

RESEARCH COMMUNICATION

Knowledge of Cervical Cancer and HPV Vaccine Post-Vaccination among Mothers and Daughters in Vietnam

Proma Paul¹, D Scott LaMontagne^{2*}, Nga Thi Le²

Abstract

Background: Limited human papillomavirus (HPV) related knowledge might be a barrier to future vaccine acceptance. From 2008-2010, PATH conducted an HPV vaccination demonstration project in partnership with the government immunization program in Vietnam, which included awareness campaigns prior to vaccination. **Objective:** To assess and compare knowledge and attitudes about cervical cancer and HPV vaccines between mothers and daughters, and whether knowledge was associated with vaccination status. **Methods:** We analyzed HPV-related knowledge and attitude data from mother-daughter paired responses to a cross-sectional household survey. After parents completed the survey, daughters were asked the same questions. We calculated the frequency of responses for each question and devised a scaled composite measure for knowledge. **Results:** Participants believed they had received enough information about cervical cancer and HPV vaccines and it was sufficient to make a decision about vaccination. Fifty percent of the participants knew HPV causes cervical cancer and 80% knew the HPV vaccine prevented cervical cancer. Mothers had more knowledge about cervical cancer and HPV infection ($p < 0.01$), compared to daughters, who had more vaccine specific knowledge ($p < 0.01$). However, the total mean knowledge score was similar for the groups. Girls not fully vaccinated had a lower mean knowledge score than fully vaccinated girls ($p < 0.001$). **Conclusions:** Our results suggest that the purpose of the HPV vaccine was clearly messaged; however, some misconceptions about cervical cancer and HPV still exist. Limited knowledge about the magnitude of cervical cancer, HPV as a cause of cervical cancer, and HPV vaccines may have contributed to incomplete vaccination.

Keywords: Knowledge - HPV - vaccine - cervical cancer - Vietnam

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Introduction

Cervical cancer is one of the leading causes of cancer related mortality in women (Ferlay et al., 2010). Availability of human papillomavirus (HPV) vaccine offers a method of primary prevention and has the potential to significantly reduce cervical cancer incidence and deaths (Brotherton et al., 2011). Prior to initiating an HPV vaccination program, assessing the levels of knowledge and awareness in a community has been suggested as a means to develop appropriate educational materials for vaccine recipients and decision-makers (Bingham et al., 2009; Jacob et al., 2010). A number of studies in Vietnam and other Asian countries have reported low levels of knowledge about cervical cancer, HPV, and HPV vaccines (Loi & Nhung, 2004; Dinh et al., 2007; Nghi et al., 2010; Young et al., 2010; Charakorn et al., 2011). These and other HPV vaccine acceptability studies have assessed knowledge and vaccine intentions before HPV vaccine availability (Allen et al., 2010). Although some studies have reported little or no relationship between HPV knowledge and vaccine acceptance, there is a belief

that limited knowledge may be a barrier to HPV vaccine acceptance (Sarin 2008; Charakorn et al., 2011).

A two-year demonstration project of HPV vaccine delivery was recently completed in Vietnam, achieving high coverage in both school- and health center-based approaches (LaMontagne et al., 2011). Parents reported that prevention of cervical cancer was a primary reason for accepting the vaccine (LaMontagne et al., 2011). However, their specific knowledge of cervical cancer or HPV vaccine as a prevention method has not yet been reported. As part of the demonstration project in Vietnam, awareness campaigns and education sessions about cervical cancer and HPV vaccines, based on results of previous formative research on these topics (Nghi et al., 2010), targeting vaccine-eligible girls, parents, and the broader community were designed and implemented prior to initiation of vaccinations. Key messages and communication strategies for the community centered around the burden of cervical cancer in Vietnam, the use of vaccines as a method of prevention, and the safety and potential side-effects of HPV vaccines (Nghi et al., 2010).

The object of this study was to assess knowledge of

¹University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, ²PATH: Seattle, USA; Hanoi, Vietnam *For correspondence: slamontagne@path.org

cervical cancer, HPV infection, and HPV vaccines among parents and girls exposed to an education campaign as part of the HPV vaccine demonstration project conducted in Vietnam, to compare the knowledge of these areas between mothers and daughters, and to explore whether knowledge was associated with vaccination status.

Materials and Methods

Two rounds of operational research were conducted; one after each year of HPV vaccine delivery was completed. This research used a mixed-methods approach to assess vaccine coverage achieved by the delivery strategies (LaMontagne et al., 2011), acceptability of HPV vaccine, feasibility of the vaccination program (PATH & NIHE, 2011), and the costs of delivery (Levin et al., 2011). During the first round of operational research, adjunct knowledge, attitudes, and practice (KAP) questions were asked in conjunction with the survey used to measure vaccine coverage.

Study design

An adaptation of the World Health Organization immunization coverage cluster survey was used to assess HPV vaccine coverage and reasons for vaccination (WHO, 2005). The detailed description of the study's methodology has been previously reported (LaMontagne et al., 2011). In short, a two-stage cluster sampling method was used to select households with vaccine eligible girls. At eligible households, parents/guardians were invited to participate in the coverage survey and respond to supplemental KAP questions. Respondents were primarily mothers. Girls who were eligible for HPV vaccine were also invited to answer the supplemental KAP questions. We limited our analysis to households where both a mother and her daughter responded to the KAP questions in paired mother-daughter interviews.

Data collected through the KAP questions included knowledge of cervical cancer, HPV, and the HPV vaccination program; attitudes towards HPV vaccination and the HPV vaccination program; and practices related to exposure to and satisfaction with information, education, and communication (IEC) materials and health education messages. Questions exploring different aspects of knowledge were developed based on the information included in the educational materials that parents and girls were given prior to vaccinations.

Data collection and analysis

Data were collected using a structured questionnaire that was developed in English and then translated into and administered in Vietnamese. Questions asked of girls were tailored to a grade 6 level. Surveys were administered separately: the mother first, followed by the daughter. Coded responses were recorded on a data recording sheet. Descriptive statistics were used to characterize the study population.

A scaled composite knowledge measure was created for the following knowledge parameters: cervical cancer, HPV, and HPV vaccine with point values of five, two, and three respectively, corresponding to one point for

each question covered in each knowledge parameter. If a question had multiple correct answers, the question was assigned one point for at least one correct answer. The participant's maximum knowledge score was ten. Mean scores of overall knowledge and specific knowledge parameters were calculated for mothers and daughters. Differences in mean knowledge scores between mothers and daughters and between fully vaccinated and partially/non-vaccinated populations were measured by t-test, with statistical significance of $p < 0.05$. Data were analyzed using Stata 10.0 (StataCorp, 2009).

Ethical considerations

Parents/guardians interviewed gave verbal consent prior to survey administration. At the time of this interview, parents/guardians were also asked to provide verbal permission to administer the supplemental KAP questions to their daughter. Girls were also requested to assent verbally to participate. If the parent/guardian did not allow their daughter to participate or the parent/guardian granted permission but the girl dissented, only the parent/guardian was interviewed.

This study received ethical approval from institutional review boards in the United States (PATH, Seattle, USA) and Vietnam (Vietnam Ministry of Health, Hanoi, Vietnam).

Results

Characteristics of survey participants

Among the 780 parent/guardians who completed the coverage survey and KAP questions, 757 had corresponding KAP responses from an eligible girl, with 536 (70%) mother-daughter paired interviews. Most of the households interviewed were in urban areas (57.8%); less than 4% of the mothers had no formal education and the majority of the daughters (82.1%) were 11 years old (Table 1). Eighty-seven percent of the girls interviewed had received all three doses of the HPV vaccine.

Perception of information received

When asked whether enough information was received, 73.3% and 78.2% of mothers and daughters, respectively, reported receiving enough information about cervical cancer. Approximately two-thirds of mothers and three-quarters of daughters reported that they received enough information about the HPV vaccine. The large majority of mothers and daughters felt the information received was sufficient to make a decision about vaccine acceptance (90.1% and 88.3% for mothers and daughters, respectively) (Table 1).

Cervical cancer and HPV vaccine knowledge

Out of the 1,072 mothers and daughters interviewed, nearly 40% of respondents did not know that cervical cancer was the most common cancer from which Vietnamese women die, nor did they know how to prevent cervical cancer. Less than 50% of mothers and 20% of daughters knew the peak age of cervical cancer (Table 2).

One hundred and sixty-two respondents, 119 mothers and 43 daughters, identifying at least one symptom of

Table 1. Characteristics of Study Population, Mothers and Daughters—Matched Pairs, Vietnam (2010)

	Total (N=536)	
	N	%
Study area		
Quan Hoa district, Thanh Hoa province	24	4.5%
Nong Cong district, Thanh Hoa province	202	37.7%
Ninh Kieu district, Can Tho province	222	41.4%
Binh Thuy district, Can Tho province	88	16.4%
Geographic area		
Mountainous	24	4.5%
Rural	202	37.7%
Urban	310	57.8%
Vaccination strategy		
School-based	340	63.4%
Health center-based	196	36.6%
Vaccination status		
Fully vaccinated	465	86.8%
Partially/Non-vaccinated	71	13.3%
Mother's highest educational attainment		
No formal education	21	3.9%
Primary	93	17.4%
Secondary	261	48.7%
High school	119	22.2%
College or higher	42	7.8%
Mother's occupation		
Farmer	218	40.7%
Worker	19	3.5%
Government staff	53	9.9%
Business	191	35.6%
Currently unemployed	87	16.2%
Unspecified	38	7.1%
Household number		
Less than 4	67	12.5%
4	231	43.1%
5	113	21.1%
Greater than 5	124	23.1%
Daughter's age		
10	88	16.4%
11	440	82.1%
12 and older	8	1.5%
Mother's perception of information received		
Enough information about cervical cancer	393	73.3%
Enough information about HPV vaccine	365	68.1%
Sufficient information to make a decision	483	90.1%
Daughter's perception of information received		
Enough information about cervical cancer	419	78.2%
Enough information about HPV vaccine	404	75.4%
Sufficient information to make a decision	473	88.2%

cervical cancer, reported the most common symptom identified was pain in the pelvic area (55.6%), followed by breakthrough bleeding (29.6%), and irregular discharge (21.6%). Among the 235 respondents (150 mothers and 85 daughters) who correctly identified at least one cervical cancer risk factor, the most common risk factor reported was early initiation of first sexual experience (65.1%).

Approximately 50% of mothers and daughters knew that HPV causes cervical cancer, but 28.9% and 19.9% of mothers and daughters, respectively, knew how HPV is transmitted. Although more than 80% of mothers and daughters knew the purpose of the vaccine, 201 (37.6%) mothers and 133 (24.8%) daughters did not know the eligible population for HPV vaccines (Table 2).

Table 2. Knowledge of Cervical Cancer and HPV Vaccine, Mothers and Daughters—Matched Pairs, Vietnam (2010)

	Total N (%)	Mothers N (%)	Daughters N (%)
Cervical cancer knowledge questions (max score = 5)			
1. Identified cervical cancer most common cancer from which Vietnamese women die			
Correct	663 (61.8)	285 (53.2)	378 (70.5)
Incorrect	283 (26.4)	181 (33.8)	102 (19.0)
Don't know	126 (11.8)	70 (13.1)	56 (10.4)
2. Identified symptoms of advanced cervical cancer			
None	910 (84.9)	417 (77.8)	493 (92.0)
One	109 (10.2)	75 (14.0)	34 (6.3)
Two	44 (4.1)	37 (6.9)	7 (1.3)
Three or more	9 (0.8)	7 (1.3)	2 (0.4)
3. Identified peak age of cervical cancer			
Correct	363 (33.9)	259 (48.3)	104 (19.4)
Incorrect	538 (50.2)	222 (41.4)	316 (59.0)
Don't know	171 (16.0)	55 (10.3)	116 (21.6)
4. Identified risk factors of cervical cancer			
None	837 (78.1)	386 (72.0)	451 (84.1)
One	199 (18.6)	122 (22.8)	77 (14.4)
Two	33 (3.1)	25 (4.7)	8 (1.5)
Three or more	3 (0.3)	3 (0.6)	0 (0.0)
5. Identified actions to prevent cervical cancer			
Correct	644 (60.1)	291 (54.3)	353 (65.9)
Incorrect	224 (20.9)	141 (26.3)	83 (15.5)
Don't know	204 (19.0)	104 (19.4)	100 (18.7)
Mothers (SD)	Daughters (SD)	t-test	p
Mean composite score – cervical cancer knowledge			
2.1 (1.2)	1.8 (1.0)	4.58	<0.001
HPV knowledge questions (max score = 2)			
6. Aware of a virus called HPV causes cervical cancer			
Correct	537 (50.1)	265 (49.4)	272 (50.7)
Incorrect	347 (32.4)	148 (27.6)	199 (37.1)
Don't know	188 (17.5)	123 (22.9)	65 (12.1)
7. Identified how person comes into contact with the HPV virus			
Correct	523 (48.8)	310 (57.8)	213 (39.7)
Incorrect	549 (51.2)	226 (42.2)	323 (60.3)
Mothers (SD)	Daughters (SD)	t-test	p
Mean composite score – HPV knowledge			
1.1 (0.7)	0.9 (0.7)	4.08	<0.001
HPV vaccine knowledge questions (max score = 3)			
8. Identified purpose of HPV vaccine			
Correct	906 (84.5)	430 (80.2)	476 (88.8)
Incorrect	77 (7.2)	16 (3.0)	61 (11.4)
Don't know	162 (15.1)	90 (16.8)	72 (13.4)
9. Identified who should receive HPV vaccine			
Correct	736 (68.7)	333 (62.1)	403 (75.2)
Incorrect	184 (17.2)	123 (22.9)	61 (11.4)
Don't know	151 (14.1)	79 (14.7)	72 (13.4)
10. Identified potential problems a person might have after receiving the HPV vaccine			
None	496 (46.3)	302 (56.3)	194 (36.2)
One	295 (27.5)	136 (25.4)	159 (29.7)
Two	217 (20.2)	83 (15.5)	134 (25.0)
Three or more	64 (6.0)	15 (2.8)	49 (9.1)
Mothers (SD)	Daughters (SD)	t-test	p
Mean composite score – HPV vaccine knowledge			
1.86 (0.93)	2.28 (0.79)	-9.55	<0.001
Total mean composite knowledge score			
5.0 (2.1)	5.00 (1.80)	0.16	0.88

Table 3. Comparison of Cervical Cancer and HPV Vaccine Knowledge, Fully Vaccinated and Partially/Non-Vaccinated Girls and Their Mothers, Vietnam (2010)

	Mothers				Daughters			
	Fully vaccinated N (%)	Partially/ non-vaccinated	t-test	p-value	Fully vaccinated N (%)	Partially/ non-vaccinated	t-test	p-value
Cervical cancer knowledge questions								
1. Correctly identified cervical cancer most common cancer from which Vietnamese women die.	263 (56.6)	22 (31.0)		<0.01	340 (73.1)	38 (53.5)		<0.01
2. Correctly identified at least one symptom of advanced cervical cancer.	113 (24.3)	6 (8.5)		<0.01	41 (8.8)	2 (2.8)	0.08	
3. Correctly identified peak age of cervical cancer	222 (47.7)	37 (52.1)	0.49		86 (18.5)	18 (25.4)	0.17	
4. Correctly identified at least one risk factor of cervical cancer	135 (29.0)	15 (21.1)	0.17		82 (17.6)	3 (4.2)		<0.01
5. Correctly identified ways to prevent cervical cancer.	273 (58.7)	18 (25.4)		<0.01	337 (72.5)	28 (39.4)		<0.01
	Mean (SD)	Mean (SD)	t-test	p-value	Mean (SD)	Mean (SD)	t-test	p-value
Mean composite score – cervical cancer knowledge	2.2 (1.2)	1.4 (1.2)	5.2	<0.001	1.9 (1.0)	1.3 (1.0)	5.15	<0.001
HPV knowledge questions								
6. Aware of a virus called HPV causes cervical cancer	245 (52.7)	20 (28.2)		<0.01	248 (53.3)	24 (33.8)		<0.01
7. Correctly identified how person comes into contact with the HPV virus.	271 (58.3)	39 (54.9)	0.59		195 (41.9)	18 (25.4)	0.01	
Mean composite score – HPV knowledge	1.1 (0.7)	0.8 (0.7)	2.97	<0.01	1.0 (0.7)	0.6 (0.7)	3.89	<0.001
HPV vaccine knowledge questions								
8. Correctly identified purpose of HPV vaccine.	389 (83.7)	41 (57.7)		<0.01	428 (92.0)	48 (67.6)		<0.01
9. Correctly identified who should receive HPV vaccine.	306 (65.8)	28 (39.4)		<0.01	366 (78.7)	37 (52.1)		<0.01
10. Correctly identified potential problems a person might have after receiving the HPV vaccine.	218 (46.9)	16 (22.5)		<0.01	308 (66.2)	34 (47.9)		<0.01
Mean composite score – HPV vaccine knowledge	2.0 (0.9)	1.2 (1.0)	6.75	<0.001	2.4 (0.7)	1.7 (1.0)	7.19	<0.001
Total mean composite knowledge score	5.3 (2.0)	3.4 (2.4)	7.14	<0.001	5.2 (1.6)	3.5 (1.9)	7.98	<0.001

Comparison of knowledge between mothers and daughters

Based on the mean knowledge scores for each of the parameters, mothers and daughters recalled different information during the survey (Table 2). Generally, mothers had more knowledge about cervical cancer and HPV infection compared to daughters (p<0.01). Daughters had more HPV vaccine specific knowledge (p<0.01). However, the overall mean knowledge score was similar for the two groups, 5.0 (standard deviation 2.1) for mothers and 5.0 (standard deviation 1.8) for daughters (p=0.74). Modest positive correlation between mothers' overall knowledge scores and their respective daughters was observed, r=0.356, N=536, p<0.001, demonstrating similar level of knowledge about cervical cancer and HPV vaccines between mothers and their daughters.

Comparison of knowledge and HPV vaccination status

Fully vaccinated girls had a 1.7 points higher mean knowledge score compared to partially or non-vaccinated girls (p<0.01) (Table 3). The trend was similar among mothers of vaccinated and partially or non-vaccinated girls. The mean knowledge score for mothers of fully vaccinated girls was 5.3 (standard deviation 2.0) and the mean knowledge score for mothers of partially or non-

vaccinated girls was 3.4 (standard deviation 2.4) (p<0.01).

For mothers, correctly answering questions about peak age of cervical cancer (p=0.49), cervical cancer risk factors (p=0.17), and HPV transmission (p=0.59) were not statistically significant by vaccination status. Daughter's knowledge about symptoms of advanced cervical cancer (p=0.08) and peak age of cervical cancer (p=0.17) were not different among fully and partially/non-vaccinated girls. However, information about the magnitude of the cervical cancer problem in Vietnam (p<0.01), being aware that HPV causes cervical cancer (p<0.01), and general HPV vaccine information, such as purpose of vaccine, target recipient, and potential side-effects (p<0.01), were significantly different by vaccination status for both mothers and daughters (Table 3).

Discussion

Prior to HPV vaccine delivery in the demonstration sites in Vietnam, formative research in these areas (Nghie et al., 2010), as well as previous studies in Vietnam and other Asian countries, reported the limited knowledge about cervical cancer and low to no knowledge about HPV vaccines (Loi & Nhung, 2004; Dinh et al., 2007;

Young et al., 2010; Charakorn et al., 2011). Our study investigated knowledge levels of daughters and their mothers who were exposed to HPV vaccine messaging as part of the communication strategy of a vaccination program, exploring the relationship between knowledge of mothers and their respective daughters. The total mean knowledge score, approximately five out of ten, was similar for mothers and daughters in the survey population, indicating that only half of the knowledge questions were answered correctly. These findings show that both mothers and daughters have low levels of knowledge about cervical cancer, HPV infection, and HPV vaccines even after an intensive education campaign primarily conducted immediately prior to the first HPV vaccine dose.

Notably, our findings suggest that knowledge about certain topics may have improved after the education and communication campaigns. In formative research conducted prior to the implementation of HPV vaccinations in these communities in Vietnam, researchers noted a general lack of knowledge and awareness about the existence of HPV vaccine and its use to prevent cervical cancer (Nghi et al., 2010). However, our survey found most mothers and daughters had heard of HPV vaccine and knew what it could prevent. These results suggest that the message about the purpose of the vaccine was clearly disseminated and understood by mothers and daughters, and specifics about the HPV vaccine were understood by the recipients of the vaccine.

Even though the communication content was similar for parents and girls, our results indicate that mothers and daughters may have received different information, or retained/recalled different information of relevance to them: mothers' recalled information focused on cervical cancer and daughters' recalled information focused on the vaccine. This difference may be due to presentation and relevance of the information being presented (Kreuter & Wray, 2003; Wilson, 2007). Mothers' knowledge about cervical cancer may be linked to their perceived risk about developing cervical cancer. Similarly, the vaccine related knowledge that daughters had may be due to the fact that they were receiving the vaccination.

Although knowledge was low, eligible girls in this population were highly likely to receive all three doses of HPV vaccine (LaMontagne et al., 2011), suggesting that specific HPV and cervical cancer knowledge may not be a primary driver for HPV vaccine acceptance, a finding similar to that recently reported from the Australian HPV vaccination program (Cooper et al., 2010). Previous findings from childhood immunization programs have suggested that specific knowledge about immunizations and the diseases they protect against are not necessarily associated with vaccine acceptance (Nichter, 1995; Jhetta & Newell, 2008). It is also important to note that both mothers and daughters reported receiving sufficient information about cervical cancer and HPV vaccine to make a decision about accepting HPV vaccine. Therefore, education campaigns for new vaccines should be clear on what information they want to communicate to communities balanced with what information families need to make a decision for vaccine acceptance, recognizing that the information may not necessarily be

the same for both.

Nevertheless, the higher mean knowledge of fully vaccinated girls and their parents, when compared to partially/non-vaccinated girls and their parents suggests that limited knowledge about magnitude of cervical cancer, HPV as the cause of cervical cancer, and general information about HPV vaccinations may have contributed to incomplete vaccination. Therefore, communication and education campaigns may want to focus on these messages to facilitate vaccine uptake. Given the correlation between daughters' overall knowledge and their mothers' overall knowledge, comprehensive cervical cancer messaging that covers both vaccination and screening may help reinforce messages to both groups.

Our study has a few limitations that should be kept in mind when interpreting our results. First, respondents in our study were asked cervical cancer and HPV vaccine knowledge questions nine months after the initial education campaigns. Recall of information may have been different if respondents were asked the same set of questions immediately after the campaign, such as after the administration of the first dose. The study was unable to assess whether respondents knew the information and forgot it, never knew it, or if it was related to how many times they were exposed to the key message. Lastly, due to the cross-sectional nature of the study, as well as the small number of daughters not vaccinated, we cannot conclude that the information disseminated determined vaccine acceptance, as that decision could have also been influenced by other factors, such as fear of cancer, wishes of the father, familial history, or experience with cervical cancer, amongst others. Even given these limitations, our study still provides valuable insight into knowledge retention and recall with a population-based sample of mothers and daughters, a particular strength in our design.

In conclusion, the results from this study suggest knowledge of daughters and their mothers alone may not be the deciding factor for HPV vaccination, since vaccination uptake was high even with low overall knowledge. Even if comprehensive information on cervical cancer, HPV vaccines, and the program is provided to the communities, mothers and daughters may also remember different aspects of an HPV vaccine education campaign. Individuals may rely on certain pieces of information that they feel are more important to them. Since mothers of girls who did not complete the vaccination series or who were not vaccinated at all seem to have limited knowledge about cervical cancer, HPV as its cause, and HPV vaccines more generally, future education campaigns may want to ensure that these key messages are included. Further research is needed to assess and understand the precise requirements of a communication strategy for HPV vaccines that results in high uptake: what pieces of information, to which audiences, how often, and to what degree of saturation.

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References

- Allen JD, Coronado GD, Williams RS, et al (2010). A systematic review of measures used in studies of human papillomavirus (HPV) vaccine acceptance. *Vaccine*, **28**, 4027-37.
- Bingham A, Janmohamed A, Bartolini R, et al (2009). An approach to formative research in HPV vaccine introduction planning in low-resource settings. *Open Vaccine J*, **2**, 1-16.
- Brotherton JM, Gertig GM (2011). Primary prophylactic human papillomavirus vaccination programs: future perspective on global impact. *Exper Rev Anti Infec Ther*, **9**, 627-39.
- Charakorn C, Rattanasiri S, Lertkhachonsuk AA, et al (2011). Knowledge of Pap smear, HPV and the HPV vaccine and the acceptability of the HPV vaccine by Thai women. *Asia Pac J Clin Oncol*, **7**, 160-7.
- Cooper Robbins SC, Bernard D, McCaffery K, Brotherton JML, Skinner SR (2010). I Just Signed. Factors Influencing Decision-Making for School-Based HPV Vaccination of Adolescent Girls. *Health Psychol*, **29**, 618-25.
- Dinh TA, Rosenthal SL, Doan ED, et al (2007). Attitudes of mothers in Da Nang, Vietnam toward a human papillomavirus vaccine. *J Adol Health*, **40**, 559-63.
- Ferlay J, Shin HR, Bray F, et al (2010). Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer*, **127**, 2893-917.
- Jacob M, Mawar N, Menezes L, et al (2010). Assessing the environment for introduction of human papillomavirus vaccine in India. *Open Vaccine J*, **3**, 96-107.
- Jhetta M, Newell J (2008). Childhood vaccination in Africa and Asia: the effects of parents' knowledge and attitudes. *Bull World Health Organ*, **86**, 419.
- Kreuter MW, Wray RJ (2003). Tailored and targeted health communication: strategies for enhancing information relevance. *Am J Health Behav*, **27**, 227-32.
- LaMontagne DS, Barge S, Le NT, et al (2011). Delivery strategies for HPV Vaccination programs that achieved high coverage in low and middle-income countries. *Bull World Health Organ*, **89**, 821-30.
- Levin CE, Minh HV, Odaga J, et al (2011). Costs and financial implications of delivery strategies to introduce HPV vaccine in Peru, Uganda, Vietnam, and India. Manuscript submitted to Bull World Health Organ.
- Loi TT, Nhung BTH (2004). Screening cervical cancer of perimenopausal women in Ho Chi Minh City. *HCMH J Med*, **8**, 116-9.
- Nghi NQ, LaMontagne DS, Bingham A, et al (2010). Human papillomavirus vaccine introduction in Vietnam: formative research findings. *Sex Health*, **7**, 262-70.
- Nichter M (1995). Vaccinations in the Third World: a consideration of community demand. *Soc Sci Med*, **41**, 617-32.
- PATH and Vietnam National Institute of Hygiene and Epidemiology (2010). Evaluating HPV Vaccine Delivery Strategies in Vietnam. Seattle, Washington: PATH.
- Sarin R (2008). HPV vaccine for primary prevention of cervical cancer in developing countries: the missing links. *J Cancer Res Ther*, **4**, 105-6.
- StataCorp (2009). Stata Statistical Software: Release 10.0.
- Wilson BJ (2007). Designing media messages about health and nutrition: what strategies are most effective? *J Nutr Educ Behav*, **39**, 13-9.
- World Health Organization (2005). Immunization coverage cluster survey – reference manual. Geneva: WHO, Department of Immunization, Vaccines and Biologicals.
- Young AM, Crosby RA, Jagger KS, et al (2010). HPV vaccine acceptability among women in the Philippines. *Asian Pac J Cancer Prev*, **11**, 1781-7.