



## Factors associated with future commitment and past history of human papilloma virus vaccination among female college students in northern Taiwan

Ping-Fen Kuo<sup>1</sup>, Ying-Tse Yeh<sup>2</sup>, Shuh-Jen Sheu<sup>1</sup>, Tze-Fang Wang<sup>1</sup>

<sup>1</sup>National Yang Ming University School of Nursing, Taipei; <sup>2</sup>Department of Medicine, Taichung Veterans General Hospital, Taichun, Taiwan

**Objective:** To investigate factors influencing commitment to human papilloma virus (HPV) vaccination and prior vaccination among female college students in northern Taiwan.

**Methods:** A quota sample of 400 female college students was recruited from nine colleges in northern Taiwan during March 2013. Of these, 398 completed the self administered questionnaire which was designed based on the health promotion model.

**Results:** The results showed that factors associated with prior vaccination behavior were family history of gynecologic malignancy, ever being advised to get HPV vaccination, perceived barriers of action and perceived self-efficacy. Predictors for commitment to HPV vaccination in the next 6 months were the cost of vaccination, ever being advised to get HPV vaccination, perceived self-efficacy and situational influences. Perceived self-efficacy was significantly influenced by relationship status, past receipt of a recommendation for HPV vaccination and level of knowledge about HPV.

**Conclusion:** When formulating vaccination policies, governmental or medical institutions should include these factors to promote vaccination.

**Keywords:** College student, Female, Health promotion model, Human papilloma virus, Vaccines

### INTRODUCTION

Cervical cancer was the fourth leading cause of cancer deaths among females worldwide in 2008 [1]. Cervical cancer is almost always caused by a human papilloma virus (HPV) infection [2]. In Taiwan, there was an annual incidence rate of 16.2 per 100,000 people for invasive cervical cancer and a mortality rate of 7.8 per 100,000 people in 2006 [3]. A community-based study of 10,602 participants (aged 30 to 65) in Taiwan reported that the overall prevalence of HPV was

16.2% [4].

The peak prevalence of HPV infection occurs within the first decade after sexual debut, typically between the ages of 15 and 25 in most Western countries [5,6]. Therefore, the United States Advisory Committee on Immunization Practices recommended routine vaccination for females between 11 and 12 years of age. Catch-up vaccination was recommended for females aged 13 to 26 who had not been previously vaccinated or who had not completed their vaccine series. Taiwan first introduced the HPV vaccine in 2006, but few cities have provided free vaccination programs for female junior high school students, and there is still no free access to catch up on vaccinations. The average age of sexual debut in Taiwan is 17 to 18 [7], so there are still a substantial number of potential candidates among female college students for catch up vaccinations.

One study in Taiwan found that 38% of the women who were vaccinated were over the age of 26. Women aged 18 to

Received Dec 23, 2013, Revised Apr 15, 2014, Accepted Apr 17, 2014

Supplementary material for this article can be found at [www.ejgo.org](http://www.ejgo.org).

Correspondence to Tze-Fang Wang

National Yang Ming University School of Nursing, No. 155, Section 2, Li-Nong St, Shi-Pai, Taipei 11221, Taiwan. E-mail: [fang@ym.edu.tw](mailto:fang@ym.edu.tw)

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26 were more likely to consider the cost and availability of vaccination than women over 26, and the media also played an important role in a woman's decision to seek HPV vaccination [7]. Over 50% of undergraduate women were aware of HPV and the HPV vaccine, and 63% of the students reported a high intent to obtain the HPV vaccine [8]. In the past, college women in Taiwan have experienced difficulties with HPV-related cervical cancer prevention. It has been hoped that a publicly funded HPV immunisation program, a friendly medical environment, sufficient knowledge about HPV, and an open-minded society would improve HPV-related cervical cancer prevention [9].

The health promotion model describes an individual's behavioral outcomes that are influenced by "individual characteristics and experiences" and "behavior-specific cognitions and affects." An individual behavioral outcome includes commitment to a plan of action and health-promoting behavior [10]. By utilizing the health promotion model, we hoped to develop insight into the factors influencing both intent to vaccinate and a history of prior vaccination.

Most previous studies have investigated intent of HPV vaccination and prior vaccination history among community based women with a wide range of ages [7,11]. The purpose of this study, therefore, was to investigate the factors influencing the prior vaccination and commitment to HPV vaccination in the future among female college students in northern Taiwan, with a particular focus on the dimensions proposed by the health promotion model. There is a geographic variation in the prevalence of HPV between northern and southern Taiwan. The overall HPV prevalence in northern Taiwanese women was 32.4% [12] and it was 19.3% in southern Taiwanese women. [13] We believed that investigating the factors influencing commitment to vaccination among female college students in northern Taiwan was relatively more important.

## MATERIALS AND METHODS

### 1. Sample and data collection

This was a cross sectional study design. The project was approved by the Institutional Review Board of the Antai Tian-Sheng Memorial Hospital in Taiwan. A quota sample (non-probability) of 400 female college students was recruited from nine colleges in northern Taiwan: 100 from liberal arts colleges (25%), 200 from social science colleges (50%), and 100 from medical science colleges (25%) according to the number of college students in 2012 as reported by the Ministry of Education. Inclusion criteria were: (1) regularly enrolled in a college/university; (2) able to read Chinese; and (3) completed informed

consent. College students aged  $\geq 20$  were invited to fill out the questionnaire in a classroom under the supervision of researchers and without the presence of male classmates. Students aged  $< 20$  were asked to fill out the questionnaire on our website due to ethical considerations. Data were collected in March 2013. We obtained written informed consent from each participant, but all questionnaires were administered without a request for names or personal information, so that the participants' autonomy and confidentiality were protected.

A sample size of 385 was calculated by the following formula:

$$n = \frac{1.96^2 \times p \times (1-p)}{d^2},$$

where  $p=0.5$  was the response rate set to maximize the calculated sample size, and  $d=0.05$  indicated the acceptable margin of error. The calculated sample size of 385 was further increased to 400 to account for nonresponse or noncompleted questionnaires.

### 2. Instruments

The self administered questionnaire was divided into three parts (**Suppl. 1**). The first included individual characteristics and experiences (e.g., age and personal or family history of gynecologic disease), prior related behaviors that might affect future HPV vaccination (e.g., age at first sexual experience, and past receipt of recommendations for HPV vaccination), and knowledge about cervical cancer as measured by a 15 item quiz. For the first part of the questionnaire, Cronbach's  $\alpha=0.78$ .

The second part included behavior-specific cognitions and affects relative to HPV vaccination. Each of the 21 items was measured on a 4-point Likert scale, ranging from "strongly disagree" 1 to "strongly agree" 4. For each of the six dimensions, a higher total score implied more perceived benefits of HPV vaccination, fewer perceived barriers to HPV vaccination, higher perceived self-efficacy, more positive HPV vaccination-related affect, greater likelihood to be affected by interpersonal influence, or a greater likelihood to be affected by situational influences. For the second part of the questionnaire, Cronbach's  $\alpha=0.79$ .

The final part questioned immediate behavioral contingencies including commitment to HPV vaccination and a prior history of HPV vaccination. For nonvaccinated participants, we queried their commitment to vaccination within the next 6 months. Participants were also requested to identify an affordable price for HPV vaccine. For the third part of the questionnaire, Cronbach's  $\alpha=0.90$ .

### 3. Validity

The questionnaire was validated by an expert panel consist-

ing of four physicians from the Department of Obstetrics and Gynecology and two professors from the Nursing School. The experts graded the items on the questionnaire using a 5-point Likert scale, ranging from “very unsuitable” 1 to “very suitable.” The content validity index (CVI) was calculated accordingly. For the first part of the questionnaire, “individual characteristics and experience,” the CVI=93.4%; for the second part, “behavior-specific cognition and affect,” the CVI=92.4%; for the third part, “immediate competing demands and preferences,” the CVI=90%; and for “commitment to a plan of action and behavior,” the CVI=90%.

**4. Statistical analysis**

Descriptive analysis included distribution frequencies for categorical variables, means with standard deviations for normally distributed continuous variables, and medians and range for non-normally distributed variables. For inferential statistics to determine the associations of “individual characteristics and experiences” and “cognition and affect relative to HPV vaccination” and “prior HPV vaccination” and “future HPV vaccination,” we utilized the independent two samples t-test to compare normally distributed continuous variables between two groups, the nonparametric Mann-Whitney test to compare non-normally distributed continuous variables between two groups, the nonparametric Kruskal-Wallis test to compare non-normally distributed continuous variables between three or more groups, and Fisher exact test to evaluate the associations between categorical variables. Logistic regression models were utilized to evaluate independent factors influencing prior vaccination and future HPV vaccination: variables with a  $p < 0.1$  in the univariate logistic regression models were entered step-wise into multivariate logistic regression models by the forward conditional selection method. The correlation between scores for total knowledge and perceived self-efficacy was expressed by the Spearman correlation coefficient ( $\rho$ ). Two-tailed  $p$ -values  $< 0.05$  were considered statistically significant. Data were analyzed using SPSS ver. 15.0 (SPSS Inc., Chicago, IL, USA).

**RESULTS**

**1. Individual characteristics and experiences and knowledge about HPV vaccine**

Of the 400 subjects enrolled in this study, 398 completed the questionnaires. Their average age was  $20.04 \pm 1.80$  years. With regard to monthly living expenses, 82.4% spent less than US \$333 per month (<new Taiwan dollar [NTD], 10,000). Only 5.5% and 9.5% had a personal history of gynecologic disease

**Table 1.** Individual characteristics, knowledge about HPV vaccine, and cognitions and affects relative to HPV vaccine (n=398)

Characteristic	Value
Age (yr)	20.04 ± 1.8
College	
Liberal arts	100 (25.1)
Social science	198 (49.7)
Medical science	100 (25.1)
Religion	
None	188 (47.2)
Taiwanese folk religion	96 (24.1)
Christian	41 (10.3)
Buddhist	37 (9.3)
Taoist	31 (7.8)
Other	5 (1.3)
Expenses per month	
<NTD 10,000	328 (82.4)
≥NTD 10,000	70 (17.6)
Personal history of gynecologic disease	
Yes	22 (5.5)
No	376 (94.5)
Family history of gynecologic malignancy	
Yes	38 (9.5)
No/not sure	360 (90.5)
Relationship status (intimate relationship with friend)	
No	292 (73.4)
Yes	106 (26.6)
With sexual experience	75 (19.0)
Age of sexual debut (yr)	18.45 (1.7)
Ever heard of HPV vaccine	305 (76.6)
Ever been vaccinated with HPV vaccine	38 (9.5)
Ever been advised to get an HPV vaccination	142 (35.7)
From family	72 (18.1)
From teachers	40 (10.1)
From peers	35 (8.8)
From medical personnel	32 (8.0)
From mates	3 (0.8)
Total knowledge score	8.01 ± 2.9
Cognition and affect relative to HPV vaccination	
Perceived benefits of action	18.76 ± 2.5
Perceived barriers to action	10.02 ± 2.1
Perceived self-efficacy	8.01 ± 1.6
Activity-related affect	7.47 ± 1.7
Interpersonal influences	16.13 ± 2.7
Situational influences	5.45 ± 1.1

Values are presented as mean ± SD or number (%). HPV, human papilloma virus; NTD, new Taiwan dollar.

or family history of gynecologic malignancy, respectively. Only 38 participants (9.5%) were vaccinated. Nineteen percent had engaged in sexual intercourse, with an average age of 18.45 for sexual debut. Although 76.6% had heard about HPV vaccine, only 142 (35.7%) had ever received a recommendation to be vaccinated. Among those who had been advised to be vaccinated, the recommendations were from family (18.1%), teachers (10.1%), and peers (8.8%), and only 8.0% were from medical personnel. The mean score for total knowledge was  $8.01 \pm 2.91$ , which showed that the level of knowledge was moderate (**Table 1**).

### 2. Cognitive and affect relative to HPV vaccination

The mean scores for perceived benefits of action, perceived barriers to action, perceived self-efficacy, and activity-related

affect were 18.76, 10.02, 8.01, and 7.47 respectively. The mean scores for interpersonal and situational influences were 16.13 and 5.45, respectively (**Table 1**).

### 3. Factors influencing prior vaccination

Factors significantly associated with past vaccination were family history of gynecologic malignancy, ever having heard of HPV vaccine, ever having been advised to receive an HPV vaccination, and total knowledge score; 23.7% of those with a family history of gynecologic malignancy were more likely to be vaccinated than were those without such a family history (8.1%,  $p=0.005$ ). Those who had ever heard of HPV vaccine were more likely to be vaccinated (94.7%) than were those who never heard of it (74.7%,  $p=0.004$ ). Those who had ever been advised to have an HPV vaccination were more likely to

**Table 2.** Associations of individual characteristics and scores for human papilloma virus knowledge and commitment for vaccination and prior vaccination history

Characteristic		Ever being vaccinated with HPV vaccine			I might get vaccinated with HPV vaccine in the next 6 mo		
		Yes (n=38)	No (n=360)	p-value	Strongly agree and agree (n=87)	Disagree and strongly disagree (n=273)	p-value
Age (yr)		19.95±1.14	20.04±1.85	0.752	20.17±2.20	20.00±1.74	0.461
College	Liberal arts	8 (21.1)	92 (25.6)	0.695	21 (24.1)	71 (26.0)	0.085
	Social science	22 (57.9)	176 (48.9)		36 (41.4)	140 (51.3)	
	Medical science	8 (21.1)	92 (25.6)		30 (34.5)	62 (22.7)	
Religion	None	24 (63.2)	164 (45.6)	0.199	43 (49.4)	121 (44.3)	0.194
	Taiwanese folk religion	5 (13.2)	91 (25.3)		17 (19.5)	74 (27.1)	
	Christian	3 (7.9)	38 (10.6)		7 (8.0)	31 (11.4)	
	Buddhist	4 (10.5)	33 (9.2)		13 (14.9)	20 (7.3)	
	Taoist	1 (2.6)	30 (8.3)		7 (8.0)	23 (8.4)	
	Other	1 (2.6)	4 (1.1)		0 (0.0)	4 (1.5)	
Expenses per month	<NTD 10,000	27 (71.1)	301 (83.6)	0.071	65 (74.7)	236 (86.4)	0.013*
	≥NTD 10,000	11 (28.9)	59 (16.4)		22 (25.3)	37 (13.6)	
Personal history of gynecologic disease		4 (10.5)	18 (5.0)	0.147	4 (4.6)	14 (5.1)	1.000
Family history of gynecologic malignancy		9 (23.7)	29 (8.1)	0.005*	6 (6.9)	23 (8.4)	0.822
Relationship status (intimate relationship with friend)	No	27 (71.1)	265 (73.6)	0.704	56 (64.4)	209 (76.6)	0.036*
	Yes	11 (28.9)	95 (26.4)		31 (35.6)	64 (23.4)	
Sexual experience		5 (13.5)	70 (19.6)	0.509	23 (27.1)	47 (17.3)	0.060
Ever heard of HPV vaccine		36 (94.7)	269 (74.7)	0.004*	72 (82.8)	197 (72.2)	0.049*
Ever been advised to have an HPV vaccination		37 (97.4)	105 (29.2)	<0.001*	42 (48.3)	63 (23.1)	<0.001*
From family		31 (81.6)	41 (11.4)	<0.001*	23 (26.4)	18 (6.6)	<0.001*
From teachers		7 (18.4)	33 (9.2)	0.086	13 (14.9)	20 (7.3)	0.052
From peers		2 (5.3)	33 (9.2)	0.558	13 (14.9)	20 (7.3)	0.052
From medical personnel		10 (26.3)	22 (6.1)	<0.001*	9 (10.3)	13 (4.8)	0.072
From mates		1 (2.6)	2 (0.6)	0.261	1 (1.1)	1 (0.4)	0.425
Total knowledge score		10.13±2.50	7.79±2.86	<0.001*	8.51±2.94	7.56±2.80	0.007*

Values are presented as mean±SD or number (%).  
 HPV, human papilloma virus and NTD, new Taiwan dollar.  
 \* $p<0.05$  indicates a significant difference between two groups.

be vaccinated (97.4%) than were those who had never been so advised (29.2%,  $p < 0.001$ ). Recommendations from family and medical personnel were significantly associated with prior vaccination ( $p < 0.001$ ). Compared to the unvaccinated group, the 38 vaccinated subjects had significantly higher scores for total knowledge (10.13 vs. 7.79;  $p < 0.001$ ) (Table 2).

Compared to the unvaccinated group, the 38 vaccinated subjects had significantly higher scores on the four dimensions of perceived barriers to action (12.0 vs. 9.81;  $p < 0.001$ ), perceived self-efficacy (9.18 vs. 7.88;  $p < 0.001$ ), activity-related affect (8.24 vs. 7.39;  $p = 0.003$ ), and situational influences (5.84 vs. 5.41;  $p = 0.017$ ) (Table 3).

#### 4. Independent factors influencing prior vaccination

After forward conditional selection of the variables with a  $p < 0.1$  in the univariate logistic regression models, four independent factors influencing prior vaccination remained in the multivariate logistic regression model. After the other three factors were controlled, subjects with a family history of gynecologic malignancy were more likely to have been vaccinated (odds ratio [OR], 9.52;  $p = 0.003$ ); subjects who had ever been advised to be vaccinated were more likely to have been (OR, 112.42;  $p < 0.001$ ); and the opportunity to be vaccinated was increased by every one unit increase in the scores for perceived self-efficacy (OR, 1.50;  $p = 0.006$ ) and perceived barriers to action (OR, 1.44;  $p = 0.008$ ) (Table 4).

#### 5. Factors influencing commitment to vaccination

Living expenses per month, relationship status, ever having heard of HPV vaccine, past receipt of recommendations for HPV vaccination, and total knowledge scores were significantly associated with commitment to vaccination. About one-fourth of the high commitment group (25.3%) had living expenses  $\geq$ NTD 10,000 per month, but only 13.6% of the low commitment group did ( $p = 0.013$ ). Over one-third of the high commit-

ment group (35.6%) were in a relationship but only 23.4% of the low commitment group were ( $p = 0.036$ ). Over eighty percent of the high commitment group (82.8%) had ever heard of HPV vaccine but only 72.2% of the low commitment group had ( $p = 0.049$ ). Nearly half of the high commitment group had ever been advised to be vaccinated but only 23.1% of the low commitment group were ( $p < 0.001$ ). Over one-fourth of the high commitment group (26.4%) had ever been advised by family members to be vaccinated but only 6.6% of the low commitment group had ( $p < 0.001$ ). Compared to the low commitment group, the 87 subjects in the high commitment group had significantly higher scores for total knowledge (8.51 vs. 7.56;  $p = 0.007$ ) (Table 2).

Compared to the low commitment group, the 87 subjects in the high commitment group had significantly higher scores on the five dimensions including perceived benefits of action (19.44 vs. 18.42;  $p = 0.001$ ), perceived barriers to action (10.39 vs. 9.62;  $p = 0.001$ ), perceived self-efficacy (8.52 vs. 7.68;  $p < 0.001$ ), interpersonal influences (17.07 vs. 15.72;  $p < 0.001$ ), and situational influences (5.80 vs. 5.28;  $p < 0.001$ ) (Table 3).

#### 6. Independent factors influencing commitment to vaccination

After forward conditional selection of the variables with a  $p < 0.1$  in the univariate logistic regression models, four independent factors influencing commitment to vaccination remained in the multivariate logistic regression model. After the other three factors were controlled, subjects with a budget of  $\geq$ NTD 10,000 per month were more likely to agree to be vaccinated in the next 6 months (OR, 2.15;  $p = 0.021$ ) as were subjects who had ever been advised to have an HPV vaccination (OR, 3.21;  $p < 0.001$ ); the preference to be vaccinated in the next 6 months was increased by every one unit increase in the scores for perceived self-efficacy (OR, 1.35;  $p < 0.001$ ) and situational influences (OR, 1.41;  $p = 0.015$ ) (Table 5).

**Table 3.** Association among cognitions and affects relative to human papilloma virus (HPV) vaccination and prior vaccination history and commitment to future vaccination

Variable	Ever being vaccinated with HPV vaccine			I might get vaccinated with HPV vaccine in the next 6 mo		
	Yes (n=38)	No (n=360)	p-value	Agree (n=87)	Disagree (n=273)	p-value
Perceived benefits of action	19.63 ± 3.06	18.67 ± 2.51	0.067	19.44 ± 2.60	18.42 ± 2.43	0.001*
Perceived barriers to action	12.00 ± 2.12	9.81 ± 1.95	<0.001*	10.39 ± 2.02	9.62 ± 1.89	0.001*
Perceived self-efficacy	9.18 ± 1.77	7.88 ± 1.56	<0.001*	8.52 ± 1.46	7.68 ± 1.54	<0.001*
Activity-related affect	8.24 ± 1.58	7.39 ± 1.66	0.003*	7.49 ± 2.00	7.36 ± 1.53	0.574
Interpersonal influences	16.92 ± 2.95	16.05 ± 2.65	0.061	17.07 ± 2.82	15.72 ± 2.52	<0.001*
Situational influences	5.84 ± 1.24	5.41 ± 1.05	0.017*	5.80 ± 1.07	5.28 ± 1.02	<0.001*

Values are presented as mean ± SD.

\* $p < 0.05$  indicates a significant difference in the score between two groups.

**Table 4.** Independent factors influencing prior vaccination (n=398)

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (yr)	0.97 (0.79–1.19)	0.751		
College				
Liberal arts	Reference			
Social science	1.44 (0.62–3.36)	0.401		
Medical science	1.00 (0.36–2.78)	1.000		
Religion				
None	Reference			
Taiwanese folk religion	0.38 (0.14–1.02)	0.054		
Christian	0.54 (0.15–1.89)	0.334		
Buddhist	0.83 (0.27–2.55)	0.742		
Taoist	0.23 (0.03–1.75)	0.155		
Other	1.71 (0.18–15.93)	0.638		
Expenses per month				
<NTD 10,000	Reference			
≥NTD 10,000	2.08 (0.98–4.42)	0.057		
Personal history of gynecologic disease				
No	Reference			
Yes	2.24 (0.72–6.98)	0.166		
Family history of gynecologic malignancy				
No	Reference			
Yes	3.54 (1.53–8.19)	0.003*	9.52 (2.19–41.42)	0.003*
Relationship status (intimate relationship)				
No	Reference			
Yes	1.14 (0.54–2.38)	0.735		
Sexual experience				
No	Reference			
Yes	0.64 (0.24–1.70)	0.372		
Ever heard of HPV vaccine				
No	Reference			
Yes	6.09 (1.44–25.79)	0.014*		
Ever being advised to have an HPV vaccination				
No	Reference			
Yes	89.86 (12.17–663.45)	<0.001*	112.42 (13.17–959.72)	<0.001*
Score for total knowledge	1.40 (1.21–1.62)	<0.001*		
Cognition and affect relative to HPV vaccination				
Perceived benefits of action	1.15 (1.01–1.30)	0.030*		
Perceived barriers to action	1.84 (1.49–2.26)	<0.001*	1.44 (1.10–1.88)	0.008*
Perceived self-efficacy	1.65 (1.33–2.04)	<0.001*	1.50 (1.12–2.01)	0.006*
Activity-related affect	1.37 (1.11–1.69)	0.003*		
Interpersonal influences	1.12 (0.99–1.26)	0.063		
Situational influences	1.47 (1.07–2.02)	0.018*		

CI, confidence interval; HPV, human papilloma virus; NTD, new Taiwan dollar; OR, odds ratio.  
\*p<0.05 indicates a significant influence on prior vaccination.

**Table 5.** Independent factors influencing commitment to vaccination in the next 6 months (n=360)

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (yr)	1.05 (0.93–1.18)	0.465		
College				
Liberal arts	Reference			
Social science	0.87 (0.47–1.60)	0.653		
Medical science	1.64 (0.85–3.15)	0.140		
Religion				
None	Reference			
Taiwanese folk religion	0.65 (0.34–1.22)	0.176		
Christian	0.64 (0.26–1.55)	0.318		
Buddhist	1.83 (0.84–3.99)	0.129		
Taoist	0.86 (0.34–2.14)	0.740		
Other	NA			
Expenses per month				
<NTD 10,000	Reference			
≥NTD 10,000	2.16 (1.19–3.91)	0.011*	2.15 (1.12–4.13)	0.021*
Personal history of gynecologic disease				
No	Reference			
Yes	0.89 (0.29–2.78)	0.843		
Family history of gynecologic malignancy				
No	Reference			
Yes	0.81 (0.32–2.05)	0.649		
Relationship status (intimate relationship)				
No	Reference			
Yes	1.81 (1.07–3.04)	0.026*		
Sexual experience				
No	Reference			
Yes	1.78 (1.00–3.15)	0.049*		
Ever heard of HPV vaccine				
No	Reference			
Yes	1.85 (1.00–3.43)	0.050*		
Ever being advised to have an HPV vaccination				
No	Reference			
Yes	3.11 (1.88–5.16)	<0.001*	3.21 (1.87–5.52)	<0.001*
Score for total knowledge	1.13 (1.03–1.23)	0.008*		
Cognition and affect relative to HPV vaccination				
Perceived benefits of action	1.17 (1.07–1.29)	0.001*		
Perceived barriers to action	1.24 (1.09–1.42)	0.002*		
Perceived self-efficacy	1.44 (1.22–1.71)	<0.001*	1.35 (1.12–1.63)	0.001*
Activity-related affect	1.05 (0.91–1.22)	0.518		
Interpersonal influences	1.21 (1.10–1.32)	<0.001*		
Situational influences	1.68 (1.30–2.17)	<0.001*	1.41 (1.07–1.86)	0.015*
Immediate competing demands and preferences	1.38 (1.06–1.79)	0.017*		

CI, confidence interval; HPV, human papilloma virus; NA, not available; NTD, new Taiwan dollar; OR, odds ratio.

\*p<0.05 indicates a significant influence on commitment to vaccination in the next 6 months.

**Table 6.** Associations of individual characteristics and prior related behaviors and perceived self-efficacy scores

Characteristic	No.	Perceived self-efficacy	p-value
College			0.148
Liberal arts	100	8.0 (5.0–12.0)	
Social science	198	8.0 (3.0–12.0)	
Medical science	100	8.0 (3.0–12.0)	
Religion			0.246
None	188	8.0 (5.0–12.0)	
Taiwanese folk religion	96	8.0 (3.0–12.0)	
Christian	41	8.0 (6.0–10.0)	
Buddhist	37	8.0 (6.0–12.0)	
Taoist	31	9.0 (6.0–12.0)	
Other	5	7.0 (3.0–12.0)	
Expenses per month			0.490
<NTD 10,000	328	8.0 (3.0–12.0)	
≥NTD 10,000	70	8.0 (6.0–12.0)	
Personal history of gynecologic disease			0.195
Yes	22	7.0 (6.0–10.0)	
No	376	8.0 (3.0–12.0)	
Family history of gynecologic malignancy			0.594
Yes	38	8.0 (6.0–12.0)	
No/not sure	360	8.0 (3.0–12.0)	
Relationship status (intimate relationship)			0.040*
Yes	106	9.0 (3.0–12.0)	
No	292	8.0 (3.0–12.0)	
Sexual experience			0.070
Yes	75	9.0 (3.0–12.0)	
No	319	8.0 (3.0–12.0)	
Ever heard of HPV vaccine			0.766
Yes	305	8.0 (3.0–12.0)	
No	93	8.0 (6.0–12.0)	
Ever being advised to have an HPV vaccination			0.031*
Yes	142	9.0 (3.0–12.0)	
No	256	8.0 (3.0–12.0)	
Score for total knowledge	398	$\rho=0.138$	0.006*

Values are presented as median (range).

HPV, human papilloma virus; NTD, new Taiwan dollar.

\*Perceived self-efficacy and situational influences are expressed by the Spearman correlation coefficient ( $\rho$ ).

### 7. Associations of individual characteristics and prior vaccination with cognition and affect relative to HPV vaccination

Since perceived self-efficacy was the only independent factor influencing both prior vaccination and commitment to vaccination, additional analyses of the associations between independent characteristics and prior vaccination with perceived self efficacy scores were performed.

Subjects in relationships ( $p=0.040$ ) and those ever having

been advised to be vaccinated ( $p=0.031$ ) had significantly higher scores for perceived self-efficacy. A very weak positive correlation was observed in scores for total knowledge and perceived self-efficacy ( $\rho=0.138$ ;  $p=0.006$ ) (**Table 6**).

### DISCUSSION

HPV infection is considered to be one of the most common



sexually transmitted disease. Nineteen percent of the female college students in our study had engaged in sexual intercourse with an average age of 18.45 for their sexual debut. This percentage was less than that in many Western countries such as the United States (US) (78%), France (67.2%), Italy (45.5%) [14-16] but similar to that in other Asian countries [15,17,18]; however, the overall prevalence of HPV in Taiwan could be as high as 19.85%, and the younger the subjects, the higher the infection and multiple infection rates [19]. Only 9.5% of our participants were vaccinated. That rate among female college students was similar to that in the the US (9% of females aged 18 to 26) [20]. Although 76.6% of our participants had heard of the HPV vaccine, only 35.7% had ever been advised to be vaccinated. Subjects with a family history of gynecologic malignancy or those who had ever been advised to be vaccinated were more likely to have been vaccinated. This was consistent with many previous studies [7,16,21,22]. Subjects who had ever been advised to be vaccinated were more likely to agree with being vaccinated in the next 6 months as well.

The cost of vaccination was perceived to be the greatest barrier. Most HPV vaccinations in the US are paid for by health insurance, whereas there is no free access to HPV vaccination for female college students in Taiwan. A previous study also found that insurance coverage was one of the factors associated with a desire to receive HPV vaccine [23]. Subjects with a budget of  $\geq$ NTD 10,000 (US \$333) per month were more likely to agree to be vaccinated in the next 6 months; however, only 17.6% of participants achieved this financial level.

Perceived self-efficacy had a significant effect on both prior vaccination and commitment to receive vaccination in the future. Subjects who had an intimate relationship or had ever been advised to be vaccinated had significantly higher scores for perceived self-efficacy and a weakly positive correlation with scores for total knowledge. A previous study used the health belief model to predict vaccine intentions among college-age women and also found that women's self-efficacy was one of the major predictors for HPV vaccine intent and behavior [24]. Using the theory of planned behavior, Gerend and Shepherd [25] also found that key predictors for receiving HPV vaccination by young adult women included subjective norms, self-efficacy, and vaccine cost.

Interpersonal influence was substantial as it was significantly associated with commitment to vaccination. Receipt of a recommendation for HPV vaccination was associated with both commitment to vaccination and a history of prior vaccination. The most trusted sources were parents/ family, partners, medical personnel, and peers, in that order. Individual religious beliefs had no impact on prior vaccination history or commitment to be vaccinated. Recommendations from others (e.g.,

family, health care providers) are one of the main reasons for young women to receive HPV vaccination [7,8]. Another study reported that factors independently associated with HPV vaccination intention included believing that influential people would approve of vaccination [23]. When promoting HPV vaccination, we should educate parents/family and partners as well as students.

Situational influences were significantly associated with commitment to vaccination and a history of prior vaccination. Nearly half of the participants (49.3%) agreed that they would get vaccinated if they received such a recommendation from an advertisement on television or the internet. Television had been identified as a common source of information about HPV vaccination in many previous studies [15,16,21], but no previous study had identified the internet as one of the top three sources of information.

There were some limitations to this study. First, this was not a random sample, as we only enrolled college women from northern Taiwan so that the results may not be representative of all young women in the whole country. Second, the demographic data showed that teachers were the second most common source of information about HPV vaccination and we did not include teachers when measuring interpersonal influences. Third, the responses were anonymous, so we had no way of knowing how many subjects followed through and were vaccinated within 6 months.

In conclusions, the major factors associated with both prior vaccination and commitment to receive vaccination in the future were the cost, self-efficacy, interpersonal influences, and situational influences. College students with a family history of gynecologic malignancy had a greater intent to receive HPV vaccine. When formulating vaccination policies, governmental or medical institutions should be aware of our findings in order to design a program to promote vaccination.

#### CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

#### SUPPLEMENTARY MATERIALS

Visit the following URL for supplementary 1.

#### Supplementary Questionnaire.

<http://ejgo.org/src/sm/jgo-25-188-s001.pdf>

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