RESEARCH ARTICLE

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Knowledge and Awareness of Human Papillomavirus Vaccination and Cervical Cancer among Men and Women in Japan: A Questionnaire Survey

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Abstract

Background: In many advanced countries other than Japan, the incidence and mortality rates of cervical cancer, which is mainly caused by the human papillomavirus (HPV) infection, are decreasing probably due to the high rate of HPV vaccination and cervical cancer screening. In Japan, these rates are on the rise owing to the stagnation of vaccination and low screening rate. To improve these situations, active promotion of HPV vaccination and screening is required. As a preliminary stage, we investigated perceptions regarding cervical cancer and HPV vaccines among Japanese men and women and examined the difference in perceptions by sex. **Methods:** This was a prospective cross-sectional questionnaire survey targeting Sojo University students and working adults. University students were targeted before learning about cervical cancer. Working adults were recruited on the basis of information from the Health Promotion of Health and Welfare Department of Kumamoto Prefectural Government in Japan and from companies via student organizations promoting cancer prevention. We surveyed respondents' knowledge and awareness about HPV vaccination and cervical cancer and performed logistic regression analysis to compare the results between men and women. **Result:** A total of 557 completed questionnaires (205 men and 352 women) were analyzed. Women had high levels of knowledge and awareness about HPV vaccination and cervical cancer compared with men. However, 70% of women surveyed had never been screened for cervical cancer. **Conclusion:** A total of 557 completed questionnaires (205 men and 352 women) were analyzed. Women had high levels of knowledge and awareness about HPV vaccination and cervical cancer compared with men. However, among surveyed women, the degree of knowledge and awareness was lower than that among women in other countries with established HPV vaccination programs. Furthermore, 70% of women surveyed had never been screened for cervical cancer.

Keywords: Cervical cancer- human papillomavirus- human papillomavirus- cancer screening

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Introduction

Cervical cancer is the fourth most frequently diagnosed cancer and leading cause of cancer death among women, with an estimated 604,000 new cases and 342,000 deaths worldwide in 2020 (Sung et al., 2021). In Japan, the number of cervical cancer cases per 100,000 population is 16.8 (ganjoho.jp). Human papillomavirus (HPV) infection has been identified as the cause of most cervical cancers (Walboomers et al., 1999). This virus infects the cervix through sexual contact, and approximately 80% of women will be infected during their lifetime (Chesson et al., 2014). In more than 90% of HPV-infected women, the virus is spontaneously eliminated by the immune system; however, HPV infection persists in the remaining 10%. The infection can slowly develop into cervical cancer over several years through precancerous changes known as dysplasia. A high rate of sexual contact, having many partners, smoking, low immunity, high frequency of childbirth, and long-term use of oral contraceptives are reported as the risk factors in the development from dysplasia to cervical cancer (Burd, 2003). To reduce the development and incidence rate of cervical cancer, public dissemination of information concerning cervical cancer and regular gynecologic examination are required for early detection of cervical cancer (Cyr et al., 2021; Okuhara et al., 2021; Mattern et al., 2022). Moreover, as a preliminary step, HPV vaccination for young teens is essential to reducing cervical cancer incidence.

Currently, a bivalent vaccine targeting HPV 16/18

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genotypes, a quadrivalent vaccine targeting HPV 6/11/16/18 genotypes, and a 9-valent vaccine targeting HPV 6/11/16/18/31/33/45/52/58 genotypes are commonly used worldwide , and the effectiveness of HPV vaccination has been reported (Tabrizi et al., 2012; Tabrizi et al., 2014; Cameron et al., 2016; Berenson et al., 2017; Lei et al., 2020; Wang et al., 2020; Falcaro et al., 2021). The synergistic effect of vaccination and regular gynecologic examination leads to a reduction in mortality and morbidity owing to cervical cancer (Peirson et al., 2013). Therefore, it is believed that cervical cancer is nearly completely preventable.

The situation regarding HPV vaccination against cervical cancer is quite different in Japan, the only advanced country with high rates of cervical cancer morbidity and mortality (Katanoda et al., 2021) at 10,978 new cases and 2,921 deaths per year (ganjoho.jp). In Japan, HPV vaccination started in 2010, and HPV vaccine was included in the routine immunization program under the Preventive Vaccination Law in April 2013 (Ministry of Health, 2013b). However, owing to reports of adverse reactions such as pain and movement disorders for which a causal relationship with vaccination could not be ruled out, the Ministry of Health, Labour and Welfare announced in June 2013 that routine HPV vaccination would not be actively recommended (Ministry of Health, 2013a). As a result, the vaccination rate abruptly dropped from 70% to 1.6% among young teens (Nakagawa et al., 2020), a situation that continued for nearly 9 years. On the basis of a recent report (Falcaro et al., 2021), the Ministry of Health, Labour and Welfare finally decided to resume active recommendation of HPV vaccination from April 2022 (72nd Health Sciences Council, 2021; Ministry of Health, 2021). Thus, vaccination coverage is expected to improve in the future. In keeping with the vaccination rate, the rate of regular gynecologic examination for screening of cervical cancer in Japan is the lowest among Group of Seven (G7) countries, at 43.7%. In contrast, these rates in the remaining G7 countries are approximately 70%–80% (OECD, 2022). Therefore, Japan must also improve the rate of consultation and cervical cancer screening. The World Health Organization (WHO) has announced a strategy to accelerate the elimination of cervical cancer (World Health Organization, 2020). WHO declaration sets out three objectives: raise the HPV vaccination rate to 90% for girls by 15 years of age, increase the screening rate to 70% for women by age 35 years and again by age 45 years, and treat 90% of women identified with cervical disease.

Under these objectives, it is necessary to actively increase the rates of vaccination and periodic screening in Japan. For this, gynecologic examination among women should be promoted. Therefore, it is important to inform the public in Japan regarding the characteristics of cervical cancer and HPV as a trigger for consultation. In this regard, few surveys have reported on the current perceptions of cervical cancer and HPV in Japan (Oshima and Maezawa, 2013; Sukegawa et al., 2021). Additionally, existing reports have only targeted women because cervical cancer is a disease unique to women; thus, men's perceptions of cervical cancer and HPV are unknown, unlike in other countries (Baer et al., 2000; Kops et al., 2019). To raise awareness regarding cervical cancer and HPV throughout Japanese society, men's active involvement is essential. In this study, we conducted a survey on the perceptions of cervical cancer and HPV among men and women in Japan and examined differences in perceptions by sex.

Materials and Methods

Participants

This was a prospective observational study. We administered a questionnaire survey from April 2017 to November 2017. Questionnaires were provided in printed form. Participants were first-, second-, and third-year pharmacy students at Sojo University and employees at three companies in Kumamoto City (Meikougijuku, Kumamoto Prefectural Television Corporation, and Nippon Life Insurance Company) in Japan. Regarding recruitment of companies to include in this study, we received a list of companies that would be willing to cooperate in administering the survey from the Health Promotion of Health and Welfare Department of Kumamoto Prefectural Government. We communicated with each company individually by telephone, email, or in person, and we received permission from employers for workers to cooperate in filling out the questionnaire. Otherwise, we recruited companies via student organizations that promoted the importance of cancer prevention. Pharmacy students at Sojo University receive academic lectures about cervical cancer in their third year. To avoid the influence of information regarding HPV and cervical cancer provided in these lectures, we administered the questionnaire survey for third-year pharmacy students in May, before they had received lectures related to cervical cancer. We did not include fourth-, fifth-, and sixth-year pharmacy students in this study because they had already received academic lectures concerning cervical cancer.

Questionnaire items

Eight pharmacy students, three doctors, including an obstetrician-gynecologist, a pharmacist, a cervical cancer survivor, and a person from a television station who was responsible for media programming, participated in the development of the questionnaire. The questionnaire was designed using the Delphi method (Felicity Hasson BA MSc, 2000), in which multiple people repeatedly discussed, verified, reconstructed, and aggregated the results. The questionnaire included items querying respondents' knowledge and awareness about screening and related to cervical cancer.

Statistical analysis

The sample size for the survey was determined considering the number of pharmacy students at Sojo University and the number of employees. We collected 602 completed questionnaires. We excluded surveys from four people who did not give their consent, surveys from another four people who did not provide information regarding their sex, and 37 university students who worked part time at one of the targeted companies. Finally, responses from 557 completed questionnaires were analyzed. For categorical variables, we performed

a pairwise Fisher's exact test. We performed multivariate logistic regression analysis to discriminate responses from women and men for objective variables. Explanatory variables included each questionnaire item with covariates of age, type of occupation (first-, second-, or third-year student or working adult), and presence or absence of a close relationship with a person who has cancer. This multiple logistic regression analysis based on women was individually performed for each question item, and the odds ratio (OR) of each item was estimated. There were fewer than 5% missing values, so we performed a complete case analysis using logistic regression analysis (Patrick Royston, 2009). Each of the analyses was assumed to be independent. All analyses were performed using R version 4.1.3. (The R Project for Statistical Computing, Vienna, Austria). The level of statistical significance was set to $p<0.05$.

Results

Participant characteristics

We analyzed the survey responses of 205 men and 352 women. Among men, 143 were university students and 62 were working adults; among women, 213 were university students and 139 were working adults. Approximately 75% of respondents were in their late teens or 20s, and half of all respondents had someone close to them who had had cancer (Table 1).

Knowledge and awareness of cervical cancer

More women than men had correct knowledge and high levels of awareness for the following items: the difference between cervical and uterine body cancer (Q1; OR=0.64, 95% confidence interval [CI]: 0.42–0.99, p=0.044), the degree of knowledge about cervical cancer

Table 1. Participant Characteristics

	Men n=205	Women n=352
Age		
10s / 20s / 30s / 40s / ≥50s	54 / 87 / 10 / 10 / 17 (30.3 / 48.9 / 5.6 / 5.6 / 9.6)	105 / 149 / 20 / 14 / 28 (33.2 / 47.2 / 6.3 / 4.4 / 8.9)
Group		
1st-year university student / 2nd-year university student / 3rd-year university student / Working adult	61 / 42 / 40 / 62 (29.8 / 20.5 / 19.5 / 30.2)	68 / 78 / 67 / 139 (19.3 / 22.2 / 19.0 / 39.5)
Close relationship with a person who has cancer		
Presence / Absence	99 / 89 (52.7 / 47.3)	188 / 136 (58.0 / 42.0)

Table 2. Responses to Questions about Knowledge and Awareness of Cervical Cancer

	Men	Women	p-value
Q1. Do you know that there are two types of uterine cancer: cervical cancer and uterine body cancer?			
Yes / No	96 / 109 (46.8 / 53.2)	212 / 139 (60.4 / 39.6)	0.002
Q2. How much do you know cervical cancer disease?			
A lot / Some / A little / Nothing	13 / 68 / 96 / 28 (6.3 / 33.2 / 46.8 / 13.7)	35 / 141 / 167 / 9 (9.9 / 40.1 / 47.4 / 2.6)	<0.001
Q3. Have you have ever been educated about cervical cancer?			
Yes / No	65 / 140 (31.7 / 68.3)	165 / 185 (47.1 / 52.9)	<0.001
Q4. Do you know that there are national guidelines that recommend cervical cancer screening once every 2 years for women over 20 years old?			
Yes / No	39 / 159 (19.7 / 80.3)	127 / 219 (36.7 / 63.3)	<0.001
Q5. Do you know the main cause of cervical cancer?			
Correct answer / Incorrect answer	51 / 151 (25.2 / 74.8)	85 / 265 (24.3 / 75.7)	0.84
Q6. What is the peak age at which cervical cancer is diagnosed?			
Correct answer / Incorrect answer	77 / 124 (38.3 / 61.7)	158 / 189 (45.5 / 54.5)	0.11
Q7. What is the percentage of all cancer deaths that are caused by cervical cancer?			
Correct answer / Incorrect answer	53 / 149 (26.2 / 73.8)	117 / 225 (34.2 / 65.8)	0.06
Q8. Do you know what kind of test is used in cervical cancer screening? (Options: urine test, blood test, saliva test, endoscopy, cytology)			
Correct answer / Incorrect answer	17 / 181 (8.6 / 91.4)	113 / 232 (32.8 / 67.2)	<0.001

Table 3. Results of Logistic Regression Analysis for Differences in Perceptions between Men and Women

	Odds ratio	95% CI	p-value
Cervical Cancer			
Q1. Do you know that there are two types of uterine cancer: cervical cancer and uterine body cancer?			
	0.64	0.42-0.99	0.044
Q2. How much do you know cervical cancer disease?			
	0.68	0.51-0.90	0.007
Q3. Have you have ever been educated about cervical cancer?			
	0.5	0.32-0.77	0.002
Q4. Do you know that there are national guidelines that recommend cervical cancer screening once every 2 years for women over 20 years old?			
	0.43	0.27-0.70	<0.001
Q5. Do you know the main cause of cervical cancer?			
	1.2	0.72-2.01	0.48
Q6. What is the peak age at which cervical cancer is diagnosed?			
	0.76	0.51-1.14	0.19
Q7. What is the percentage of all cancer deaths that are caused by cervical cancer?			
	0.67	0.44-1.04	0.07
Q8. Do you know what kind of test is used in cervical cancer screening? (Options: urine test, blood test, saliva test, endoscopy, cytology)			
	0.15	0.07-0.31	<0.001
Vaccines to prevent cervical cancer			
Q9. Do you know about the existence of a vaccine to prevent cervical cancer?			
	0.06	0.03-0.11	<0.001
Q10. What is the rate at which the cervical cancer vaccine can prevent development of a potentially cancerous “precancerous” condition?			
	0.44	0.27-0.74	0.002
Q11. Do you know that adverse reactions can occur after receiving the cervical cancer vaccine?			
	0.11	0.07-0.18	<0.001
Q12. Do you know that there have been cases of complex regional pain syndrome seen after receiving the cervical cancer vaccine?			
	0.19	0.11-0.31	<0.001
Obtaining information about cervical cancer			
Q13. Have you ever talked to anyone about cervical cancer (including screening and vaccines)?			
	0.07	0.04-0.12	<0.001
Q14. Do you know anyone close to you who has undergone cervical cancer screening?			
	0.29	0.17-0.50	<0.001
Q15. Would you like to learn more about cervical cancer?			
	0.3	0.19-0.47	<0.001
How would you like to obtain more information? (multiple answers are acceptable)			
Mass media	0.45	0.28-0.72	<0.001
Pamphlet, document	0.54	0.33-0.74	0.012
Lecture, study meeting	0.89	0.52-1.52	0.66
Internet	1.08	0.65-1.80	0.75
Other*	3310000	0 - Inf	0.98
Feelings for partner regarding cervical cancer screening			
Q16. Would you tell (men: like to be informed) your partner if you (your partner) undergo(es) cervical cancer screening?			
	7.3	4.25-12.50	<0.001
Q17. Would you like to get (provide) support if you (she) were to undergo cervical cancer screening?			
	21.1	12.20-39.90	<0.001

In Q2, degree of knowledge about cervical cancer (“Nothing,” “Some,” “A little,” “A lot”) was replaced by dummy variables (“0,” “1,” ”2,” ”3”) that were used for continuous variables. In Q16 and Q17, the response option of “Other” was the summed responses of “Can’t say” and “No.” In these questions, “Yes” was replaced by dummy variable “1,” and “Other” was replaced by dummy variable “0”. In other questions, “Yes” or “Correct answer" was replaced by dummy variable “1,” and “No” or “Incorrect answer” was replaced by dummy variable “0”; The decimal point is rounded to the third place and displayed to the second decimal place; OR, odds ratio; CI, confidence interval; *Maximum likelihood estimation could not be calculated because of quasi-complete separation.

disease (Q2; OR=0.68, 95% CI: 0.51–0.90, p=0.007), the existence of national guidelines (Q4; OR=0.43, 95% CI: 0.27–0.70, p<0.001), and the content of cervical cancer screening (Q8; OR=0.15, 95% CI: 0.07–0.31, p<0.001).

Table 4. Responses to Questions about Vaccines to Prevent Cervical Cancer

	Men	Women	p-value
Q9. Do you know about the existence of a vaccine to prevent cervical cancer?			
Yes / No	105 / 99 (51.5 / 48.5)	332 / 20 (94.3 / 5.7)	<0.001
Q9's answer: Yes			
Q10. What is the rate at which the cervical cancer vaccine can prevent development of a potentially cancerous "precancerous" condition?			
Correct answer / Incorrect answer	32 / 148 (17.8 / 82.2)	108 / 234 (31.6 / 68.4)	0.001
Q11. Do you know that adverse reactions can occur after receiving the cervical cancer vaccine?			
Yes / No	66 / 130 (33.7 / 66.3)	276 / 70 (79.8 / 20.2)	<0.001
Q12. Do you know that there have been cases of complex regional pain syndrome seen after receiving the cervical cancer vaccine?			
Yes / No	31 / 165 (15.8 / 84.2)	157 / 189 (45.4 / 54.6)	<0.001

For the question regarding having received education about cervical cancer, 47.1% of women responded "yes" compared with 31.7% of men (Q3; OR=0.50, 95% CI: 0.32–0.77, p=0.002). However, more than 70% of respondents did not know the causes of cervical cancer, regardless of sex (Table 2, 3).

Knowledge and awareness regarding HPV vaccination

Women were more aware than men about the existence of HPV vaccines (Q9; OR=0.06, 95% CI: 0.032–0.11, p<0.001), the preventive effect of vaccines (Q10; OR=0.44, 95% CI: 0.27–0.74, p=0.002), the existence of adverse reactions after vaccination (Q11; OR=0.11, 95% CI: 0.07–0.18, p<0.001), and complex regional pain syndrome after vaccination (Q12; OR=0.19, 95% CI: 0.11–0.31, p<0.001) (Table 3, 4).

Obtaining information about cervical cancer

Women reported having a keen interest in cervical cancer (Table 3, 5), talking about cervical cancer with someone (Q13; OR=0.07, 95% CI: 0.04–0.12, p<0.001), having an acquaintance who had been screened for cervical cancer (Q14; OR=0.29, 95% CI: 0.17–0.50, p<0.001), and having a strong interest in obtaining knowledge regarding cervical cancer (Q15; OR=0.30, 95% CI: 0.19–0.47, p<0.001).

Thoughts regarding partners and cervical cancer among men and women

When their partner underwent cervical cancer screening, most men wanted to be informed (Q16; OR=7.30, 95% CI: 4.25–12.5, p<0.001) and wanted to provide some support (Q17; OR=21.1, 95% CI: 12.2–39.90, p<0.001) in comparison to women (Table 3, 6).

Discussion

In this study, we administered a questionnaire survey to university pharmacy students and adult workers, and compared knowledge and awareness about cervical cancer between men and women in Japan. Men had less knowledge and awareness of cervical cancer than women. Additionally, men had lower knowledge levels regarding HPV vaccination. Moreover, our results showed that men were less willing than women to obtain information about cervical cancer. Because many believe that cervical cancer is a female-specific disease, men may think that the disease is not relevant to them and thus have little interest. However, HPV affects both men and women (Chesson et al., 2014). For example, HPV causes genital warts, oropharyngeal cancer, penile cancer, and anal cancer. HPV vaccination for men has been reported to not only inhibit the spread of HPV infection with sexual contact but also prevent HPV-related diseases

Table 5. Responses to Questions on Obtaining Information about Cervical Cancer

	Men	Women	p-value
Q13. Have you ever talked to anyone about cervical cancer (including screening and vaccines)?			
Yes / No	32 / 166 (16.2 / 83.8)	229 / 116 (66.4 / 33.6)	<0.001
Q14. Do you know anyone close to you who has undergone cervical cancer screening?			
Yes / No / Don't know	29 / 76 / 91 (14.8 / 38.8 / 46.4)	129 / 95 / 118 (37.7 / 27.8 / 34.5)	<0.001
Q15. Would you like to learn more about cervical cancer?			
Yes / No	117 / 79 (59.7 / 40.3)	280 / 61 (82.1 / 17. 9)	<0.001

Table 6. Responses to Questions Regarding Partner and Cervical Cancer Screening among Men and Women

	Men	Women	p-value
Q16. Would you tell (men: like to be informed) your partner if you (your partner) undergo(es) cervical cancer screening?			
Yes / No / Can't say	182 / 12 / 10 (89.2 / 5.9 / 4.9)	183 / 134 / 27 (53.2 / 39.0 / 7.8)	<0.001
Reason for No			
(Men) I don't think it's important / I wouldn't understand / I don't know how to react / Other	2 / 7 / 2 / 1	—	—
(Women) It is my problem / I don't want to worry him / I think it's a woman's disease / I think he wouldn't understand or sympathize / Other	—	101 / 15 / 15 / 10 / 6	—
Q17. Would you like to get (provide) support if you (she) were to undergo cervical cancer screening?			
Yes / No / Can't say	184 / 5 / 15 (90.2 / 2.5 / 7.4)	105 / 240 (30.4 / 69.6)	<0.001

The response options for Q17 among women were only "Yes" or "No." The reasons for answering "No" to Q16 are shown as bar graphs (multiple answers are acceptable).

(Spînu et al., 2021). Therefore, several countries such as Australia recommend HPV vaccination for men to achieve eradication of cervical cancer and HPV-related diseases (Hall et al., 2019; Laserson et al., 2020). In the case of Japan, HPV vaccination for men was covered by the National Health Insurance as of 2020 (MSD, 2021). However, as described, men had low interest and knowledge levels regarding cervical cancer and HPV vaccines. Our research also revealed that the proportion of men who had received education regarding cervical cancer was low in comparison to women. Low awareness and few educational opportunities among men may reflect the influence of the prolonged period during which HPV vaccination was not actively recommended in Japan, which is a serious problem. If men do not know that the main cause of cervical cancer is HPV and that the virus can be transmitted by both men and women, they will not be able to understand the importance of HPV vaccination. This lack of understanding about HPV and HPV-related diseases can be a barrier to the uptake of HPV vaccination. Thus, it is important that Japanese men as well as women have an opportunity to acquire correct knowledge about HPV and cervical cancer. For instance, in the United States and Canada, educational interventions using computers, pamphlets, and videos on HPV were found to improve university students' knowledge about HPV and their willingness to be vaccinated against HPV (Doherty and Low, 2008; Krawczyk et al., 2012). Additionally, an educational intervention targeting young adults and parents with daughters improved their knowledge and awareness regarding HPV and vaccination (Dempsey et al., 2006; Kennedy et al., 2011; Kester et al., 2014). Such educational support may be effective among Japanese university students and parents, in the long run, which may lead to improvement perceptions about HPV and related diseases among both men and women.

In the case of women specifically, although their knowledge and awareness about cervical cancer were greater than the levels among men, they were low compared with women in other countries that have established HPV vaccination programs (Marlow et al., 2013). Moreover, the proportion of our female respondents who had previously undergone screening for cervical cancer was approximately 30%. This rate is also very low compared with other advanced countries (OECD, 2022). As in men, the reason for these results might have to do with the prolonged period during which HPV vaccination was not actively recommended in Japan, which could have affected both sexes. In this regard, women who had undergone cervical cancer screening understood the importance of cervical cancer screening, and most had a positive attitude about repeated screening for cervical cancer.

Our findings suggest that a key for improving cervical cancer screening in Japanese women is to increase opportunities for a first screening. For this, it is important to further promote education regarding HPV and cervical cancer among women as well as men (Baer et al., 2000; Dempsey et al., 2006; Krawczyk et al., 2012; Kops et al., 2019). However, studies have reported that raising awareness about cervical cancer alone does not lead to actual behavioral changes in women, such as receiving preventive vaccination (Gottvall et al., 2010; Patel et al., 2012; Vanderpool et al., 2013). Thus, additional approaches for changing behavior are needed. A woman's family or partner may play a large role in women's positive attitudes toward screening, as has been reported for some diseases (e.g., cardiovascular health and cancer) (Bevan and Pecchioni, 2008; Vedanthan et al., 2016). Cao et al. stated that life partners influence whether a person receives preventive health care services, and women in particular are more likely to respond to their partner's positive health behaviors (Cao et al., 2020). Our study revealed that women were more likely than men to talk with someone about cervical cancer. Nevertheless, the proportion of women who said that they would inform their partner if they underwent screening and who wanted support from their partner was only 53.2% and 30.4%, respectively. These results are markedly lower compared with those of men (Q16: 89.2%, Q17: 90.2%). As to the reasons for not communicating with their partner, many women thought it was their own problem or a disease specific to women. Thus, women themselves may believe that cervical cancer is a disease specific to women. Another reason reported by some women was a belief that their partner would not understand or sympathize. Therefore, men need to

have sufficient knowledge regarding HPV and cervical cancer to be empathetic toward their partners. If men had adequate understanding, it is highly likely that they would perceive HPV and related diseases as their own problem. Accordingly, women would more easily trust and could more easily communicate with partners. Women also need to recognize the existence of HPV-related diseases in men and understand that men may be willing to support them. To foster mutual understanding, men and women can discuss topics related to HPV or cervical cancer. Such collaboration would help to increase the proportion of individuals who are vaccinated against HPV and regularly screened for cervical cancer, which would decrease the incidence and mortality of cervical cancer in Japan.

This study had several limitations. First, we performed our survey in a medium-sized city (Kumamoto) of Japan. Second, a limited number of companies cooperated with the survey, resulting in a small sample size. However, our study included a sample of younger male college students, which is unique and valuable in Japan. Moreover, the goal of cervical cancer eradication is being pursued globally, and we believe that the findings of our study can contribute to the development of measures for eradication in Japan. Third, our study was conducted during the period when publicly funded vaccination had been suspended in Japan. Thus, because the Japanese Ministry of Health, Labour and Welfare did not resume its recommendation for vaccination against cervical cancer until April 2022, it is highly likely that current perceptions among young people in Japan are still similar to the prevailing perceptions during the period of our study. Therefore, our findings can be used as baseline data regarding young people's knowledge and awareness about cervical cancer and HPV for surveys that are conducted after publicly funded HPV vaccination resumed in Japan.

In this study, we found that men's awareness about cervical cancer and HPV vaccines was lower than that of women. HPV-related diseases such as cervical cancer do not only affect women. To eradicate cervical cancer, it is important to raise awareness about cervical cancer among men as well as women. Although women's awareness of cervical cancer was higher than that of men in our study, it was lower than the level among women in other countries with established vaccination programs. Therefore, it is also important to raise awareness about HPV and HPV-related diseases among women in Japan. To trigger actions such as cervical cancer screening and vaccination, communication between men and women to foster mutual understanding and concern for health is key.

Author Contribution Statement

I.F. contributed to conception and design of this study. F.H., M.Z., D.T., A.T., M.M., and I.F. developed the questionnaire, and collected the data. F.H., T.I., and Y.U. performed the statistical analysis and wrote the manuscript. All authors have read and approved the final version of this manuscript.

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Ethical Declaration

This research was approved by the Research Ethics Committee of Sojo University Faculty of Pharmacy (number: 17-01). Written informed consent was obtained from all participants after the procedure had been fully explained in the questionnaire forms. The information from all surveys was kept anonymous.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare no conflict of interest.

References

72nd Health Sciences Council SoIaV, Adverse Reaction Study Group; FY2021 22nd Investigative Committee on Safety Measures for Drugs, etc., Safety Measures Subcommittee, Pharmaceutical Affairs and Food Sanitation Council (2021). HPV wakuchin ni tuite [About HPV Vaccine].

Baer H, Allen S, Braun L (2000). Knowledge of human papillomavirus infection among young adult men and women: implications for health education and research. *J Community Health*, **25**, 67-78.

Berenson AB, Hirth JM, Chang M (2017). Change in Human Papillomavirus Prevalence Among U.S. Women Aged 18-59 Years, 2009-2014. *Obstet Gynecol*, **130**, 693-701.

Bevan JL, Pecchioni LL (2008). Understanding the impact of family caregiver cancer literacy on patient health outcomes. *Patient Educ Couns*, **71**, 356-64.

Burd EM (2003). Human papillomavirus and cervical cancer. *Clin Microbiol Rev*, **16**, 1-17.

Cameron RL, Kavanagh K, Pan J, et al (2016). Human Papillomavirus Prevalence and Herd Immunity after Introduction of Vaccination Program, Scotland, 2009-2013. *Emerg Infect Dis*, **22**, 56-64.

Cao YJ, Noyes K, Homish GG (2020). Life Partner Influence on Uptake of Preventive Services: Evidence From Flu Vaccine Adoption Among the Aging Population. *J Aging Health*, **32**, 441-52.

Chesson HW, Dunne EF, Hariri S, et al (2014). The estimated lifetime probability of acquiring human papillomavirus in the United States. *Sex Transm Dis*, **41**, 660-4.

Cyr PR, Pedersen K, Iyer AL, et al (2021). Providing more balanced information on the harms and benefits of cervical cancer screening: A randomized survey among US and Norwegian women. *Prev Med Rep*, **23**, 101452.

Dempsey AF, Zimet GD, Davis RL, et al (2006). Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. *Pediatrics*, **117**, 1486-93.

Doherty K, Low KG (2008). The Effects of a Web-Based Intervention on College Students' Knowledge of Human Papillomavirus and Attitudes toward Vaccination. *Int J Sex Health*, **20**, 223-32.

Falcaro M, Castañon A, Ndlela B, et al (2021). The effects of the national HPV vaccination programme in England, UK, on cervical cancer and grade 3 cervical intraepithelial neoplasia incidence: a register-based observational study. *Lancet*, **398**, 2084-92.

Felicity Hasson BA, Hugh M (2000). Research guidelines for the Delphi survey technique. *J Adv Nurs*, **32**, 1008-15.

ganjoho.jp. Gan syubetsu toukei zyouhou. [Atatistics information by cancer type.] [Online]. Available: https://ganjoho.jp/reg_stat/statistics/stat/cancer/17_cervix_uteri.html [Accessed 2022.3.22.

Gottvall M, Tydén T, Höglund AT, et al (2010). Knowledge of human papillomavirus among high school students can be increased by an educational intervention. *Int J STD AIDS*, **21**, 558-62.

Hall MT, Simms KT, Lew JB, et al (2019). The projected timeframe until cervical cancer elimination in Australia: a modelling study. *Lancet Public Health*, **4**, 19-27.

Katanoda K, Hori M, Saito E, et al (2021). Updated Trends in Cancer in Japan: Incidence in 1985-2015 and Mortality in 1958-2018-A Sign of Decrease in Cancer Incidence. *J Epidemiol*, **31**, 426-50.

Kennedy A, Sapsis KF, Stokley S, et al (2011). Parental attitudes toward human papillomavirus vaccination: evaluation of an educational intervention, 2008. *J Health Commun*, **16**, 300-13.

Kester LM, Shedd-Steele RB, Dotson-Roberts CA, et al (2014). The effects of a brief educational intervention on human papillomavirus knowledge and intention to initiate HPV vaccination in 18-26 year old young adults. *Gynecol Oncol*, **132**, 9-12.

Kops NL, Hohenberger GF, Bessel M, et al (2019). Knowledge about HPV and vaccination among young adult men and women: Results of a national survey. *Papillomavirus Res*, **7**, 123-8.

Krawczyk A, Lau E, Perez S, et al (2012). How to Inform: Comparing Written and Video Education Interventions to Increase Human Papillomavirus Knowledge and Vaccination Intentions in Young Adults. *J Am College Health*, **60**, 316-22.

Laserson AK, Oliffe JL, Krist J, et al (2020). HPV Vaccine and College-Age Men: A Scoping Review. *Am J Mens Health*, **14**, 1557988320973826.

Lei J, Ploner A, Elfström KM, et al (2020). HPV Vaccination and the Risk of Invasive Cervical Cancer. *N Engl J Med*, **383**, 1340-8.

Marlow LA, Zimet GD, McCaffery KJ, et al (2013). Knowledge of human papillomavirus (HPV) and HPV vaccination: an international comparison. *Vaccine*, **31**, 763-9.

Mattern J, Letendre I, Sibiude J, et al (2022). Diagnosis of advanced cervical cancer, missed opportunities?. *BMC Womens Health*, **22**, 97.

Ministry of Health LaWiJ (2013a). Hito papillomavirus kansensyou no teikisessyu no taiou ni tsuite. [Response to routine vaccination against human papillomavirus infection (Recommendation). [Online]. Available: https://www.mhlw.go.jp/bunya/kenkou/kekkaku-kansenshou28/pdf/kankoku_h25_6_01.pdf.

Ministry of Health LaWiJ (2013b). Yobousessyuhou no ichibu wo kaiseisuru houritsu no sekou tou ni tsuite. [Enforcement, etc. of the law amending part of the Immunisation Law.] [Online]. Available: https://www.mhlw.go.jp/topics/bcg/tp250330-2.html.

Ministry of Health LaWiJ (2021). Hito papillomavirus kansensyou ni kakawaru teikisessyu no konngono taiou ni tsuite. [Future plans for routine vaccinations related to human papillomavirus infection.] [Online]. Available: https://www.mhlw.go.jp/content/000875155.pdf.

MSD KK (2021). Drug Interview Form; GARDASIL® Aqueous Suspension for Intramuscular Injection Syringes [Online]. Available: https://www.msdconnect.jp/wp-content/uploads/sites/5/2022/02/if_gardasil.pdf.

Nakagawa S, Ueda Y, Yagi A, et al (2020). Corrected human papillomavirus vaccination rates for each birth fiscal year in Japan. *Cancer Sci*, **111**, 2156-62.

OECD (2022). Health Care Utilisation: Screening [Online]. Available: https://stats.oecd.org/index.aspx?queryid=30159#.

Okuhara T, Okada H, Goto E, et al (2021). Readability Assessment of HPV Vaccination and Cervical Cancer Information: A Systematic Scoping Review. *Healthcare (Basel)*, **9**.

Oshima S, Maezawa M (2013). Perception of cervical cancer screening among Japanese university students who have never had a pap smear: a qualitative study. *Asian Pac J Cancer Prev*, **14**, 4313-8.

Patel DA, Zochowski M, Peterman S, et al (2012). Human papillomavirus vaccine intent and uptake among female college students. *J Am Coll Health*, **60**, 151-61.

Patrick Royston KGMM, Douglas GA, Yvonne V (2009). Prognosis and prognostic research: Developing a prognostic model. *BMJ*, **338**.

Peirson L, Fitzpatrick-Lewis D, Ciliska D, et al (2013). Screening for cervical cancer: a systematic review and meta-analysis. *Syst Rev*, **2**, 35.

Spînu AD, Anghel RF, Marcu DR, et al (2021). HPV vaccine for men: Where to? (Review). *Exp Ther Med*, **22**, 1266.

Sukegawa A, Ohshige K, Suzuki Y, et al (2021). Ten-year questionnaire study on human papillomavirus vaccination targeting new female medical school students: Follow-up to the 2015 report. *J Obstet Gynaecol Res*, **47**, 3618-27.

Sung H, Ferlay J, Siegel RL, et al (2021). Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin*, **71**, 209-49.

Tabrizi SN, Brotherton JM, Kaldor JM, et al (2012). Fall in human papillomavirus prevalence following a national vaccination program. *J Infect Dis*, **206**, 1645-51.

Tabrizi SN, Brotherton JM, Kaldor JM, et al (2014). Assessment of herd immunity and cross-protection after a human papillomavirus vaccination programme in Australia: a repeat cross-sectional study. *Lancet Infect Dis*, **14**, 958-66.

Vanderpool RC, Cohen E, Crosby RA, et al (2013). "1-2-3 Pap" Intervention Improves HPV Vaccine Series Completion among Appalachian Women. *J Commun*, **63**, 95-115.

Vedanthan R, Bansilal S, Soto AV, et al (2016). Family-Based Approaches to Cardiovascular Health Promotion. *J Am Coll Cardiol*, **67**, 1725-37.

Walboomers JM, Jacobs MV, Manos MM, et al (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *J Pathol*, **189**, 12-9.

Wang R, Pan W, Jin L, et al (2020). Human papillomavirus vaccine against cervical cancer: Opportunity and challenge. *Cancer Lett*, **471**, 88-102.

World Health Organization (2020). A cervical cancer-free future: First-ever global commitment to eliminate a cancer [Online]. Available: https://www.who.int/news/item/17-11-2020-a-

cervical-cancer-free-future-first-ever-global-commitment-to-eliminate-a-cancer.