV high-risk strains (16, 18, 31, 33, 35, 39, 45, 51, 52, and 58) that are associated with cervical, vulvar, vaginal, and anal cancers, and non-oncogenic or low-risk HPV strains (6, 11, 40, 42, 43, 44, and 54) that are associated with genital warts.[3] One of the most worrisome aspects of HPV infection is that a significant proportion of cases are transient and/or asymptomatic.[4] In many of these cases, since no symptoms are observed, no investigation or treatment is sought. Moreover, since most women do not attend regularly scheduled gynecologic examinations to screen for HPV and other conditions, precancerous and cancerous lesions are often identified late in the course of disease, which lowers the likelihood of a favorable outcome of treatment.[5]

According to the Centers for Disease Control and Prevention (CDC), children aged 11 to 12 years should receive two doses of HPV vaccine given 6 to 12 months apart. HPV vaccines can be given starting as young as age 9 years. However, children who start their HPV vaccination regimen on or after their 15th birthday need three doses of HPV vaccine given over 6-month period. HPV vaccination should be completed before becoming sexually active since the objective of the vaccine is to prevent new HPV infection.[6] There are currently 3 types of HPV vaccine available, including 2-strain, 4-strain, and 9-strain HPV vaccine regimens. The 2-strain vaccine covers HPV strains 16 and 18 (brand name: Cervarix®; GlaxoSmithKline, Middlesex, UK); the 4-strain vaccine covers HPV strains 6, 11, 16, and 18 (brand name: Gardasil®; Merck & Co. Rahway, New

Jersey, USA); and, the 9-strain vaccine covers HPV strains 6, 11, 16, 18, 31, 33, 45, 52, and 58 (brand name: Gardasil 9®; Merck & Co.).

HPV vaccination was first introduced in Thailand in 2017; however, free nationwide availability of the 4-strain HPV vaccine was made available to all 5th grade Thai school girls in 2022 as part of Thai National Healthcare policy.[7] It is, however, important to note that this vaccine is voluntary and not all eligible female students may agree to accept the vaccine. It is, therefore, essential that we learn and understand the level of awareness about HPV and attitudes towards HPV vaccine acceptance among women as an important step towards lowering the incidence of HPV infection. Khon Kaen University (KKU) is the largest university in Northeastern Thailand, which is also the largest region of Thailand. Moreover, the Faculty of Medicine, Khon Kaen University is rated the 4th leading medical school in Thailand.[8] This, in addition to the fact that KKU has an undergraduate and graduate student population exceeding 35,000 that come from provinces located all across Thailand, makes KKU an ideal place to study female understanding of HPV infection and the prevalence of HPV vaccination among college age Thai females.

The aim of this study was to investigate the prevalence of HPV vaccination among female undergraduate and graduate students at KKU. If the findings of this study reveal an unacceptably low rate of HPV vaccination, further study in a much larger study population will be needed to identify the factors that are significantly and independently associated with the decision to accept or reject HPV vaccination in this highly vulnerable population.

Methods

Study protocol

This survey-based cross-sectional study was conducted on the campus of KKU, and the data were collected during March 2024. Undergraduate and graduate Thai female KKU students were eligible for inclusion. Individuals that were approached and asked to participate in this study were given a small pamphlet in Thai and English language (Figure 1) that describes the objective of the study, and that declares how completing and submitting the questionnaire would be interpreted as conscious willingness to allow her data to be confidentially included in the study.

Questionnaire development and translation

Using the convenience sampling method, a custom developed 11-item Thai language questionnaire was distributed by hand to female undergraduate and graduate KKU students at locations on and around the KKU campus. The questionnaire was first drafted in English and then translated to Thai using the language translation feature of the Google search engine website (https://translate.google.com/). The generated English to Thai translation was then checked for accuracy by a bilingual (Thai/English) coauthor (JCJ), and by a bilingual (Thai/English) Thai registered nurse that was not otherwise affiliated with the study. Since only Thai female students were included, only the Thai version of the survey was used to collect respondent data. The arbitrarily determined target sample size was 200 fully completed questionnaires. No formal sample size calculation was performed.

Data collection

The data collection strategy involved collecting surveys at different locations on and around the KKU campus in order to reduce location bias. An introductory flyer was created in both English and Thai language to introduce the author collecting the data (JCJ), describing the aim of the study, describing the informed consent protocol, and inviting them to participate by completing the questionnaire. The flyer (in both languages) is shown in Figure 1.

A.

Hello :)

My name is Jacqueline Carolyn Jones, I am a 7th grader at the Demonstration School of Khon Kaen University (KKU) - Satit Suksasat, and I am conducting a research project. This study aims to investigate the prevalence of human papillomavirus (HPV) vaccination among female students at KKU. Voluntarily completing and submitting this questionnaire implies your agreement to allow your data to be **confidentially** included in this study. Thank you for your time and your willingness to participate. This 11-item survey will take approximately 2 minutes to complete.

B.

สวัสดีค่ะ :)

ฉันชื่อเด็กหญิง แจ็กเกอลีน แคโรลีน โจนส์ ฉันอยู่ชั้นมัธยมศึกษาปีที่ 1 โรงเรียนสาธิตมหาวิทยาลัยขอนแก่น - ศึกษาศาสตร์ และฉันกำลังทำโครงการวิจัย การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาความชุกของการฉีดวัคซีน Human Papillomavirus (HPV) ในนักศึกษาหญิงของมหาวิทยาลัยขอนแก่น การกรอกและส่งแบบสอบถามนี้โดยสมัครใจแสดงว่าคุณตกลงที่จะอนุญาตให้ข้อมูลของคุณถูกรวมไว้เป็นความลับในการศึกษานี้ ขอขอบคุณสำหรับเวลาและความเต็มใจที่จะเข้าร่วมการทำแบบสอบถามนี้ แบบสำรวจ 11 ข้อนี้จะใช้เวลาประมาณ 2 นาทีจึงจะเสร็จสิ้น

Figure 1. The research pamphlet that was given to individuals that were approached with a request to complete the study questionnaire and join the study: (A) English language version that was translated to the (B) Thai language version that was distributed with the Thai language questionnaire.

A free pencil or pen was given to each participating respondent as a gesture of appreciation after submitting their completed paper survey form. No prior mention of the pencil/pen was made to avoid incentivization bias. The English language and Thai language study questionnaires are shown in Supplementary Figures 1 and 2, respectively, which are located after the references.

The following data were collected: current age, hometown located in what region of Thailand, student educational status (undergraduate or graduate student), enrolled at which KKU faculty or college, the highest level of education achieved by the student's mother or father, existing awareness (yes or no) that HPV is the leading cause of cervical cancer among women, HPV vaccination status (yes or no), age at HPV vaccination, who

paid for the HPV vaccine, how many strain HPV vaccine was received (2, 4, 9, or not sure), and the number of doses (injections) of HPV vaccine received (1, 2, or 3).

Measurement outcomes

The primary outcome was the percentage of female KKU students who have been vaccinated against HPV infection. The secondary outcomes were mean age at HPV vaccination, who paid for the HPV vaccine, how many strain HPV vaccine was received, the number of doses/injections of HPV vaccine received, and awareness (or not) that HPV is the leading cause of cervical cancer among women.

Statistical analysis

Categorical data are described as number and percentage, and normally-distributed continuous data are described as mean plus/minus (±) standard deviation (SD). There was no non-normally distributed continuous data in this study. All calculations in this study were manually calculated, except for the mean ± SD for current age and age at vaccination. Those values were obtained by using the statistical tools available at the www.calculator.net website (https://www.calculator.net/standard-deviation-calculator.html).

Results

A total of 201 fully completed questionnaires were obtained during the March 2024 data collection period. Table 1 shows the sociodemographic characteristics of all included female KKU students, and compared between female student who have and have not been vaccinated for HPV.

Table 1 Sociodemographic characteristics of all included female KKU students, and compared between women who have and have not been vaccinated for HPV

Characteristics	All students (n=201) Mean±SD or n (%)	Vaccinated (n=41) Mean±SD or n (%)	Not vaccinated (n=160) Mean±SD or n (%)
- Current age (years)	20.56 ± 1.41	20.37 ± 1.46	20.62 ± 1.39
KKU student status			
- Undergraduate student	200 (99.50)	41 (100.00)	159 (99.38)
- Graduate student	1 (0.50)	0 (0.00)	1 (0.62)
Hometown is located in what region of Thailand?			
- Northeastern Thailand	173 (86.07)	34 (82.93)	136 (85.00)
- Northern Thailand	3 (1.49)	1 (2.43)	2 (1.25)
- Central Thailand	16 (7.96)	4 (9.76)	15 (9.38)
- Southern Thailand	9 (4.48)	2 (4.88)	7 (4.37)
KKU faculty/college			
- Non-medical-related			
- Agriculture	16 (7.96)	2 (4.88)	14 (8.75)
- Architecture	3 (1.49)	0 (0.00)	3 (1.87)
- Science	16 (7.96)	3 (7.32)	13 (8.13)
- Business Administration/Accountancy	11 (5.47)	4 (9.76)	6 (3.75)
- Technology	8 (3.98)	0 (0.00)	8 (5.00)
- Economics	5 (2.49)	0 (0.00)	5 (3.13)
- Education	30 (14.93)	3 (7.32)	27 (16.88)
- Engineering	3 (1.49)	0 (0.00)	3 (1.87)
- Fine and Applied Arts	0 (0.00)	0 (0.00)	0 (0.00)
- Graduate Study in Management	0 (0.00)	0 (0.00)	0 (0.00)
- Humanities and Social Sciences	12 (5.97)	3 (7.32)	9 (5.63)
- Interdisciplinary Studies	1 (0.50)	1 (2.44)	0 (0.00)
- International College	49 (24.38)	9 (21.95)	40 (25.00)
- Law	1 (0.50)	0 (0.00)	1 (0.62)
- Local Administration	0 (0.00)	0 (0.00)	0 (0.00)

Characteristics	All students (n=201) Mean±SD or n (%)	Vaccinated (n=41) Mean±SD or n (%)	Not vaccinated (n=160) Mean±SD or n (%)
- Medical-related			
- Dentistry	1 (0.50)	0 (0.00)	1 (0.62)
- Associated Medical Sciences	17 (8.45)	6 (14.63)	11 (6.88)
- Medicine	10 (4.98)	8 (19.51)	2 (1.25)
- Nursing	0 (0.00)	0 (0.00)	0 (0.00)
- Pharmaceutical Sciences	2 (0.99)	1 (2.44)	1 (0.62)
- Public Health	16 (7.96)	1 (2.44)	15 (9.38)
- Veterinary Medicine	16 (7.96)	3 (7.32)	13 (8.13)
Highest level of education achieved by respondent's father or mother	0 (0.00)	0 (0.00)	1 (0.62)
- No diploma or degree	42 (20.89)	10 (24.39)	32 (20.00)
- High school diploma	47 (23.38)	8 (19.51)	39 (24.37)
- Polytechnic diploma	4 (1.99)	1 (2.44)	3 (1.88)
- Bachelor's degree	70 (34.83)	16 (39.02)	55 (34.37)
- Master's degree	25 (12.44)	3 (7.32)	21 (13.12)
- Doctoral degree	4 (1.99)	1 (2.44)	3 (1.88)
- Professional degree [a]	9 (4.48)	2 (4.88)	7 (4.38)
Respondent reported being aware that HPV is the leading cause of cervical cancer	174 (86.57)	39 (95.12)	136 (85.00)

[a] Medical doctor, dentist, veterinarian, etc.

Abbreviations: HPV, human papillomavirus; KKU, Khon Kaen University; SD, standard deviation

The mean ± standard deviation age of overall respondents was 20.56±1.41 years. The vast majority of respondents (99.50%) were undergraduate students, and 86.07% of overall students were from the Northeastern region of Thailand. The most commonly reported highest level of education attained by either the student's mother or father was bachelor's degree (34.83%), followed by high school diploma (23.38%) and no diploma or degree (20.89%). Surveys were obtained from students attending 17 of KKU's 22 colleges/faculties (77.27%).

Table 2 describes the vaccination-related characteristics of female KKU students who received HPV vaccination.

Table 2 Vaccination-related characteristics of female KKU students who received HPV vaccination

Characteristics	(n=41) Mean±SD or n (%)
Mean age at HPV vaccination (years)	18.24 ± 3.22
Who paid for your HPV vaccine?	
- Self-pay	13 (31.71)
- Cost covered by outside source [a]	28 (68.29)
How many strain HPV vaccine received	
- 2-strain [b]	8 (19.51)
- 4-strain [c]	8 (19.51)
- 9-strain [d]	3 (7.32)
- Unsure	22 (53.66)
Number of doses (injections) of HPV vaccine received	
- 1 dose	24 (58.54)
- 2 doses	11 (26.83)
- 3 doses	6 (14.63)
Awareness that HPV is the leading cause of cervical cancer among women	
- Yes	39 (95.12)
- No	2 (4.88)

[a] The cost of the HPV vaccine covered by insurance, employer, the government, or some other funding source

[b] HPV strains 16, 18 (Cervarix®)

[c] HPV strains 6, 11, 16, 18 (Gardasil®)

[d] HPV strains 6, 11, 16, 18, 31, 33, 45, 52, 58 (Gardasil 9®)

Abbreviations: HPV, human papillomavirus; KKU, Khon Kaen University

The prevalence of HPV vaccination in this study was 20.40% (41/201); the mean age at HPV vaccination was 18.24±3.22 years; most vaccinated women (68.29%) had their vaccine paid for by an outside source; the majority of respondents (53.66%) did

not know the type of HPV vaccine (2-, 4-, or 9-strain) they received; and, the percentage of vaccinated women who had 1, 2, and 3 doses of HPV vaccine was 58.54%, 26.83%, and 14.63%, respectively. Importantly, 86.57% of overall study women reported knowing the association between HPV infection and cervical cancer.

Discussion

The present study set forth to investigate the prevalence of HPV vaccination among female students at KKU. The main finding of this study is that an unacceptably low percentage of female study respondents (20.40%) are vaccinated against HPV infection. This finding is somewhat consistent with those reported from previous studies. Aldawood, et al.[9], Chen, et al.[10], and Juntasopeepun, et al.[11] conducted studies at universities in Saudi Arabia, China, and Thailand, and found the rates of HPV vaccination to be 5.2%, 23.6%, and 1.2% - all respectively. The wide variation in reported HPV vaccination rates can be attributed to a range of factors, including differences in patient education, culture, family income, government healthcare policy, and an increase in disease awareness over time.

Regarding the mean age of female KKU students at HPV vaccination, the mean age of 18.24±3.22 years is far higher than the recommended optimal vaccination age of 11 or 12 years.[6] Reasons that may explain the higher mean age found in this study include later patient education and awareness of HPV risk, HPV vaccine hesitancy, and financial limitations.

Concerning the party who paid for the HPV vaccine, we found that most respondents (68.29%) had their HPV vaccine paid for by an outside source, such as private, employer provided, or government provided insurance or some other type of institutional funding support, such as non-governmental organizations or public health clinics. A low 31.71% of respondents paid for their HPV vaccine themselves. This finding is unsurprising since the cost of HPV vaccination is out financial reach for many families. This might also help to explain the disparity between the high proportions of women who reported knowing about HPV-related cancer risk (86.57% of overall women, 95.12% of vaccinated women, and 85.00% of non-vaccinated woman) and the low HPV vaccination rate (20.40%). Since the results of this study have revealed an unacceptably low HPV

vaccination rate among female students at KKU but a high cause and effect awareness, further study is needed to understand the determinants that influence the student decision not to become vaccinated.

Regarding how many strain HPV vaccine (2-, 4-, or 9-strain) was received by study subjects, most female KKU students (53.66%) reported not knowing how many strain HPV vaccine they received. Among those who reported knowing, 19.51% received the 2-strain vaccine, 19.51% received the 4-strain vaccine, and 7.32% received the 9-strain vaccine. Current and future patient education about this topic should include the importance of having and retaining this knowledge because it influences the duration of immunity, the number of injections needed, and the recommended duration between injections.

Concerning the number of doses/injections of HPV vaccine received, the majority of respondents in this study received 1 dose/injection of HPV vaccine (58.54%), followed by 2 doses (26.83%) and 3 doses (14.63%). In stark and absolute contrast, Sonawane, et al.[12] studied women in the United States, and among the 616 women who received at least 1 dose of HPV vaccine, they found the number of doses of HPV vaccine received to be 1 dose (17.21%), 2 doses (20.45%), and 3 doses (62.34%). Differences between our study and the Sonawane, et al. study may be due to several factors, including cost (if self-pay), a failure to return for follow-up injection(s), and failure to understand the need to have more than one vaccine dose/injection in order to be protected against HPV infection. Another concern is that all of the currently available HPV vaccines require at least 2 doses. Even though most respondents in our study reported not knowing which HPV vaccine regimen they received, 58.54% of our study women reported receiving only one dose of HPV vaccine, which suggests that many women who think they are fully vaccinated against HPV are not.

The most commonly reported highest level of education attained by either the student's mother or father was bachelor's degree (34.83%), followed by high school diploma (23.38%) and no diploma or degree (20.89%). Since close to half of respondents reported a lower level of parental education, education cannot be ruled out as a factor the influences either HPV knowledge or the decision to get or not get vaccinated against HPV infection.

Not surprisingly, the vast majority of student respondents come from the Northeastern region of Thailand, but a small proportion from the Northern, Central, and Southern regions were also included. Concerning our cross-sectional coverage of the 22 colleges/faculties at KKU, we surveyed students from 17 KKU colleges/faculties for a coverage rate of 77.27%.

Regarding respondent awareness (or not) that HPV is the leading cause of cervical cancer among women, we found that most female KKU students (174/201, 86.57%) reported being aware of the relationship between HPV infection and cervical cancer; however, the prevalence of HPV vaccination was only a modest 20.40%. Among the HPV vaccinated and non-vaccinated groups, the rates of HPV cause and effect awareness were 95.12% (39/41) and 85.00% (136/160), respectively. This suggests a disconnect between respondent knowledge about the relationship between HPV and cervical cancer and the action step of getting vaccinated against HPV infection. Other previously published studies reported a low proportion of study subjects knowing that HPV infection is the leading cause of cervical cancer. A study conducted in South Africa by Tiiti, et al. found that only 18.8% of 527 women reported knowing that HPV infection causes cervical cancer.[13] A questionnaire-based study from the United States by Stark, et al. reported that a modest 19% of 328 respondents admitted awareness of the negative relationship between HPV infection and cervical cancer.[14] Despite that fact that this information is widely available, there may still be a problem effectively communicating the importance of this relationship and the resulting healthcare crisis to women of all ages. The results of this study and of the aforementioned published reports strongly suggests the need to reassess how this information is being disseminated to women, and to find improved methods for communicating this critically important message to women.

Limitations

This study has some mentionable limitations. First, translation of the English version of the questionnaire to Thai language was performed using the language translation feature of Google with subsequent translation accuracy evaluation by a bilingual (Thai/English) coauthor (JCJ) and by a bilingual (Thai/English) Thai registered

nurse. However, the language translation process employed in this study did not follow internationally recognized guidelines for language translation in a research setting. Second, neither the original English language version or the translated Thai version of the study questionnaire were validated before use. Third, a potential selection bias may have been created by including medical students, dental students, pharmacy students, associated medical science students, nursing students, and veterinary students since these groups have a medical orientation that would predispose them to more awareness about HPV and its related risks compared to non-medically-oriented groups of students. Fourth, the decision was made not to collect monthly family household income data due to respondent family privacy-related concerns. Fifth and last, the aim of this study was to initially investigate the prevalence of HPV vaccination at KKU, so more sophisticated statistical comparisons and regression analyses were not performed to identify both significant differences between groups and significant/independent factors associated with HPV vaccination-related behaviors. Having acknowledged these limitations, the strength of this study is that it is the first to investigate the overall prevalence of HPV vaccination among female students at KKU, which is one of the largest universities in Thailand. Future study in a larger study population that is designed to mitigate the acknowledged limitations of this study is warranted.

Conclusion

Despite the fact that 86.57% of overall female KKU students reported knowing that HPV is the main cause of cervical cancer, only 20.40% of students reported being vaccinated against HPV infection. More needs to be done to increase the rate of HPV vaccination among female students at Khon Kaen University. Future study may provide additional important data that supports the need for a change in Thailand healthcare policy to provide HPV vaccine coverage to Thai females of all ages.

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Conflict of interest declaration

Both authors declare no personal or professional conflicts of interest relating to any aspect of this study.

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Authors' contributions

KJ conceived and designed the study, designed the questionnaire, participated in the recording and organization of the data, conducted the statistical analysis, prepared the first draft of the manuscript, and assumes the role of corresponding author. JCJ participated in the conception of the study, collected all of the data, participated in the data interpretation process, and provided English language to Thai language translations and translation corrections. Both authors have read and are in agreement with the version of the manuscript submitted for journal publication.

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Supplementary Figure 1. The English language research questionnaire that was translated to Thai language for use in this pilot study

Research Questionnaire

Voluntarily completing and submitting this questionnaire implies your agreement to allow your data to be **confidentially** included in this study. Thank you for your time and your willingness to participate. This 11-item survey will take approximately 2 minutes to complete.

1. What is your current age?
   a) _____ years
2. Hometown located in what region of Thailand? (please ✓ one)
   a) Northeastern Thailand _____
   b) Northern Thailand _____
   c) Central Thailand _____
   d) Southern Thailand _____
3. Are you an undergraduate student (bachelor's degree program) or a graduate student (master's degree or doctoral degree program) at KKU? (please ✓ one)
   a) Undergraduate student _____
   b) Graduate student _____
4. What is your KKU faculty or college? (please ✓ one)
   a) Agriculture _____
   b) Architecture _____
   c) Associated Medical Sciences _____
   d) Business Administration/Accountancy _____
   e) Dentistry _____
   f) Economics _____
   g) Education _____
   h) Engineering _____
   i) Fine and Applied Arts _____
   j) Graduate Study in Management _____
   k) Humanities and Social Sciences _____

l) Interdisciplinary Studies _____
m) International College _____
n) Law _____
o) Local Administration _____
p) Medicine _____
q) Nursing _____
r) Pharmaceutical Sciences _____
s) Public Health _____
t) Science _____
u) Technology _____
v) Veterinary Medicine _____

5. What is the highest level of education achieved by either your father or your mother? (Please check one answer only)
   a) No diploma or degree _____
   b) High school diploma _____
   c) Polytechnic diploma _____
   d) Bachelor's degree _____
   e) Master's degree _____
   f) Doctoral degree _____
   g) Professional degree _____
6. Are you aware that HPV is the leading cause of cervical cancer among women? (please ✓ one)
   a) Yes _____
   b) No _____
7. Have you ever been vaccinated for human papillomavirus (HPV)? (please ✓ one)
   a) Yes _____
   b) No _____
8. At what age did you receive your HPV vaccination?

If you answered '**yes**' to question 6, **please proceed and answer all remaining questions**.
If you answered '**no**' to question 7 - please STOP and submit your questionnaire

a) _____ years

9. Who paid for your HPV vaccine? (please ✓ one)
   a) Self pay (paid for in cash by yourself or family) _____
   b) Cost covered by someone else (insurance, employer, government, etc.) ____
10. Did you receive a 2-strain, 4-strain, or 9-strain HPV vaccine? (please ✓ one)
   a) 2-strain _____ (protects against HPV strains 16 and 18 - Cervarix®)
   b) 4-strain _____ (protects against HPV strains 6, 11, 16, and 18 - Gardasil®)
   c) 9-strain _____ (protects against HPV strains 6, 11, 16, 18, 31, 33, 45, 52, 58 - Gardasil 9®)
   d) Unsure _____
11. How many doses (injections) of HPV vaccine did you receive? (please ✓ one)
   a) 1 dose _____
   b) 2 doses _____
   c) 3 doses _____

Supplementary Figure 2. The Thai language research questionnaire used in this pilot study

แบบสอบถามวิจัย

การกรอกและส่งแบบสอบถามนี้โดยสมัครใจแสดงว่าคุณตกลงที่จะอนุญาตให้ข้อมูลของคุณถูกรวมไว้เป็นความลับในการศึกษานี้ ขอขอบคุณสำหรับเวลาและความเต็มใจที่จะเข้าร่วม แบบสำรวจ 11 ข้อนี้จะใช้เวลาประมาณ 2 นาทีจึงจะเสร็จสิ้น

1. ปัจจุบันคุณอายุเท่าไหร่?
   a) _____ ปี
2. บ้านเกิดอยู่ภาคใดของประเทศไทย? (กรุณา ✓ หนึ่งอัน)
   a) ภาคตะวันออกเฉียงเหนือของประเทศไทย _____
   b) ภาคเหนือของประเทศไทย _____
   c) ภาคกลางของประเทศไทย _____
   d) ภาคใต้ของประเทศไทย _____
3. คุณเป็นนักศึกษาระดับปริญญาตรี (หลักสูตรปริญญาตรี) หรือนักศึกษาระดับบัณฑิตศึกษา (หลักสูตรปริญญาโทหรือปริญญาเอก) ที่ มข.? (กรุณา ✓ หนึ่งอัน)
   a) นักศึกษาระดับปริญญาตรี _____
   b) นักศึกษาระดับบัณฑิตศึกษา _____

4. คณะหรือวิทยาลัย มข. ของคุณคือคณะอะไร? (กรุณา ✓ หนึ่งอัน)
   a) เกษตรกรรม _____
   b) สถาปัตยกรรม _____
   c) วิทยาศาสตร์การแพทย์ที่เกี่ยวข้อง _____
   d) บริหารธุรกิจและการบัญชี _____
   e) ทันตกรรม _____
   f) เศรษฐศาสตร์ _____
   g) การศึกษา _____
   h) วิศวกรรม _____
   i) ศิลปกรรมศาสตร์และประยุกต์ _____
   j) การศึกษาระดับบัณฑิตศึกษาสาขาการจัดการ _____
   k) มนุษยศาสตร์และสังคมศาสตร์ _____
   l) สหวิทยาการศึกษา _____
   m) วิทยาลัยนานาชาติ _____
   n) กฎหมาย _____
   o) การปกครองท้องถิ่น _____
   p) การแพทย์ _____
   q) การพยาบาล _____
   r) เภสัชศาสตร์ _____
   s) สาธารณสุข _____
   t) วิทยาศาสตร์ _____
   u) เทคโนโลยี _____
   v) สัตวแพทยศาสตร์ _____
5. พ่อหรือแม่ของคุณได้รับการศึกษาระดับสูงสุดที่ใด? (โปรดตรวจสอบ ✓ หนึ่งคำตอบเท่านั้น)
   a) ไม่มีอนุปริญญาหรือปริญญา _____
   b) ประกาศนียบัตรมัธยมปลาย _____
   c) ประกาศนียบัตรโพลีเทคนิค _____
   d) ปริญญาตรี _____
   e) ปริญญาโท _____
   f) ปริญญาเอก _____
   g) ปริญญาวิชาชีพ _____

6. คุณรู้หรือไม่ว่า HPV เป็นสาเหตุสำคัญของมะเร็งปากมดลูกในผู้หญิง? (กรุณา ✓ หนึ่งอัน)
   a) ใช่ _____
   b) ไม่ _____
7. คุณเคยได้รับการฉีดวัคซีน Human papillomavirus (HPV) หรือไม่? (กรุณา ✓ หนึ่งอัน)
   a) ใช่ _____
   b) ไม่ _____

หากคุณตอบว่า 'ใช่' ในคำถามที่ 6 โปรดดำเนินการต่อและตอบคำถามที่เหลือทั้งหมด หากคุณตอบว่า 'ไม่' สำหรับคำถามที่ 7 - โปรดหยุดและส่งแบบสอบถามของคุณ

8. คุณได้รับวัคซีน HPV เมื่ออายุเท่าไร?
   a) _____ ปี
9. ใครเป็นผู้จ่ายค่าวัคซีน HPV ของคุณ? (กรุณา ✓ หนึ่งอัน)
   a) ชำระด้วยตนเอง (ชำระเป็นเงินสดด้วยตนเองหรือครอบครัว) _____
   b) ค่าใช้จ่ายที่บุคคลอื่นเป็นผู้รับผิดชอบ (ประกันภัย นายจ้าง รัฐบาล ฯลฯ) _____
10. คุณได้รับวัคซีน HPV 2 สายพันธุ์ 4 สายพันธุ์ หรือ 9 สายพันธุ์หรือไม่? (กรุณา ✓ หนึ่งอัน)
    a) 2 สายพันธุ์ _____ (ป้องกันเชื้อ HPV สายพันธุ์ 16, 18 - Cervarix®)
    b) 4 สายพันธุ์ _____ (ป้องกันเชื้อ HPV สายพันธุ์ 6, 11, 16, 18 - Gardasil®)
    c) 9 สายพันธุ์ _____ (ป้องกันเชื้อ HPV สายพันธุ์ 6, 11, 16, 18, 31, 33, 45, 52, 58 - Gardasil 9®)
    d) ไม่แน่ใจ _____
11. คุณได้รับวัคซีน HPV กี่เข็ม ? (กรุณา ✓ หนึ่งอัน)
    a) 1 เข็ม _____
    b) 2 เข็ม _____
    c) 3 เข็ม _____