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Urban-rural disparities in acceptance of human papillomavirus vaccination among women in Can Tho, Vietnam

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Key words: HPV vaccination, cervical cancer, women, urban, rural Vietnam
Parole chiave: Vaccinazione anti-HPV, cancro cervicale, donne, urbano, rurale, Vietnam

Abstract

Background. *In Vietnam, cervical cancer is a significant public health concern for women. Unfortunately, despite the availability of the HPV vaccine, low vaccination rates persist.*
Objectives. *This study investigates the discrepancy between urban and rural areas in the willingness to receive HPV vaccination with or without fees.*
Methods. *A cross-sectional study was conducted on a sample of 648 women aged between 15 and 49, living in two urban and two rural Vietnamese districts of Can Tho, between May and December 2021.*
Results. *The overall vaccination rate was 4%, with urban women having a higher rate of 4.9% compared to rural women at 3.1%. Among unvaccinated women, those from rural areas expressed a significantly higher desire to receive the free vaccine (91.4%) than urban women (84.4%). However, the intention to vaccinate declined when rural women and urban women were advised to pay the cost (63.4% and 57.1%, respectively). A strong correlation was found between a positive attitude and intention for vaccination, irrespective of its price or free availability. Education and access to information about the HPV vaccine were also identified as the most significant factors influencing the intention to vaccination among urban and rural women.*
Conclusion. *The low HPV vaccination rates among women aged 15-49 living in both urban and rural regions of Vietnam are a notable public health concern. These outcomes emphasize the critical need for*

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effective programs of vaccine laterization, as an introduction to the offer of affordable and accessible HPV vaccines for women in Can Tho, Vietnam.

Introduction

Cervical cancer is a significant public health concern that impacts women worldwide (1). The latest studies from Globocal 2018 and IARC Vietnam reported 4,177 new cases and 2,420 deaths related to cervical cancer in 2018, with an estimated 604,000 new cases and 342,000 deaths worldwide in 2020 (2). These statistics underscore an urgent need for effective prevention and control measures for cervical cancer. Therefore, comprehensive public health strategies must prioritize early detection, screening, and vaccination programs to minimize the incidence and mortality due to cervical cancer. Effective policies and interventions can significantly impact the alarming prevalence of cervical cancer, which is caused primarily by human papillomavirus (HPV) infection (3).

According to several studies, HPV is a group of viruses with worldwide presence, with over 150 types. Among these viruses, at least 13 are considered high-risk, due to their ability to cause dysplasia or cancer (1, 4). Furthermore, HPV is the leading cause of genital-anal cancer, including cervical, vaginal, and vulvar cancer, with at least 13 high-risk types responsible for such cases. Notably, not all HPV types cause clinical symptoms, and around 30-40 types of HPV are sexually transmitted. Several studies in the past have demonstrated that the prevalence of HPV is high globally (5), including Vietnam (6). The occurrence of HPV among Vietnamese married women follows a distinct pattern with age, indicating variations in sexual behaviors among various age groups. Among married women sexually active, the most frequently detected types are HPV 16, 18, 58, and 52 (7-10). Moreover, a report spanning the period from 2000 to 2013 illustrated that the overall prevalence of HPV was 7.9% (11). These findings signify the need for targeted interventions to tackle the age-specific risk factors for HPV infection among married Vietnamese women.

Recent medical advancements have led to the development and widespread utilization of a vaccine against the high-risk HPV virus types that cause cervical cancer – a substantial public health hazard. This vaccine is currently being introduced into several countries worldwide, aiming to prevent cervical cancer (1, 12). However, effective implementation of HPV vaccination programs in low- and middle-income countries faces multiple challenges, including sociocultural barriers, inadequate health systems, and governmental impediments (13). In addition, to ensure effective vaccination campaigns, active guidance strategies are required on critical aspects of HPV vaccination programs, including dosage and expenses. Furthermore, other appropriate administrative levels must be included, such as schools or clinical facilities. Addressing these challenges will be critical in minimizing the burden of cervical cancer worldwide through effective HPV vaccination programs (7, 13).

In Vietnam, the HPV vaccine was introduced in 2008 through the launch of a pilot program that employed both school-based and community-based approaches to enhance immunization rates among children. HPV vaccination should include both males and females in the prevention of problems related to this virus. However, in

Vietnam, the HPV vaccine is mostly known for being recommended by the media as the best cervical cancer prevention measure for women. The pilot program was supported by funding from the *Global Alliance for Vaccines and Immunization,* having as target the 12-year-old girls. Unfortunately, although the pilot program attained an impressive coverage rate of over 96.0%, the HPV vaccine is yet to be incorporated into the current Vietnam immunization program. In addition, even though the vaccine is relatively cheap in Vietnam, with a cost ranging from $150 to $195 for a series of three doses, compared to the global average of $400, this price still poses a significant financial burden to the majority of Vietnamese households, given the country's per capita income of approximately $2,170 in 2016 (14).

Several studies have evaluated the influence of demographic characteristics, information exposure, and prior experience on the acceptance and awareness of the HPV vaccine issue in Asia (15, 16). For instance, Yerramilli and Dugee conducted a study in Asia to conclude that a minority of surveyed women knew that cervical cancer could be prevented through vaccination. The study also found that urban women demonstrated greater awareness of preventive measures than their rural counterparts (17). Despite having lesser knowledge of risk factors, a higher percentage of rural women were willing to receive the HPV vaccine for themselves (or their daughters) than of urban women (18). In Vietnam, most studies indicate that awareness of the HPV vaccine is limited, and vaccination rates are low in regions where the vaccine is not offered for free. A cross-sectional survey conducted in Hanoi in 2018 concluded that most respondents agreed to pay for the HPV vaccine at an average cost of US $ 49.3 (19). Another study conducted by Xuan Thi Thanh Le in a Vietnamese province discovered that age, geography, monthly income, awareness of cervical cancer, knowledge of the HPV vaccine, and attitudes toward vaccination significantly predicted participants' intention to receive the vaccine (14). In order to address the low uptake of the HPV vaccine, the *Free HPV Vaccination Program for Girls* was launched in various countries like India, Peru, Uganda, and Vietnam. Parents and guardians of the girls reported a lack of awareness about the vaccination program, girls being absent from school on vaccination day, health systems not offering adequate information about cervical cancer, and challenges in assessing whether girls have had sex or not as reasons for their children not receiving the vaccine or only receiving one or two doses (20). Furthermore, previous studies conducted in Vietnam did not find a significant difference between urban and rural women in terms of their willingness to vaccinate against HPV, regardless of whether the vaccine was provided free of cost or required a fee.

Cervical cancer has become a global disease burden, severely affecting the health and psychology of women, their families, the health system, and the society. The burden of cervical cancer is very important in Southeast Asian countries, including Vietnam. Implementing HPV vaccination would produce significant health and economic benefits in these countries, due to the high cervical cancer incidence in this region. This study aimed to evaluate the willingness of unvaccinated urban and rural women aged 15-45 years to pay for HPV vaccination and their acceptance of the vaccine if provided for free to generate meaningful health data. Understanding their attitudes toward vaccination is critical, since they demonstrated greater interest in vaccination program. Thus, the findings would be vital for designing and implementing effective vaccination programs to improve the acceptance of HPV vaccines in society and minimize HPV-related diseases.

Methods

Study setting, sample size, and sampling method

A cross-sectional study was conducted among women in urban and rural districts of Can Tho City between May and December 2021. The sample size was computed using the calculation formula for estimating a proportion with a significance level of 0.04 and a confidence level of 95%. These data were a proportion of data estimates based on the study by *Touch Sothy* in Cambodia in 2016 (4) which reported that 35.6% of women were willing to pay the HPV vaccine cost. The calculated sample size was 545, and 648 individuals were obtained from this study.

The study employed a multi-stage sampling method, randomly selecting two urban and two rural districts out of five urban and four rural districts in *Can Tho* City. Next, two communes/wards were randomly selected in each district, followed by randomly selecting two sectors/hamlets in each commune/ward. Finally, 41 households with women aged 15-49 years who met the sampling criteria were chosen in each sectors/hamlet. In each household, one woman aged 15-49 was selected at the time of the survey, with preference given to those meeting the selection criteria. The inclusion criteria were women aged 15-49, currently living for at least six months at the selected sites, and consenting to participate in the study. The exclusion criteria involved candidates with mental diseases, memory disorders, muteness, deafness, and other diseases affecting communication. In addition, those participants who failed to meet the selection criteria or did not present after three invitations were excluded. Figure 1 illustrates the flowchart depicting the selection of the sampling method.

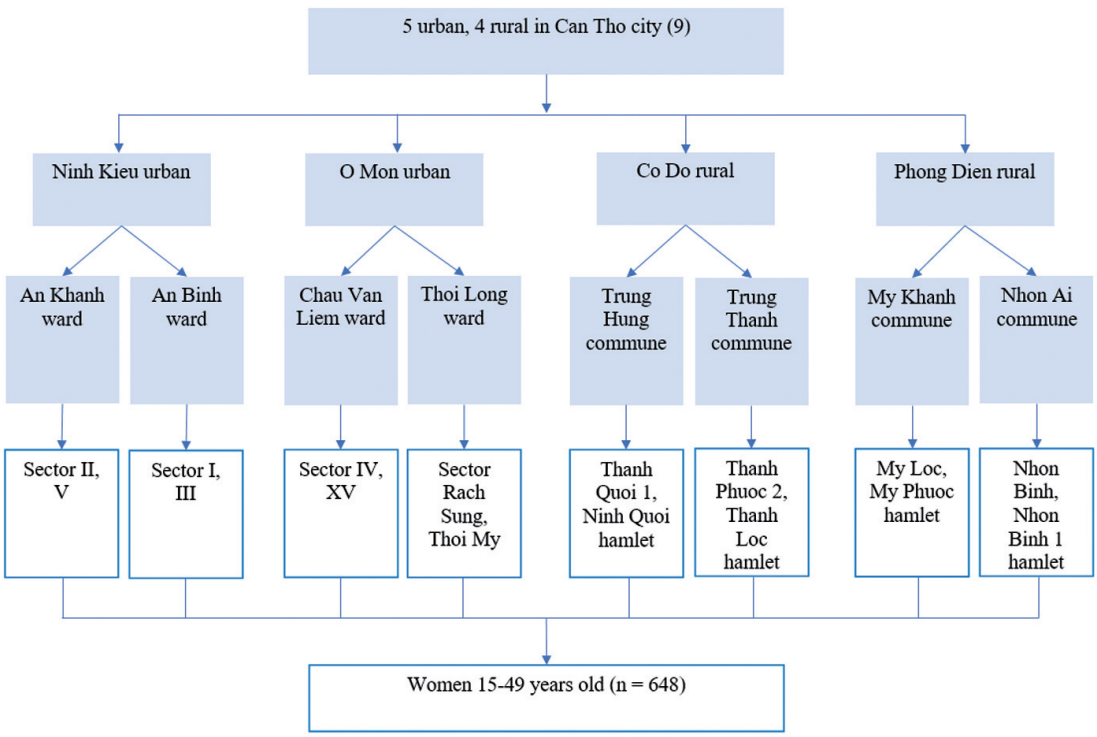

Figure 1 - Flowchart of the selection of the sample of 648 women 15-49 years old.

Measures and instruments

The study employed a Vietnamese questionnaire with a three-part structure to interview participants directly.

The first part included questions on sociological characteristics, such as age (15-30, 31-49), ethnicity (Kinh, other), religion (yes, no), marital status (single/ divorced/ separated/ widow; married, living with husband/partner), number of children (0, 1-3), an education level (secondary school or lower; upper secondary or higher), occupation (housewife; self-business; employed/farmer/ freelancers/other), personal income (yes, no), economic status (not poor; near/poor household), and place of residence (urban; rural). Furthermore, this section included questions on respondents' access to media (yes; no) and sources of information on the HPV vaccine (multiple choice) to find information about HPV vaccine (yes; no), including seeking advice from medical staff (yes; no), and advice impacting a subject's decision to vaccinate (parents/ family; friends/ colleagues; health professional; teachers; media programs; self). Near poor households are households meeting both the following criteria: 1) average personal income is more than VND 1.75 but less than VND 2.3 million per month (more than VND 21 million but less than VND 28 million/ person/year); 2) having a total 5 social deprivation score of less than 40 points.

The second part of the questionnaire focused on vaccination issues, starting with a question on participants receiving any HPV vaccine. The vaccination process is understood to include women being vaccinated with 1, 2, and 3 doses during the procedure. For those who had not received the vaccination, further questions were asked to examine 1) reasons for not being vaccinated, 2) awareness about the HPV, cervical cancer, and the HPV vaccine, and 3) attitudes towards vaccination. Finally, participants were also inquired if they would be willing to receive the vaccine if it was provided free of charge or at a low cost.

A multiple-choice question was used regarding reasons for not being vaccinated, which included options such as never having heard about the vaccine, lack of awareness, considering vaccination unnecessary, high cost, skepticism about vaccines, and being of inappropriate age, etc. The knowledge of HPV, cervical cancer, and HPV vaccine was evaluated using 25 questions, with each correct answer receiving one point.

The general knowledge score was computed as the sum of all correct answers, ranging from 1 to 25. The higher the knowledge score, the more knowledgeable the participant is about cervical cancer or HPV vaccination. Based on knowledge scores, participants were divided into two groups of good and not-good knowledge. Women were categorized as "*good*" if their knowledge score was higher than the mean for all participants. Moreover, if that score was below this mean, they were included in the "*not-good*" group.

In order to quantify attitudes towards HPV vaccination, nine questions were used, and participants were asked to rate their agreement using a 5-point *Likert* scale that ranged from 1 (strongly disagree) to 5 (strongly agree). A positive attitude towards vaccination has been defined as having at least 6 out of 9 answers that agree or strongly agree, while a negative attitude has been described as having the majority of answers strongly disagree, disagree, and neutral.

The unvaccinated women's willingness to vaccinate if offered at no cost was determined through a single yes and no choice question. Similarly, unvaccinated women's intention to accept a fee for the HPV vaccine was selected through a questionnaire with a yes and no choice.

The questionnaire was developed based on the Vietnamese Ministry of Health guidelines for preventing infectious diseases (21) and related references/studies (22, 23). To ensure questionnaire validity and reliability, face

validation was conducted. Three experts reviewed and provided feedback on the questionnaire's clarity, relevance, and structure. The revised questionnaire was then tested on ten women who met the sampling conditions, and their feedback was analyzed to improve clarity and accuracy. The Cronbach's alpha coefficient for the knowledge and attitude scales was found to be 0.855 and 0.861, respectively. This indicates a high level of internal consistency and reliability for both scales.

Statistical analysis

This study utilized SPSS 20.0 software to conduct statistical analyses. Descriptive analyses, such as frequency and percent, were employed to represent qualitative variables. Moreover, Pearson's chi-squared or Fisher's exact test was used to investigate differences between urban and rural women regarding sociodemographic characteristics, access to media, reasons for not being vaccinated, vaccine availability, and willingness to vaccinate if offered free of charge or willingness to receive HPV vaccination even with fees. The study also examined the correlation between willingness to vaccinate for free and acceptance to pay for vaccination, and sociodemographic characteristics, media access, general knowledge, and attitudes for the overall population and urban and rural subgroups. In the multivariable logistic regression analysis, the dependent variable was acceptance to pay for HPV vaccination/willingness to vaccinate if provided free of charge among urban/rural women, while independent variables were demographic information of research participants, knowledge and attitudes towards HPV vaccination. Moreover, the multivariate regression model included variables with a p-value ≤ 0.05 (obtained from univariate regression analysis). A p-value ≤ 0.05 was deemed statistically significant.

Ethical considerations

The Council of Ethics approved this study in Biomedical Research of Can Tho University of Medicine and Pharmacy (No. 162/HĐĐD.PCT dated May 28, 2020). The investigators - who were preventive medicine students - provided a comprehensive explanation of the study's objectives to all participants and confirmed that they understood the study's purpose sufficiently. Participation in the study was voluntary, and participants were assured of confidentiality, data protection, and privacy. In addition, participants were confirmed the right to withdraw from the study at any time.

Results

Out of 648 women in urban and rural areas, most participants were over 30 (72.8%) and sexually active (84.1%). Most participants were *Kinh* ethnicity (91.4%) and about 51.2% of the population followed a popular religion in Vietnam such as Buddhism, Hoa Hao, Catholicism, Cao Dai, etc.. More than half of the participants had an education from high school or higher. However, a high percentage of women worked as housewives in the family (32.7%) and had not independent income (52.5%) resources. The majority of the women in the sample were married and living with their husbands (82.1%) and had children (84.3%) (Table 1). The HPV vaccination rate in the study group was only 4%, with a slightly higher rate in urban regions (4.9%) than in rural areas (3.1%). Over half of the unvaccinated women were willing to pay for the vaccination, while more than three-fourths were willing to get it if it was free.

Inadequate access to media about HPV vaccines was a significant issue among women in the urban and rural areas (Table 2). Our survey data revealed that only a minority of women had access to information about HPV vaccines (31.5% urban and 29.6% rural), and a mere 11.7% and 10.8% of urban and rural women sought information about the vaccination. Among those with

Table 1 - Information about research participants (n=648)

Variables		Total n (%)	Urban n (%)	Rural n (%)	p-value*
Age group	15-30	176 (27.2)	81 (25.0)	95 (29.3)	0.216
	31-49	472 (72.8)	243 (75.0)	229 (70.7)	
Ethnicity	Kinh	592 (91.4)	270 (83.3)	322 (99.4)	<0.001
	Other	56 (8.6)	54 (16.7)	2 (0.6)	
Religion	No	316 (48.8)	178 (54.9)	138 (42.6)	**0.002**
	Yes	332 (51.2)	146 (45.1)	186 (57.4)	
Education level	Secondary school or lower	291 (44.9)	128 (39.5)	163 (50.3)	**0.002**
	High school or higher	357 (55.1)	196 (60.5)	161(49.7)	
Occupational	Employed/Famer/Freelancer/ other	270 (41.7)	145 (44.8)	125 (38.6)	0.117
	Housewife	212 (32.7)	118 (36.4)	94 (29.0)	
	Self-business	166 (25.6)	81 (25.0)	85 (26.2)	
Economic status	Not poor	616 (95.1)	303 (93.5)	313 (96.6)	**0.070**
	Near poor/ Poor household	32 (4.9)	21 (6.5)	11 (3.4)	
Personal income	Yes	308 (47.5)	153 (47.2)	155 (47.8)	0.875
	No	340 (52.5)	171 (52.8)	169 (52.2)	
Age started have sexually behavior	Not sexually active	103 (15.9)	45 (13.9)	58 (17.9)	0.162
	≥ 18 age	545 (84.1)	279 (86.1)	266 (82.1)	
Marital status	Single/ Divorced/Separated/ Widow	116 (17.9)	60 (18.5)	56 (17.3)	0.682
	Married, living with husband/ partner	532 (82.1)	264 (81.5)	268 (82.7)	
Number of children	0	102 (15.7)	45 (13.9)	57 (17.6)	0.196
	1-3 children	546 (84.3)	279 (86.1)	267 (82.4)	
Family history of cervical cancer	Yes	4 (0.6)	3 (0.9)	1 (0.3)	0.624**
	No	644 (99.4)	321 (99.1)	323 (99.7)	
Vaccinated with HPV vaccination	Yes	26 (4.0)	16 (4.9)	10 (3.1)	0.230
	No	622 (96.0)	308 (95.1)	314 (96.9)	
If "Not Vaccinated", Willing to get the HPV vaccine if offered for free **(n=622)**	Yes	547 (87.9)	260 (84.4)	287 (91.4)	**0.007**
	No	75 (12.1)	48 (15.6)	27 (8.6)	
If "Not Vaccinated", Acceptance to pay for HPV vaccination at a cost **(n=622)**	Yes	375 (60.3)	176 (57.1)	199 (63.4)	0.112
	No	247 (39.7)	132 (42.9)	115 (36.6)	

*Chi-square test; ** Fisher's exact test.

access to information, the internet/social networks were the most accessible channels (14.2% of urban women and 14.5% of rural women). Furthermore, advice from health professionals appeared to play a significant role in HPV vaccination decisions in both urban and rural areas, with over half of the respondents specifying that it influenced their decision (52.8% urban and 70.4% rural).

Urban and rural women possessing certain characteristics, such as a high school diploma or higher education ($p = 0.017$), non-religious affiliation ($p = 0.048$), and a positive attitude ($p < 0.001$), demonstrated

Table 2 - Media access of research participants (n=648)

Variables		Total n (%)	Urban n (%)	Rural n (%)	p*
Access to media	Yes	198 (30.6)	102 (31.5)	96 (29.6)	0.609
	No	450 (69.4)	222 (68.5)	228 (70.4)	
Sources of information	Television	87 (13.4)	36 (11.1)	51 (15.7)	0.084
	Books, Newspapers	41 (6.3)	32 (9.9)	9 (2.8)	**<0.001**
	Internet/ social network	93 (14.4)	46 (14.2)	47 (14.5)	0.911
	Friends	39 (6.0)	16 (4.9)	23 (7.1)	0.248
	Relatives/parent	33 (5.1)	17 (5.2)	16 (4.9)	0.858
	Leaflets, posters	15 (2.3)	9 (2.8)	6 (1.9)	0.433
	Medical staff	48 (7.4)	28 (8.6)	20 (6.2)	0.230
	Radio	8 (1.2)	3 (0.9)	5 (1.5)	0.725**
Find information about vaccines	Yes	73 (11.3)	38 (11.7)	35 (10.8)	0.709
	No	575 (88.7)	286 (88.3)	289 (89.2)	
Health workers advise on HPV vaccination	Yes	87 (13.4)	51 (15.7)	36 (11.1)	0.084
	No	561 (86.6)	273 (84.3)	288 (88.9)	
Advice that influences a subject's decision to vaccinate	Parents/ Family	81 (12.5)	54 (16.7)	27 (8.3)	**<0.001**
	Friends/ colleagues	47 (7.3)	30 (9.3)	17 (5.2)	
	Health professionals	399 (61.6)	171 (52.8)	228 (70.4)	
	Teachers	11 (1.7)	1 (0.1)	10 (3.1)	
	Media programs/ campaigns	56 (8.6)	24 (7.4)	32 (9.9)	
	Self	54 (8.3)	44 (13.6)	10 (3.1)	

*Chi-square test; ** Fisher's exact test.

a willingness to receive HPV vaccination when offered for free (Table 3). Furthermore, Table 4 highlights the significant correlation between positive attitudes towards vaccines among urban and rural women and their willingness to receive free HPV vaccination ($p<0.001$).

Table 5 illustrates that the most common reason for not receiving the HPV vaccine among women is never having heard of it (48.8% urban and 52.8% rural). Other causes include a lack of adequate information about the vaccine (21.9% urban and 38% rural), high cost (8.8% urban and 8.6% rural), and a lack of knowledge about where to receive the vaccine (0.9% urban and 3.4% rural).

Discussion

While several countries have effectively carried out vaccination programs, implementing HPV vaccination initiatives in some countries is challenging (4, 14). In particular, the COVID-19 pandemic has led to a decline of over 25% in global HPV vaccination coverage compared to the range achieved in 2019. This sizeable reduction has resulted in severe health consequences for women and girls, as the worldwide HPV vaccine coverage remains low at only 15% as of 2020. Notably, the first HPV vaccine was licensed over 15 years ago, underscoring the need for continued efforts to improve

Table 3 - Multivariate logistic regression analysis of factors affecting acceptance of fee for HPV vaccination among unvaccinated urban and rural women (n=622)

Variables	Total				Urban				Rural			
	OR (95%CI)	p*	aOR (95%CI)	p*	OR (95%CI)	p*	aOR (95%CI)	p*	OR (95%CI)	p*	aOR (95%CI)	p*
Age												
15-30	1.78 (1.22 -2.61)	**0.003**	1.43 (0.88-2.32)	0.146	2.54 (1.43-4.51)	**0.001**	1.58 (0.77-3.25)	0.210	1.28 (0.76-2.14)	0.342		
31-49												
Ethnicity												
Kinh	2.78 (1.57 -4.90)	**<0.001**	2.64 (1.40 – 5.0)	**0.003**	2.46 (1.34 - 4.49)	**0.003**	3.30 (1.49-7.29)	**0.003**	0.36 (0.31-0.42)	0.062**		
Other												
Religion												
No	1.77 (1.28 -2.45)	**0.001**	1.46 (1.00 -2.12)	**0.048**	1.80 (1.14 – 2.85)	**0.011**	1.14 (0.64-2.03)	0.650	1.92 (1.19-3.11)	**0.007**	1.89 (1.10-3.23)	**0.019**
Yes												
Education level												
High school or higher	2.24 (1.61-3.11)	**<0.001**	1.59 (1.08 - 2.33)	**0.017**	2.17 (1.36 – 3.45)	**0.001**	1.42 (0.80-2.50)	0.223	2.51 (1.56-4.04)	**<0.001**	1.94 (1.15-3.28)	**0.013**
Secondary school or lower												
Occupational												
Housewife	0.95 (0.65-1.38)	0.792			0.90 (0.53-1.54)	0.724	0.39 (0.19-0.79)	**0.010**	0.99 (0.58-1.70)	0.983		
Self-business	0.81 (0.54-1.21)	0.313			0.47 (0.26-0.85)	**0.012**	0.41 (0.2 - 0.85)	**0.017**	1.40 (0.78-2.51)	0.249		
Emloyed/Famer/freelancers /other	-	-		-	-	-		-				
Economic status												
Not poor	2.66 (1.27-5.55)	**0.007**	2.10 (0.91- 4.83)	0.081	2.29 (0.92–5.70)	0.068			3.16 (0.90-11.03)	0.058		
Near poor/ Poor household												
Personal income												
Yes	0.98 (0.71-1.35)	0.915			0.60 (0.38-0.96)	**0.032**	0.59 (0.32-1.06)	0.079	1.60 (1.01 -2.56)	**0.044**	1.49 (0.89-2.49)	0.122
No												

Age started have sexually behavier												
Not sexually active	1.82 (1.14-2.92)	**0.011**	2.22 (1.10–4.47)	**0.025**	3.27 (1.51-7.09)	**0.002**	4.07 (1.17-14.17)	**0.027**	1.15 (0.62-2.12)	0.644		
≥ 18 age												
Marital status												
Single/ Divorced/ Separated/ Widow	1.48 (0.96-2.30)	0.074			2.06 (1.09-3.88)	**0.023**	1.14 (0.46-2.83)	0.772	1.07 (0.58-1.99)	0.809		
Married, living with husband												
Number of children												
0	1.77 (1.09-2.86)	**0.018**	0.57 (0.27–1.21)	0.146	3.31 (1.46-7.47)	**0.003**	0.50 (0.13-1.87)	0.307	1.11 (0.60-2.05)	0.725		
1-3 children												
Family history of cervical cancer												
Yes	0.65 (0.09-4.69)	0.673			1.50 (0.1316.78)	1**			2.74 (2.37–3.17)	0.366**		
No												
Access to media												
Yes	2.14 (1.46 -3.14)	**<0.001**	1.23 (0.75-2.02)	0.409	3.09 (1.77-5.40)	**<0.001**	1.91 (0.91-4.01)	0.087	1.51 (0.89-2.55)	0.122		
No												
Health workers advise on HPV vaccination												
Yes	2.8 (1.51-5.16)	**0.001**	2.31 (1.18-4.50)	**0.014**	2.50 (1.17-5.33)	**0.014**	1.49 (0.62-3.58)	0.369	3.80 (1.28-11.26)	**0.010**	4.15 (1.30-13.21)	**0.016**
No												
Find information about vaccines												
Yes	2.39 (1.26-4.54)	**0.006**	1.38 (0.63-3.00)	0.410	2.41 (0.99-5.87)	**0.045**	0.96 (0.29-3.11)	0.952	2.37 (0.93-6.01)	0.062		
No												
Knowledge of cervical cancer, HPV and HPV vaccination												
Good	2.28 (1.39-3.73)	**0.001**	0.93 (0.50-1.71)	0.824	3.57 (1.59-8.03)	**0.001**	1.27 (0.46-3.52)	0.638	1.606 (0.85 - 3.01)	0.138		
Not good												
Attitude toward HPV vaccinations												
Positive	4.63 (3.19-6.71)	**<0.001**	4.63 (3.09–6.94)	**<0.001**	4.15 (2.51-6.87)	**<0.001**	5.48 (2.93-10.27)	**<0.001**	5.11 (2.94 -8.89)	**<0.001**	4.42 (2.48-7.87)	**<0.001**
Neutral/negative												

*Chi-square test; ** Fisher's exact test

vaccine coverage and overcoming challenges related to immunization (24).

The public health systems must examine the prevalence and disparities of HPV vaccination practices, particularly in areas where vaccination services are available. Therefore, this study aimed to investigate the rate of HPV vaccination among female subjects aged 15-49 years in *Can Tho* City. The cross-sectional study included 648 subjects sampled with a relatively even distribution across urban and rural regions. The study found that a meager proportion of the subjects (less than 5%) had received the HPV vaccine, with a notable difference in vaccination rates between urban (4.9%) and rural (3.1%) regions (Table 1). These findings suggest that despite vaccination services and awareness campaigns regarding vaccine benefits, accessibility, and availability, vaccine implementation and uptake approaches may differ by location and subject. Therefore, further research and intervention are warranted to enhance HPV vaccine uptake and address disparities in vaccination practices (4, 14).

Access to cervical cancer prevention services is often limited to women and their families in health systems without free healthcare. Among unvaccinated women in the present study, rural women (91.4%) were statistically more willing to vaccinate if the services were provided for free compared to urban women (84.4%) (Table 1). These results indicate a higher willingness to vaccinate among women as compared to a previous study conducted by Olajumoke Adetoun Ojeleye, in which only 33.2% of women were willing to vaccinate for free (25). The group of women involved in this study are adolescents, and their willingness to receive vaccination is influenced by the requirement of parental consent. This requirement also impacts the overall level of willingness to vaccinate. In Nigeria, the target age for routine HPV vaccination for both boys and girls is set between 9 and 13 years old. Despite the licensing and introduction of two out of three HPV vaccines in Nigeria since 2009, there is limited awareness of these vaccines among the population. Additionally, factors such as high cost contribute to their limited accessibility, resulting in only a privileged few being able to receive them. Unlike in Vietnam, the immunization schedule in Nigeria does not include routine immunization of adolescents for any disease, except for tetanus vaccination for women aged 15 years and older. In the southern regions of Nigeria, certain vaccines, such as those against tetanus, diphtheria, polio, meningitis, etc., are provided free of charge through the expanded immunization program. However, this does not extend to routine immunization of adolescents, as is the case in Vietnam. The availability and cost of vaccination services are also significant factors influencing self-vaccination. Our study suggests that if provided free, urban and rural women have a positive attitude towards vaccination (Table 4). Differences in willingness to vaccinate against HPV may be attributed to variations in study locations and subjects, despite the availability of HPV vaccination services and communication about the benefits of vaccines (14). However, overall, willingness to vaccinate declined when women surveyed in our study were required to pay for the service. Similar findings were found in a PATH study conducted in 2009, which highlighted cost as a main impediment to using the HPV vaccine in Vietnam (26). Economic constraints have been found to keep women in developing countries from taking advantage of this vital medical service, even when it is available (27, 28). As such, vaccine promotion strategies should consider cultural differences in Asian countries, such as the age at which sexual intercourse begins and necessary attitudes towards vaccination.

This study found a significant correlation between the level of practice of rural women and vaccination advice by health workers.

Table 4. Multivariable logistic regression analysis of factors affecting willingness to receive free HPV vaccination among unvaccinated urban and rural women (n=622)

Variables	Total				Urban				Rural			
	OR (95%CI)	p*	aOR (95%CI)	p*	OR (95%CI)	p*	aOR (95%CI)	p*	OR (95%CI)	p*	aOR (95%CI)	p*
Age												
15-30 31-49	1.69 (0.91-3.11)	0.088			2.07 (0.88-4.84)	0.086			1.20 (0.49-2.94)	0.687		
Ethnicity												
Kinh Other	1.91 (0.94-3.89)	0.068			1.29 (0.59-2.78)	0.513			11 (0.66-181.02)	0.165**		
Religion												
No Ys	1.77 (1.07-2.92)	**0.024**	1.51 (0.88-2.59)	0.132	2.04 (1.09-3.84)	**0.023**	1.93 (0.97-3.84)	0.060	1.80 (0.76-4.26)	0.172		
Education level												
Upper secondary or higher Secondary school or lower	2.27 (1.37-3.75)	**0.001**	1.58 (0.91-2.75)	0.1	2.24 (1.19-4.18)	**0.010**	1.74 (0.87-3.47)	0.114	3 (1.23-7.31)	**0.012**	2.44 (0.91-6.56)	0.076
Occupational												
Housewife	0.88 (0.48-1.62)	0.689	0.35 (0.18-0.67)	**0.002**	0.59 (0.25-1.37)	0.220	0.18 (0.075-0.45)	**<0.001**	1.61 (0.59-4.35)	0.344		
Self-business	0.46 (0.25 - 0.82)	**0.008**	0.43 (0.22-0.82)	**0.011**	0.23 (0.10-0.53)	**<0.001**	0.31 (0.14- 0.70)	**0.005**	1.17 (0.45-3.04)	0.740		
Emloyed/Famer/ freelancers /other	-	-		-	-	-		-	-	-		-
Economic status												
Not poor Near poor/ Poor household	3.67 (1.66-8.09)	**0.003****	3.45 (1.42-8.39)	**0.006**	2.33 (0.85-6.35)	0.113*			6.95 (1.89-25.52)	**0.009****	4.7 (1.09- 20.17)	**0.037**
Personal income												
Yes No	1.08 (0.66-1.76)	0.743			0.94 (0.51 -1.75)	0.860			1.34 (0.60-3.00)	0.465		

Age started have sexually behavior												
Not sexually active	0.80 (0.42-1.49)	0.488			1.47 (0.54-3.95)	0.441			0.39 (0.16-0.92)	**0.036****	0.30 (0.11-0.82)	**0.019**
≥ 18 age												
Marital status												
Single/ Divorced/ Separated/ Widow	0.91 (0.49-1.70)	0.781			1.10 (0.48-2.51)	0.815			0.70 (0.26-1.83)	0.432**		
Married, living with husband												
Number of children												
0	1.17 (0.58-2.38)	0.646			2.41 (0.71-8.17)	0.146			0.57 (0.23-1.43)	0.286**		
1-3 children												
Family history of cervical cancer												
Yes	1.13 (1.10-1.17)	1**			1.18 (1.13-1.24)	1**			1.09 (1.05-1.13)	1**		
No												
Access to media												
Yes	1.83 (0.99-3.37)	**0.048**	0.82 (0.40-1.66)	0.590	2.55 (1.09-5.94)	**0.025**	1.20 (0.45-3.21)	0.706	1.16 (0.47-2.85)	0.742		
No												
Health workers advise on HPV vaccination												
Yes	0.77 (0.37-1.58)	0.477			0.85 (0.35-2.05)	0.720			0.76 (0.21-2.71)	0.720**		
No												
Find information about vaccines												
Yes	2.62 (0.80-8.62)	0.098			2.55 (0.58 - 11.14)	0.196			2.81 (0.36 - 21.50)	0.490**		
No												
Knowledge of cervical cancer, HPV and HPV vaccination												
Good	7.76 (1.87-32.20)	**0.001**	4.34 (0.96-19.55)	0.056	8.54 (1.14-63.72)	**0.013**	4.04 (0.48-33.69)	0.197	6.30 (0.83-47.44)	**0.038****	3.33 (0.42-26.42)	0.255
Not good												
Attitude toward HPV vaccinations												
Positive	5.33 (3.20-8.85)	**<0.001**	5.09 (2.95-8.78)	**<0.001**	4.35 (2.28-8.29)	**<0.001**	4.32 (2.08-8.99)	**<0.001**	6.56 (2.85-15.09)	**<0.001**	5.26 (2.18-12.70)	**<0.001**
Neutral/negative												

* Chi-square test; ** Fisher's exact test.

Table 5. Reasons for not vaccinating with HPV vaccine (n=622)

Variables	Total n (%)	Urban n (%)	Rural n (%)	p*
Never heard of the HPV vaccine before	329 (50.8)	158 (48.8)	171 (52.8)	0.307
Lack of adequate information about the HPV vaccine	194 (29.9)	71 (21.9)	123 (38.0)	**<0.001**
Healthy self, no need for injections	83 (12.8)	52 (16.0)	31 (9.6)	**0.014**
Not interested	81 (12.5)	45 (13.9)	36 (11.1)	0.285
Worried about the safety of vaccines	31 (4.8)	10 (3.1)	21 (6.5)	**0.043**
Expensive/ The cost for vaccination HPV is too high	54 (8.7)	27 (8.8)	27 (8.6)	1.000
Do not believe in the effectiveness of preventing cervical cancer	20 (3.1)	8 (2.5)	12 (3.7)	0.364
Age inappropriate	29 (4.5)	15 (4.6)	14 (4.3)	0.849
It is not necessary to have	35 (5.4)	18 (5.6)	17 (5.2)	0.862
Not advised/recommended by medical staff	46 (7.1)	15 (4.6)	31 (9.6)	**0.014**
Fear of injections	12 (1.9)	3 (0.9)	9 (2.8)	0.080
Fear of adverse reactions to the HPV vaccine	16 (2.5)	3 (0.9)	13 (4.0)	**0.011**
Do not know where to get vaccine	14 (2.2)	3 (0.9)	11 (3.4)	**0.031**

*Chi-square test.

One point to note is that the impact of access on practice is directly proportional to the increase in information access of health workers when they are consulted (19). In addition, women with a high school diploma or higher who have heard about the HPV vaccine from doctors, nurses, or other health professionals are willing to pay the vaccine cost (Table 3). The findings suggest that rural women who have a higher level of trust in healthcare workers and possess greater knowledge about cervical cancer and HPV vaccination have a significantly higher intention to get vaccinated. This result is consistent with observational studies in which people's required knowledge and attitude seem to strongly influence their preference to vaccinate (14, 29, 30).

The availability and provision of free vaccines have been demonstrated to enhance the vaccination trend by reducing barriers, as specified in multiple past studies (4, 13, 20). In particular, rural women who have a stable economic status, no sexual practice, and a positive attitude are highly inclined to accept the vaccine (Table 4). According to the report of the 2019 Global School-based Student Health Survey in Vietnam, the proportion of sexual behaviors among high school students was significantly higher than those among secondary school students in both surveys conducted in 2013 and 2019. The percentage of students who practiced sex before age 14 was 1.48% and 3.51% in 2013 and 2019, respectively. It is noteworthy that the proportion increased significantly in high school (31). Therefore, young girls should be prioritized for HPV vaccine prevention, and future studies should carefully monitor new infection rates among this group. However, vaccine costs must be incorporated to ensure affordability, and the government should include HPV vaccination in the national immunization program to benefit the community. To better understand women's attitudes toward HPV vaccines and their unique impediments to immunization, a qualitative study is recommended.

According to our study, only approximately 10% of women in urban and rural areas actively seek information regarding HPV vaccines (Table 2). Television and the internet are the primary sources of information for unvaccinated women in both rural and urban areas. These findings align with the outcomes of the studies

conducted by Bach Xuan Tran et al (19) and Sothy Touch et al (4). This finding aligns with the responses from a majority of participants who reported having televisions in their households. It is notable that health education communication programs in these countries primarily utilize television channels as a means to reach a wide audience, including economically disadvantaged and remote areas where access to health clinics and services is limited or unavailable. Evidently, these information sources are easily accessible and align with the current trend of digital technology development. These outcomes can be attributed to attractive visuals and sound in delivering content that supports the target audience in comprehending and remembering the information. In contrast, utilizing loudspeakers to disseminate information to the public remains significantly low. It may be due to the limited accessibility to the information broadcasted by loudspeakers and the unattractive content that fails to capture women's attention. Analysis of the reasons for non-vaccination against HPV among unvaccinated women demonstrates the similarity between rural and urban groups, with a high concentration of reasons such as "never heard of HPV vaccine" and "lack of complete information about HPV vaccination." This outcome contrasts with the results of studies conducted by Bach Xuan Tran et al (19) and Sothy Touch et al (4), who emphasized that high cost is the primary reason for non-vaccination. The limited access to information regarding HPV vaccines contributed to a lack of awareness among the women in our study. Consequently, they lacked accurate knowledge about vaccine dosage, vaccination schedules, recommended ages for vaccination, and particularly the associated costs, as the vaccine is not provided free of charge in these countries. Notably, the study conducted by Sothy Touch focused on adult women aged 20-69 or specifically 25-40 years old, accounting for more than half of Bach Xuan Tran's research. A noteworthy difference between our study and Tran's is the inclusion of a younger subset of participants (<30 years old). This age group may have limited understanding of healthcare services and make decisions regarding their health behavior. Moreover, in terms of the general economic status of our data collection site in Can Tho, there is a comparatively lower socio-economic development compared to Tran's study site in the capital city of Hanoi, despite both locations being within the same country. Consequently, this raises a vital communication issue that necessitates a plan to enhance knowledge and practice among women because expertise forms the foundation for attitude and correct practice, which is the final and most critical step toward acquiring overall good health behavior.

Our study found that the healthcare experts' advice had the most significant influence on the vaccination decisions taken by the target population. However, the counseling and information provided by healthcare workers administering HPV vaccination to unvaccinated women were reported to be low, especially among women in rural regions compared to urban areas (Table 2). This finding is lower than the study performed by Afsana Bhuiyan et al in 2018 (32), signifying a shortfall in local health awareness and communication efforts. The majority of women participating in this study reside in urban areas and exhibit characteristics such as high occupational status, education level, and socioeconomic status. Consequently, these women possess greater access to healthcare services and a more favorable healthcare system. As a result, they are more likely to seek medical advice from healthcare professionals compared to rural women in our study population. Information provided by healthcare experts is a reliable channel that meets the individual

health requirements of women seeking additional information (33). Vaccination according to medical advice as well as practicing safe sex are measures to help avoid adverse effects from Human papillomavirus (34). Therefore, it is imperative to have a support plan, favorable conditions, and appropriate training for healthcare workers to offer vaccination counseling to ensure the effective use of their professional counseling role in women's healthcare.

Limitations of the study

Our cross-sectional study only focused on comparing the willingness to vaccinate among women when offered for free or for a fee in urban and rural regions. The study does not consider evaluating the ability and willingness to pay the threshold for receiving the HPV vaccine, an impactful preventive strategy against HPV virus infections, especially cervical cancer, which is common in women. Furthermore, there was an uneven distribution among age groups in the study, with women over 30 accounting for nearly three-quarters ($3/4^{th}$) of the sample. This discrepancy may lead to outcomes not representative of the entire female population. Moreover, awareness of preventive measures, access to information on HPV vaccines, and the desire to vaccinate are no longer necessary, as most girls are recommended to receive the vaccine between the ages of 9-11. Ideally, they can receive the vaccination before sexual activity, according to WHO guidelines; and the Ministry of Health in Vietnam recommends HPV vaccination for girls and women aged 9-26. Therefore, future studies should focus on young women in the vaccination age group, which would furnish more valuable scientific information for implementing HPV vaccination in women. For older age groups, these studies must focus on the vital decision-making role of parents in vaccinating their daughters at the suitable age.

Conclusions

This study concludes that women aged 15-49 in urban and rural areas have low rates of HPV vaccine uptake. Among unvaccinated participants, rural women are more willing to receive the vaccine than urban women if it is free. However, this willingness to receive immunization decreases if vaccination is required to be paid for. The most significant factor in this scenario is to enhance awareness of HPV vaccination and address impediments to its future use. Our findings emphasize the need to develop well-designed vaccination and awareness programs. They should be based on current results focusing on women (especially young women in the vaccination age range) because knowledge is a prerequisite for health-protective behaviors, including vaccination decisions. Addressing knowledge gaps can help people make improved choices. Furthermore, education campaigns (including vaccine advertisements through flyers and social media campaigns) should leverage community health centers/clinics, where rural women go for healthcare consultation and vaccination in extensive programs. Finally, it is imperative to build a team of healthcare providers to provide counseling and strengthen HPV vaccine acceptance in the community.

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Conflicts of interest: The authors have no conflicts of interest to declare.

Ethics approval: The study was approved by the Medical Ethics Council of Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam. Participants were informed that taking part in the study was voluntary.

Availability of data and material: The data that support the findings of this study are available from the corresponding author (i.e., upon reasonable request).

Riassunto

Differenze urbano-rurali nell'accettazione della Vaccinazione anti-HPV da parte delle donne di Can-Tho, Vietnam

Premessa. In Vietnam, il cancro cervicale è un problema di sanità pubblica significativo per il sesso femminile. Sfortunatamente, nonostante la disponibilità del vaccino HPV, persistono bassi tassi di vaccinazione.

Obiettivi. Questo studio indaga la differenza nella disponibilità femminile a ricevere la vaccinazione contro l'HPV, gratuitamente o a pagamento, tra aree urbane e rurali.

Metodi. È stato condotto uno studio trasversale su un campione di 648 donne di età compresa tra i 15 e i 49 anni, residenti in due distretti urbani ed in due rurali vietnamiti della città di Can Tho tra il Maggio ed il Dicembre 2021.

Risultati. Il tasso di vaccinazione complessivo è risultato del 4%, quello urbano del 4,9% e quello rurale del 3,1%. Tra le donne non vaccinate, quelle nelle zone rurali hanno espresso un desiderio significativamente più elevato (91,4%) di ricevere il vaccino gratuitamente rispetto a quelle delle zone urbane (84,4%). Tuttavia, l'intenzione di vaccinare è diminuita quando alle donne di area rurale ed alle donne di area urbana è stata proposta la vaccinazione a pagamento (rispettivamente 63,4 e 57,1%). È stata rilevata un'elevata correlazione tra un atteggiamento positivo e l'intenzione di vaccinare, indipendentemente dal prezzo o dalla disponibilità gratuita. Anche l'istruzione e l'accesso alle informazioni sul vaccino HPV sono stati identificati come i fattori più significativi che influenzano l'intenzione di vaccinarsi tra le donne urbane e rurali.

Conclusioni. I bassi tassi di vaccinazione contro l'HPV tra le donne di età compresa tra 15 e 49 anni che risiedono nelle aree urbane e rurali del Vietnam sono una notevole preoccupazione per i responsabili della Sanità Pubblica, e questi risultati sottolineano la necessità fondamentale di un programma di un'efficace promozione della vaccinazione, che offra vaccini HPV gratuiti (o almeno ad un prezzo accessibile) alle donne vietnamite.

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