

RESEARCH ARTICLE

Knowledge, Perceptions and Acceptability of HPV Vaccination among Medical Students in Chongqing, China

Chun-Jing Fu¹, Xiong-Fei Pan², Zhi-Mei Zhao², Michael Saheb-Kashaf³, Feng Chen⁴, Ying Wen², Chun-Xia Yang^{2*}, Xiao-Ni Zhong^{1*}

Abstract

Objectives: To evaluate medical students' knowledge of HPV and HPV related diseases and assess their attitudes towards HPV vaccination. **Methods:** A total of 605 medical undergraduates from Chongqing Medical University in China were surveyed using a structured and pretested questionnaire on HPV related knowledge. **Results:** Some 68.9% of the medical students were females, and mean age was 21.6 (± 1.00) years. Only 10.6% correctly answered more than 11 out of 14 questions on HPV related knowledge, 71.8% being willing to receive/advise on HPV vaccination. Female students (OR: 2.69; 95% CI: 1.53-4.72) and students desiring more HPV education (OR: 4.24; 95% CI: 1.67-10.8) were more willing to accept HPV vaccination. HPV vaccination acceptability was observed to show a positive association with HPV related knowledge. **Conclusions:** Our survey found low levels of HPV related knowledge and HPV vaccination acceptability among participating medical students. HPV education should be systematically incorporated into medical education to increase awareness of HPV vaccination.

Keywords: HPV vaccination - medical students - knowledge - acceptability - China

Asian Pac J Cancer Prev, 15 (15), 6187-6193

Introduction

Cervical cancer is one of the most common types of cancer worldwide in women, and in 2012, approximately 528,000 new cases were diagnosed with 266,000 women dying from the malignancy (WHO et al., 2012). In China, the latest annual age-standardized morbidity and mortality estimates are 9.6 and 4.3 per 100,000 women, respectively (Markowitz et al., 2007). Despite facing a huge national burden, China currently has no nationwide screening program for cervical cancer in place and no prophylactic human papillomavirus (HPV) vaccine on the market (Zhang et al., 2010).

Prophylactic HPV vaccines are important and effective tools in preventing cervical cancer. Studies have shown that HPV is a causative agent contributing to the development of cervical cancer (Peckham et al., 1995). It is the most common sexually transmitted disease occurring primarily in adolescents and young adults and, in sexually active youth, a cumulative prevalence rate of up to 82% has been observed (Brown et al., 2005). Genital HPV is classified into high-risk (mainly HPV16 and 18) and low-risk (mainly HPV6 and 11) types, according to its potential for causing invasive cervical cancer. HPV16

accounts for 50% of cases of cervical cancer and HPV18 accounts for 20% of cases (Serrano et al., 2012). Though HPV6 and 11 show a low risk for inducing cervical cancer, they cause 90% of cases of genital warts (Munoz et al., 2003). To date, two prophylactic HPV vaccines have been developed and approved in a number of countries; one is a quadrivalent vaccine, Gardasil, targeted at HPV6, 11, 16, and 18, while the other is a bivalent vaccine, Cervarix, targeted against HPV 16 and 18. The efficacy and safety of these vaccines has been validated in clinical trials (Schiller et al., 2012). Phase III clinical trials of both the quadrivalent and bivalent vaccines are still in progress in China (Zhang et al., 2013). A novel HPV vaccine against HPV16 and 18, developed by Xiamen Innovax Biotech (Xiamen, China), was recently tested in a phase III clinical trial (Wei et al., 2009). It is expected that prophylactic HPV vaccines will play an essential role in mediating cervical cancer prevention in China.

It is crucial to assess HPV-related knowledge among the target population before the initiation of a vaccination program. Existing studies have shown that knowledge about HPV may strongly influence vaccination acceptance (Gerend et al., 2007; Gottvall et al., 2009). In China, there have been some studies examining this topic, both in Hong

¹Department of Health Statistics and Information Management, School of Public Health and Management, Chongqing Medical University, Chongqing, ²Department of Epidemiology, West China School of Public Health, Sichuan University, Chengdu, ⁴Department of Preventive Healthcare and Hospital Infection Control, People's Hospital of Deyang, Deyang, China, ³Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, UK *For correspondence: zxn66@vip.sina.com, chunxia815@aliyun.com

Kong (Lee et al., 2007; Kwan et al., 2008; Kwan et al., 2009) and in mainland China (Li et al., 2009; Zhao et al., 2012; Zhang et al., 2013). The study populations assessed in these studies have included women, adolescent girls, parents, government officials, and medical personnel. To date, there have not been any studies examining HPV knowledge and HPV vaccination acceptability among medical students.

As future health care providers, medical students constitute important sources of information regarding the target vaccination population. Medical students play an important role in promoting public knowledge and awareness of cervical cancer (Pandey et al., 2012). To address this gap in the literature, as part of a multi-center survey in southwest China, we piloted a survey in a medical school to evaluate the level of HPV-related knowledge and the acceptability of HPV vaccination among medical undergraduates in China. Medical students' knowledge of HPV, cervical cancer and HPV vaccination may reflect the current state of HPV education in medical schools. An understanding of this status quo can aid the development of comprehensive vaccination policies and campaigns. Hence, the aims of this study were to evaluate medical students' knowledge of HPV and HPV-related diseases and assess their attitudes towards HPV vaccination.

Materials and Methods

Study design and population

This cross-sectional survey was conducted at Chongqing Medical University in May 2013. Considering the distribution of different majors, we sampled 650 medical undergraduates from a sampling frame comprising all enrolled students (about 7%), 605 responded to our survey when approached before class (response rate: 93%). Data was collected from the respondents through a self-administered anonymous questionnaire adapted from the existing research literature (Pandey et al., 2012; Rashwan et al., 2012; Zhang et al., 2013). It consisted of sections soliciting socio-demographic information such as age, gender, ethnicity, and grade; knowledge of HPV, cervical cancer and/or genital warts, and HPV vaccines; and perceptions of HPV vaccination. The study was approved by the Ethics Committee of Sichuan University Fourth Hospital/West China School of Public Health.

Data collection and quality control

The survey instrument was delivered to participating students in the classroom before lecture. Prior to the investigation, researchers gave a brief introduction on the purpose of the study. This introductory information was also included in the informed consent form. Since the questionnaire was anonymous, no written consent was requested from participating students. They were informed that participation is voluntary, and those unwilling to participate were asked to return a blank questionnaire. No consent was requested from parents or guardians of any participants. In order to prevent inter-communication, participants were required to maintain some distance from one another while completing the questionnaire.

Statistical analysis

Survey data was analyzed using SAS version 9.2. Demographic information was presented as frequencies and percentages. Total HPV related knowledge score was calculated by rewarding 1 point for each correct answer and students' knowledge level was categorized based on the resulting score. The acceptability of HPV vaccination was assessed by the question: "Would you like to receive/advise HPV vaccination?" Participants who answered "Yes" were regarded as accepting HPV vaccination. Univariable logistic regression analysis was conducted to explore factors influencing the acceptability of HPV vaccination, and the overall model was developed using multivariable logistic regression analysis. Two-tailed tests were employed, and $\alpha=0.05$ was set as the threshold for statistical significance.

Results

Demographic characteristics

605 medical undergraduate students participated in the survey. Demographic characteristics of the study population are shown in Table 1. Among responders, 414 (68.9%) were female and 572 (95.3%) were ethnic Han Chinese. Over 80% were senior students, and most (316, 53.4%) were 22-26 years with a mean age of 21.6 ± 1.00 years. Of the 605 students surveyed, 7.44% had experienced sexual activity, with 1.98% declining to answer. A majority (484, 80.0%) of students became sexually mature at 12-15 years old; 93 (15.4%), between 16-20 years; and 28 (4.63%) before 12 years of age.

Table 1. Demographic Characteristics of Medical Students

Characteristics	Frequency	Percent
Age (years)		
18-21	276	46.6
22-26	316	53.4
Gender		
Male	187	31.1
Female	414	68.9
Ethnic groups [#]		
Han	572	95.3
Other*	28	4.67
Grade		
2	114	18.8
3	491	81.2
Sexual maturity [#]		
8-11	28	4.63
12-15	484	80.0
16-20	93	15.4
Previous sexual behavior [#]		
Yes	45	7.44
No	548	90.6
Unknown	12	1.98
Attitude towards premarital sex behavior [#]		
Positive	71	12.0
Negative	123	20.8
Neutral	344	58.1
Undecided	54	9.12

*includes Tujia, Miao, Zhuang, Jing, Menggu, Dong, Naxi, Dai, Uygur, Chuanqing, Mulao and Hui ethnic minorities; [#]They did not add up to 100% because the numbers were rounded up

Table 2. HPV Related Knowledge among Medical Students

	Frequency	Percent
Is HPV sexually transmitted?		
Yes*	409	67.8
No	61	10.1
Unknown	133	22.1
Is HPV a common infection in women?		
Yes*	263	43.6
No	135	22.4
Unknown	205	34.0
Most women infected with HPV infection show symptoms, right?		
Yes	105	17.5
No*	292	48.7
Unknown	203	33.8
Do you think HPV can infect a man?		
Yes*	405	67.2
No	95	15.8
Unknown	103	17.1
Can HPV be cleared by the immune system?		
Yes*	263	44.0
No	136	22.7
Unknown	199	33.3
Can HPV cause cervical cancer?#		
Yes*	521	86.1
No	10	1.65
Unknown	74	12.2
Can HPV cause genital warts?#		
Yes*	414	68.7
No	24	3.98
Unknown	165	27.4
Is persistent HPV infection the necessary cause of cervical cancer?		
Yes*	82	13.6
No	311	51.7
Unknown	209	34.7
Can cervical cancer be prevented by HPV vaccines?		
Yes*	383	63.3
No	105	17.4
Unknown	117	19.3
Can HPV vaccines be given to a woman already having HPV infection?		
Yes	111	18.4
No*	331	54.8
Unknown	162	26.8
Can HPV vaccines be given to a sexually active woman?#		
Yes*	459	76.4
No	31	5.16
Unknown	111	18.5
Do girls/women need to be screened for HPV before getting vaccinated?#		
Yes	525	86.9
No*	23	3.81
Unknown	56	9.27
Do women who have already been vaccinated, require cervical cancer screening?#		
Yes*	532	88.5
No	12	2.00
Unknown	57	9.48
Is it safe to have multiple sexual partners after full course of HPV vaccination?		
Yes	66	11.0
No*	345	57.4
Unknown	190	31.6

*They corresponded to correct answers to the knowledge questions; #They did not add up to 100% because the numbers were rounded up

Regarding premarital sex behavior, most students (58.1%) expressed a neutral attitude.

Knowledge of HPV, cervical cancer and HPV vaccination

Respondents' knowledge of HPV, cervical cancer, and HPV vaccination is summarized in Table 2. Most students (67.8%) were aware of the mode of transmission. Only 43.6% of responders recognized that HPV infection is common in women, and a similar percentage of participants believed that HPV could be cleared by the immune system. Half of responders were aware of the asymptomatic nature of HPV infection, and 67.2% thought that HPV could infect men as well. 86.1% of responders knew that HPV could cause cervical cancer and 68.7% knew of the association between HPV and genital warts. 13.6% believed that persistent HPV infection was necessary for cervical cancer. 383 students (63.3%) expressed the belief that cervical cancer could be prevented by HPV vaccination. 18.4% and 76.4%, respectively, thought that HPV vaccines could be administered to women with existing HPV infection and to sexually active women. 86.9% believed that it is necessary for girls/women to be screened for HPV before vaccination, while 88.5% thought that cervical cancer screening is still necessary after vaccination. In addition, 57.4% did not think that it is safe to have multiple sexual partners even after a full course of HPV vaccination. Only 10.6% (data not shown) of responders achieved a total knowledge score of 11 or higher, meaning that they correctly answered more than 11 out of 14 knowledge questions on HPV, cervical cancer and HPV vaccination.

Perceptions and concerns about HPV vaccination

Table 3 summarizes perceptions and concerns about HPV vaccination among the surveyed medical students. 36.9% of male students preferred 13-18 years as the age group for vaccination, while 40.1% of female students preferred 19-25 years. A majority of both male and female students agreed that it was best to receive HPV vaccination before sexual debut. The local center for disease prevention and control (CDC) was selected as the most appropriate venue for vaccination by most males (67.9%) and females (73.6%), while only 19.3% males and 22.5% females preferred a school setting. 60.0% of male students thought that HPV vaccines could be given to boys, while a slightly higher percentage (68.4%) of females held the same view. In respect to sources of knowledge about HPV vaccination, male and female students responded similarly, with classroom courses cited most frequently. A majority of students (89.6% vs. 93.7%) had not been consulted by friends or relatives regarding HPV vaccination, and most (88.7% vs. 96.4%) would like to be educated by experts. Over half of males (57.2%) indicated that they would like to receive/advise HPV vaccination, as compared to 78.5% of females. Among those who did not accept HPV vaccination, inadequate information and fear of complications were cited as the most important obstacles, while worries about the efficacy of vaccination and high cost were additional reasons for the rejection of HPV vaccination. Over half of male and female students preferred imported vaccines, while one

Table 3. Perceptions and Concerns of HPV Vaccination among Medical Students

	Males		Females	
	Frequency	Percent	Frequency	Percent
Which age group HPV vaccines should be given? [#]				
0-12y	21	11.2	27	6.52
13-18y	69	36.9	136	32.9
19-25y	55	29.4	166	40.1
26y & above	16	8.56	44	10.6
Unknown	26	13.9	41	9.90
Which is the most appropriate stage for HPV vaccination? [#]				
Before sexual debut	133	71.5	332	80.4
After sexual debut	8	4.30	25	6.05
Unknown	45	24.2	56	13.6
Which venue is the most appropriate for HPV vaccination?				
CDC	127	67.9	304	73.6
Community health center/ local clinic	70	37.4	165	40.0
Women and children's hospital	90	48.1	284	68.8
General hospital	79	42.3	199	48.2
School	36	19.3	93	22.5
Unknown	5	2.67	4	0.97
Can HPV vaccines be given to boys?				
Yes	111	60.0	281	68.4
No	35	18.9	60	14.6
Unknown	39	21.1	70	17.0
What are your sources of knowledge about HPV vaccines?				
School courses	139	74.7	355	86.0
Hospital	37	19.9	75	18.3
Family / friends	13	6.99	31	7.52
Internet / television	54	29.0	111	26.9
Publications	38	20.4	80	19.4
Others	17	9.14	17	4.14
Has anybody (friends/family) sought your opinion regarding HPV vaccination? [#]				
Yes	19	10.4	26	6.34
No	164	89.6	384	93.7
Would you like yourself to be educated by experts about HPV vaccination? [#]				
Yes	164	88.7	399	96.4
No	21	11.4	15	3.62
Would you like to receive/advise HPV vaccination? [#]				
Yes	107	57.2	324	78.5
No	41	21.9	35	8.47
Unknown	39	20.9	54	13.1
What do you think will be the most important obstacle preventing yourself to receive/advise HPV vaccination?				
High cost	2	4.88	3	9.68
Worry about complications	6	14.6	11	35.5
Worry about efficacy of vaccines	5	12.2	3	9.68
Inadequate information	28	68.3	14	45.2
Which vaccines you would like to receive or advise?				
Domestic HPV vaccines	20	10.7	71	17.3
Imported HPV vaccines	96	51.3	207	50.5
Either, dependent on price	71	38.0	132	32.2
What is your attitude toward future HPV vaccination program in China?				
Positive, since the vaccine can prevent cervical cancer/genital warts.	84	44.9	153	37.0
Positive, but requesting pricing regulation and subsidy.	69	36.9	209	50.5
Neutral, since the price will be high and the consumption capacity of ordinary Chinese should be considered.	20	10.7	19	4.59
Neutral, since long-term efficacy and side effects should be evaluated.	22	11.8	55	13.3
Negative, since it may lead to promiscuity.	1	0.53	3	0.72
Others	1	0.53	0	0.00

[#]They did not add up to 100% because the numbers were rounded up.

Table 4. Factors Associated with Acceptability of HPV Vaccination in Univariable Analysis

	Number of subjects		Willing to vaccinate		p value
	in analysis		N (%)	OR (95%CI)	
Age (years)					0.61
18-21	223		192 (86.1)	1	
22-26	277		234 (84.5)	0.88 (0.53-1.45)	
Gender					<0.01
Male	148		107 (72.3)	1	
Female	359		324 (90.3)	3.55 (2.15-5.86)	
Ethnic groups					0.72
Han	482		409 (84.9)	1	
Other	24		21 (87.5)	1.25 (0.36-4.30)	
Grade					0.13
2	91		82 (90.1)	1	
3	420		352 (83.8)	0.57 (0.27-1.19)	
Sexual maturity					<0.01
8-11	25		21 (84.0)	1	
12-15	411		360 (87.6)	1.35 (0.44-4.08)	
16-20	75		53 (70.7)	0.46 (0.14-1.49)	
Previous sexual behavior					0.54
No	462		394 (85.3)	1	
Yes	38		31 (81.6)	0.76 (0.32-1.81)	
Attitude towards premarital sexual behavior					0.70
Negative	100		86 (86.0)	1	
Positive	63		51 (81.0)	0.69(0.30-1.61)	
Neutral	292		251 (86.0)	1.00(0.52-1.92)	
Undecided	44		36 (81.8)	0.73(0.28-1.90)	
Would you like yourself to be educated by experts about HPV vaccination?					<0.01
No	24		13 (54.2)	1	
Yes	486		421 (86.6)	5.48 (2.36-12.8)	
Has anybody (friends/family) sought your opinion regarding HPV vaccination?					0.37
No	462		396 (85.7)	1	
Yes	41		33 (80.5)	0.69 (0.30-1.55)	
Total score of HPV related knowledge					<0.01
0-6	104		78 (75.0)	1	
7-10	346		299 (86.4)	2.12 (1.24-3.64)	
11-13	61		57 (93.4)	4.75 (1.57-14.4)	

Table 5. Factors Associated with Acceptability of HPV Vaccination in Multivariable Analysis

	Number of subjects		Willing to vaccinate		p value*
	in analysis		N (%)	OR (95%CI)*	
Gender					<0.01
Male	148		107 (72.3)	1	
Female	359		324 (90.3)	2.69 (1.53-4.72)	
Sexual maturity					0.28
8-11	25		21(84.0)	1	
12-15	411		360 (87.6)	1.51 (0.46-4.91)	
16-20	75		53 (70.7)	0.91(0.25-3.35)	
Would you like yourself to be educated by experts about HPV vaccination?					<0.01
No	24		13 (54.2)	1	
Yes	486		421 (86.6)	4.24 (1.67-10.8)	
Total score of HPV related knowledge					0.04
0-6	104		78 (75.0)	1	
7-10	346		299 (86.4)	1.63 (0.92-2.92)	
11-13	61		57 (93.4)	4.05 (1.30-12.7)	

*adjusted for other variables in the table

third would base their choice on the pricing of the two types of vaccine. 81.8% and 87.4% held positive views of the prospects for HPV vaccination in China, 22.5% of males and 17.9% of females held neutral views, and were influenced by considerations relating to cost, unclear long-term efficacy and possible side effects. Over half of those with a positive view (54.0%) called for pricing regulations and government subsidy for HPV vaccination.

Factors associated with acceptability of HPV vaccination

In univariable logistic regression analysis Table 4, gender, sexual maturity, interest in being educated by experts about HPV vaccination, and total knowledge score were significantly associated with acceptability of HPV vaccination among surveyed medical students. Table 5 presents results from a multivariable logistic regression analysis, which included the above four factors. Students obtaining a higher total score of HPV related knowledge were more willing to accept HPV vaccination. Compared with males, female students were 2.69 (95%CI: 1.53-4.72) times more likely to receive or advise the vaccines. In addition, students who expressed an interest in expert-directed education about HPV vaccination showed higher acceptability of vaccination.

Discussion

To our knowledge, this is the first study to investigate knowledge and perceptions of HPV vaccination among medical students in China. We found that the acceptability of HPV vaccination was 57.2% among male and 78.5% among female medical students, corroborating the findings of one Indian study (53.0% vs. 79.4%) (Pandey et al., 2012) but lower than among medical students surveyed in another study (Mehta et al., 2013). Other studies conducted among general college students reported varying levels of acceptability of vaccination ranging between 10.1%-75.6% among males and 11.6%-93.8% among females (Durusoy et al., 2010; Medeiros et al., 2010; Wong et al., 2010; Bourke, 2012). This may be due to culture-specific differences and varied emphases on preventive strategies for cervical cancer in different countries.

Our study found limited knowledge of HPV, cervical cancer and HPV vaccination among medical students, with only 10.6% correctly answering over 11 of 14 knowledge questions. In particular, we noted a lack of knowledge about HPV vaccination. A similar study conducted in Malaysia founded that 33% of students majoring in medicine, dentistry and pharmacy obtained a high score of 6-8 on an 8-item questionnaire (Rashwan et al., 2012). The fact that the Malaysian government has introduced free HPV vaccine for all girls 13 and older (The Star Online, 2009) might contribute to this high level of knowledge about HPV vaccine. In our study, though participants were largely aware of HPV transmission mode, many did not realize that HPV infection was common in women and that infected women may show no symptoms. Moreover, the role of the immune system in infection clearance was not identified by over half of students. This reflects a gap between education and practice in this regard. Most students knew that HPV

is a causal agent for cervical cancer, but few noted that the precondition for development of cervical cancer is persistent HPV infection, suggesting that depth of knowledge should be stressed in future medical school curricula. The acceptability of HPV vaccination was relatively low among the medical undergraduates surveyed in this study. It was higher than among parents of young adolescents (<40.0%) (Chan et al., 2007; Zhang et al., 2013), but relatively lower than among surveyed Chinese women (>80.0%) (Kwan et al., 2009; Li et al., 2009). The vast majority of students consented to HPV vaccination after 13 years and 38.0% of males and 50.7% of females suggested an age over 19 years. This was inconsistent with World Health Organization (WHO) guidelines, calling for vaccination between the ages of 9-10 through 13 (WHO, 2009). Previous studies have demonstrated that it was best to receive HPV vaccination before sexual debut (Villa et al., 2005; Centers for Disease Control and Prevention, 2010), as HPV infection most commonly occurs in young and sexually active individuals (Weaver, 2006). Though most students preferred vaccination before sexual debut, they might be unaware of current statistics regarding sexual activity among young Chinese. While an average age at sexual debut ages ranging from 17.4 to 19.8 has been reported for college-educated women in other countries (Bendik et al., 2011; Juntasopeepun et al., 2012; Makwe et al., 2012), Chinese researchers have found a trend toward the lowering of age at sexual debut (Zhao et al., 2012). Moreover, researchers have noted a trend towards decreasing age at menarche. Research has found a strong association between earlier age at menarche and a lowering of age at sexual debut (Glynn et al., 2010). Together, these findings suggest the possibility of escalating HPV risk among young Chinese women. Students may not understand the potential link between sexual debut and HPV infection; for example, about 50% of women may develop genital HPV infection within 2 years after sexual debut (Lenselink et al., 2008). It is necessary to educate medical students about current trends in sexual behavior among young Chinese in order to increase the acceptability of HPV vaccination.

In terms of the most appropriate venue for HPV vaccination, health care institutions and especially local CDCs and women and children's hospitals were selected, paralleling the findings of another study conducted among Chinese parents (Zhang et al., 2013) indicating that these health care providers are broadly trusted by the public. In some countries, governments utilize HPV vaccination programs in schools to expand coverage (Australian Government Department of Health and Ageing, 2006; Ministry of Health in New Zealand, 2008). This approach is not applicable in China since the CDC network represents a reliable network provider of vaccination services (Zhang et al., 2013). As an important information source, health care providers can communicate the necessity of HPV vaccination to parents of young children in clinical practice and refer them to a local CDC for vaccination. Medical students selected school course work as the most important source of HPV information, which was consistent with a finding from an Indian study (Pandey et al., 2012), followed by mass media, hospital,

and family/friends. Interestingly, hospitals were not cited as a common information source; one reason may be that most students in our survey had no practical experience in hospital settings. Overall, our findings suggest that it might be important to implement tailored HPV vaccination education programs for medical students.

We identified inadequate information as the most important obstacle preventing students from accepting HPV vaccination. Consistently, lack of information about HPV infection and vaccines has been identified as a common barrier to the uptake of HPV vaccines in earlier studies (Kahn et al., 2003; Lee et al., 2007; Iliyasu et al., 2010). Most medical students surveyed in our study were willing to be educated by experts about HPV vaccination and this highlights the importance of medical education on this topic. Consistent with our findings, many studies have shown that concerns about complications and the efficacy of HPV vaccination were also important obstacles (Wong et al., 2010; Bourke, 2012). However, cost seemed less likely to influence students' attitudes towards HPV vaccination. Anticipating high prices, most responders requested government subsidy; 157 of 195 respondents desired a subsidy covering over 50% of the cost (data not shown). In an earlier study, vaccination pricing had been identified as an important factor in parents' decision-making regarding HPV vaccination, since it was expected to be the most expensive vaccine available in China (Zhang et al., 2013). Government officials also expressed concern about the high cost, and most agreed that the government should help finance vaccination (Zhao et al., 2012).

Three factors were associated with medical students' acceptance of HPV vaccination in the current study. First, females were more willing than males to receive or advise the vaccination, contradicting findings of studies conducted in the United States (Boehner et al., 2003; Blumenthal et al., 2012). This might be because students generally think that HPV vaccines prevent cervical cancer alone and thus are primarily targeted at women. This misconception is dangerous because HPV is transmitted between partners and some genotypes also cause genital warts among men. Secondly, students willing to be educated by experts about HPV vaccination were more open to receiving vaccination. This openness may be mediated by individual perceptions of the risks associated with HPV infection. Moreover, we observed a positive association between total score of HPV related knowledge and willingness to accept HPV vaccination, corroborating findings in other populations (Woodhall et al., 2007; Jones et al., 2008). Educational interventions such as distributing information pamphlets or leaflets have been recommended as a means of increasing the acceptability of HPV vaccination in other countries (Davis et al., 2004; Chan et al., 2007). The Chinese government may sponsor such education campaigns for medical students and health care providers.

In conclusion, this study found low levels of HPV related knowledge and acceptability of HPV vaccination among medical students. Gender, willingness to be educated by experts, and total knowledge score are factors associated with vaccination acceptability. HPV

education should be systematically incorporated into school courses to increase awareness of HPV vaccination among medical students. As future health care providers, they will significantly influence public perceptions of HPV vaccination. Considering the small sample size and convenient sampling strategy used in this study, we look forward to undertaking a larger survey to scale up this pilot study and thereby help inform policy making with regard to upcoming HPV vaccination programs.

Acknowledgements

We thank fellow students in the Department of Cancer Epidemiology of the Chinese Academy of Medical Sciences Cancer Institute for their help in questionnaire design, and students who completed the questionnaires in the study. We are also grateful to the trained interviewers for their work, including Bin Peng, Wen Wen, Xiao-Jing Tang, Zhen-Zhen Dai, Zhen-Li Mo, Huang Huang, and Bai-Song Li.

References

- Australian Government Department of Health and Ageing (2006). Announcement for the human papillomavirus (HPV) vaccination program. Available at: <http://www.health.gov.au/internet/immunise/publishing.nsf/Content/hpv-vac-prog>; [accessed August, 2006].
- Bendik MK, Mayo RM, Parker VG (2011). Knowledge, perceptions, and motivations related to HPV vaccination among college women. *J Cancer Educ*, **26**, 459-64.
- Blumenthal J, Frey MK, Worley MJ, Jr., et al (2012). Adolescent Understanding and Acceptance of the HPV Vaccination in an Underserved Population in New York City. *J Oncol*, **2012**, 904034.
- Boehner CW, Howe SR, Bernstein DI, Rosenthal SL (2003). Viral sexually transmitted disease vaccine acceptability among college students. *Sex Transm Dis*, **30**, 774-8.
- Bourke L (2012). Acceptance and associated factors of HPV vaccination among young male Malaysians. *J Commun Med Health Educ*, **01**.
- Brown DR, Shew ML, Qadadri B, et al (2005). A longitudinal study of genital human papillomavirus infection in a cohort of closely followed adolescent women. *J Infect Dis*, **191**, 182-92.
- Centers for Disease Control and Prevention (2010). FDA licensure of bivalent human papillomavirus vaccine (HPV2, Cervarix) for use in females and updated HPV vaccination recommendations from the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep*, **59**, 626-9.
- Chan SS, Cheung TH, Lo WK, Chung TK (2007). Women's attitudes on human papillomavirus vaccination to their daughters. *J Adolesc Health*, **41**, 204-7.
- Davis K, Dickman ED, Ferris D, Dias JK (2004). Human papillomavirus vaccine acceptability among parents of 10- to 15-year-old adolescents. *J Low Genit Tract Dis*, **8**, 188-94.
- Durusoy R, Yamazhan M, Tasbakan MI, et al (2010). HPV vaccine awareness and willingness of first-year students entering university in Western Turkey. *Asian Pac J Cancer Prev*, **11**, 1695-701.
- Gerend MA, Lee SC, Shepherd JE (2007). Predictors of human papillomavirus vaccination acceptability among underserved women. *Sex Transm Dis*, **34**, 468-71.
- Glynn JR, Kayuni N, Floyd S, et al (2010). Age at menarche,

- schooling, and sexual debut in northern Malawi. *PLoS One*, **5**, 15334.
- Gottvall M, Larsson M, Hoglund AT, Tyden T (2009). High HPV vaccine acceptance despite low awareness among Swedish upper secondary school students. *Eur J Contracept Reprod Health Care*, **14**, 399-405.
- Iliyasu Z, Abubakar IS, Aliyu MH, Galadanci HS (2010). Cervical cancer risk perception and predictors of human papilloma virus vaccine acceptance among female university students in northern Nigeria. *J Obstet Gynaecol*, **30**, 857-62.
- Jones M, Cook R (2008). Intent to receive an HPV vaccine among university men and women and implications for vaccine administration. *J Am Coll Health*, **57**, 23-32.
- Juntasopeepun P, Suwan N, Phianmongkhol Y, Srisomboon J (2012). Factors influencing acceptance of human papillomavirus vaccine among young female college students in Thailand. *Int J Gynaecol Obstet*, **118**, 247-50.
- Kahn JA, Rosenthal SL, Hamann T, Bernstein DI (2003). Attitudes about human papillomavirus vaccine in young women. *Int J STD AIDS*, **14**, 300-6.
- Kwan TT, Chan KK, Yip AM, et al (2009). Acceptability of human papillomavirus vaccination among Chinese women: concerns and implications. *BJOG*, **116**, 501-10.
- Kwan TT, Chan KK, Yip AM, et al (2008). Barriers and facilitators to human papillomavirus vaccination among Chinese adolescent girls in Hong Kong: a qualitative-quantitative study. *Sex Transm Infect*, **84**, 227-32.
- Lee PW, Kwan TT, Tam KF, et al (2007). Beliefs about cervical cancer and human papillomavirus (HPV) and acceptability of HPV vaccination among Chinese women in Hong Kong. *Prev Med*, **45**, 130-4.
- Lenselink CH, Gerrits MM, Melchers WJ, et al (2008). Parental acceptance of human papillomavirus vaccines. *Eur J Obstet Gynecol Reprod Biol*, **137**, 103-7.
- Li J, Li LK, Ma JF, et al (2009). Knowledge and attitudes about human papillomavirus (HPV) and HPV vaccines among women living in metropolitan and rural regions of China. *Vaccine*, **27**, 1210-5.
- Makwe CC, Anorlu RI, Odeyemi KA (2012). Human papillomavirus (HPV) infection and vaccines: Knowledge, attitude and perception among female students at the University of Lagos, Lagos, Nigeria. *J Epidemiol Glob Health*, **2**, 199-206.
- Markowitz LE, Dunne EF, Saraiya M, et al (2007). Quadrivalent human papillomavirus vaccine: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*, **56**, 1-24.
- Medeiros R, Ramada D (2010). Knowledge differences between male and female university students about human papillomavirus (HPV) and cervical cancer: Implications for health strategies and vaccination. *Vaccine*, **29**, 153-60.
- Mehta S, Rajaram S, Goel G, Goel N (2013). Awareness about human papilloma virus and its vaccine among medical students. *Indian J Community Med*, **38**, 92-4.
- Ministry of Health in New Zealand (2008). Information on HPV Immunisation Programme-the facts. Available at: <http://www.moh.govt.nz/moh.nsf/indexmh/hpv-immunisation-programmefacts-4aug08>; [accessed August 2008].
- Munoz N, Bosch FX, De Sanjose S, et al (2003). Epidemiologic classification of human papillomavirus types associated with cervical cancer. *N Engl J Med*, **348**, 518-27.
- Pandey D, Vanya V, Bhagat S, et al (2012). Awareness and attitude towards human papillomavirus (HPV) vaccine among medical students in a premier medical school in India. *PLoS One*, **7**, 40619.
- Peckham M, Pinedo B, Veronesi U (1995). Oxford textbook of oncology. Sections 8-20 volume 2. Oxford: oxford university press, 1995.
- Rashwan HH, Saat NZNM, Manan DNA (2012). Knowledge, attitude and practice of Malaysian medical and pharmacy students towards human papillomavirus vaccination. *Asian Pac J Cancer Prev*, **13**, 2279-83.
- Schiller JT, Castellsague X, Garland SM (2012). A review of clinical trials of human papillomavirus prophylactic vaccines. *Vaccine*, **30**, 123-38.
- Serrano B, Alemany L, Tous S, et al (2012). Potential impact of a nine-valent vaccine in human papillomavirus related cervical disease. *Infect Agent Cancer*, **7**, 38.
- The Star Online (2009). Cervical cancer vaccination: up to parent. Available at: <http://thestar.com.my/news/story.asp?file=/2009/10/8/nation/20091008103513&sec=nation> [8 October 2009].
- Villa LL, Costa RL, Petta CA, et al (2005). Prophylactic quadrivalent human papillomavirus (types 6, 11, 16, and 18) L1 virus-like particle vaccine in young women: a randomised double-blind placebo-controlled multicentre phase II efficacy trial. *Lancet Oncol*, **6**, 271-8.
- Weaver BA (2006). Epidemiology and natural history of genital human papillomavirus infection. *J Am Osteopath Assoc*, **106**, 2-8.
- Wei MX, Li SW, Huang B, et al (2009). Production of human papillomavirus type 16 virus-like particles and its immunogenicity. *Bing Du Xue Bao*, **25**, 245-50 (in Chinese).
- Who (2009). Weekly Epidemiological Record 2009:117-32.
- Who, Iarc. (2012). Globocan 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012. Available at: http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx.
- Wong LP, Sam IC (2010). Ethnically diverse female university students' knowledge and attitudes toward human papillomavirus (HPV), HPV vaccination and cervical cancer. *Eur J Obstet Gynecol Reprod Biol*, **148**, 90-5.
- Woodhall SC, Lehtinen M, Verho T, et al (2007). Anticipated acceptance of HPV vaccination at the baseline of implementation: a survey of parental and adolescent knowledge and attitudes in Finland. *J Adolesc Health*, **40**, 466-9.
- Zhang SK, Pan XF, Wang SM, et al (2013). Perceptions and acceptability of HPV vaccination among parents of young adolescents: a multicenter national survey in China. *Vaccine*, **31**, 3244-9.
- Zhang YZ, Ma JF, Zhao FH, et al (2010). Three-year follow-up results of visual inspection with acetic acid/Lugol's iodine (VIA/VILI) used as an alternative screening method for cervical cancer in rural areas. *Chin J Cancer*, **29**, 4-8 (in Chinese).
- Zhao F-H, Tiggelaar SM, Hu S-Y, et al (2012). A multi-center survey of HPV knowledge and attitudes toward HPV vaccination among women, government officials, and medical personnel in China. *Asian Pac J Cancer Prev*, **13**, 2369-78.
- Zhao FH, Tiggelaar SM, Hu SY, et al (2012). A multi-center survey of age of sexual debut and sexual behavior in Chinese women: suggestions for optimal age of human papillomavirus vaccination in China. *Cancer Epidemiol*, **36**, 384-90.