Human Papillomavirus Vaccination Awareness and Uptake among Healthcare Students in Japan

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ICMJE Statement

HH conceived the study; MS, YO, YY, and HH collected the data; MS and YO drafted the manuscript; HH revised the manuscript; FO supervised the study. All authors interpreted the results, contributed to the writing of the manuscript, and gave final approval to the submitted manuscript.

Abstract

Background: The vaccination rate for HPV (Human Papillomavirus) has remained significantly low in Japan because of the administrative suspension of active recommendation. This study investigates the awareness and uptake of the HPV vaccine among healthcare students in Japan following the reinstatement of active recommendation for young women in April 2022.

Methods: A web-based survey was administered to 2,567 healthcare students from Okayama and Shujitsu Universities in Japan in July 2023. The survey assessed participants' backgrounds, immunization status, awareness of vaccine recommendations, and knowledge of cervical cancer across various demographics, including sex, academic year, and department (Medicine, Health Science, Pharmaceutical, and Dentistry).

Results: The response rate was 36.3% (933 students; 181 male, 739 female, and 13 unspecified gender). The overall immunization rate among female students was 55.6%, with higher rates observed in medical (73.8%) and dental (63.0%) students. Awareness of the government's change in vaccine recommendation was notably high among female and senior male students. Over half of the female students (54.7%) reported receiving vaccinations based on their parents' advice. Among those unvaccinated but interested in future immunization, concerns about adverse reactions (47.4%) and challenges in scheduling vaccinations (29.1%) were predominant.

Conclusion: Healthcare students exhibited a higher HPV vaccination rate than the general population. Ongoing education to improve vaccine literacy is crucial for augmenting HPV vaccination rates in Japan.

Keywords: Cervical cancer, Human Papillomavirus, Immunization, Vaccine literacy

Introduction

The Human Papillomavirus (HPV) vaccine is recognized as the sole preventative measure against the development of cervical cancer [1-3]. In Western countries—where the HPV vaccine has been extensively incorporated into public health policies—a significant decrease in the incidence of cervical cancer has been documented [4-6]. Conversely, in Japan, despite the implementation of routine vaccination for individuals equivalent to 6th grade of elementary school to 1st grade of high school in April 2013 under the Immunization Act, widespread media coverage of adverse events—including syncope, chronic fatigue, and post-vaccination pain—contributed to increased vaccine hesitancy [6-10]. This led governmental authorities to suspend active recommendations in June of the same year [11]. As a result, the HPV vaccination rate in Japan has stagnated at less than 1%, leading to a rise in the incidence of cervical cancer [4,12].

Scientific research has substantiated the lack of a causal link between HPV vaccination and adverse events, leading to the reinstatement of active immunization endorsements in Japan in April 2022 [13]. Subsequently, from April 2023, three types of HPV vaccines (bivalent, quadrivalent, and nonavalent) have been determined as complimentary routine vaccines by the Japanese government. Despite national policies highlighting the efficacy and safety of HPV vaccines [14,15], entrenched perceptions of vaccine risks persist within the Japanese populace, resulting in a consistently low immunization rate of approximately one-fourth among the younger generations eligible for routine vaccination as of 2023 [16]. Furthermore, while catch-up vaccinations are emphatically advocated for young women born between 1997 and 2006—who were deprived of immunization opportunities during the period of recommendation suspension—their immunization rates remain exceedingly low [16].

Enhancing the HPV vaccination rate represents a significant healthcare imperative in Japan to curtail the escalating incidence of cervical cancer. Nonetheless, the factors shaping individuals' adverse perceptions toward the HPV vaccine remain unclear. Equally uncertain is how healthcare professionals—tasked with educating and informing the populace about the

vaccine's merits—acquire knowledge and awareness of the HPV vaccine during their undergraduate curriculum. To guide future medical education and public outreach initiatives, this study explores the HPV vaccination uptake, knowledge, and perceptions among healthcare students, who are within the target age bracket for vaccination and training to become the next generation of healthcare providers.

Materials and Methods

Study design

This cross-sectional, descriptive study was conducted at two academic institutions in Okayama Prefecture, Japan. We included all healthcare students enrolled in the regular courses of the healthcare-associated faculties at Okayama University (a national institution) and Shujitsu University (a private institution), enrolled in the Departments of Medicine, Health Sciences, Pharmacy, and Dentistry, totaling 2,567 undergraduate students (comprising 1,060 male and 1,507 female), as of July 2023. We utilized Google Forms to distribute an electronic survey via email and group chat applications to solicit participant responses. We conducted the survey anonymously from July 7–31, 2023, and offered lottery gift cards valued at 2,000 Japanese Yen to 20 randomly selected participants as an incentive.

Data Collection and Outcomes

The questionnaire gathered background information on respondents—including their department, academic year, age, and gender. The primary focus was to elicit participants' histories and intentions regarding HPV vaccination, as well as reasons for their choices, through free-text responses. The history of vaccinations was obtained based on self-reported responses. Secondary assessments addressed awareness of the suspension or resumption of HPV vaccination recommendations, participation in cervical cancer screenings, and self-evaluated knowledge about cervical cancer, rated on a three-point scale (well-informed; familiar with the name only;

unaware). Free-text responses were analyzed and categorized by the researchers. An English-translated questionnaire form is given as Supplementary material.

Statistical analysis

Continuous variables were described as medians and interquartile ranges (IQRs). Categorical variables were reported as numbers and percentages and were assessed using the Chi-square or Fisher's exact test, as appropriate. The data were analyzed using EZR software, a graphic user interface for the R 4.3.1 software (The R Foundation for Statistical Computing, Vienna, Austria) [17]. All reported p values <0.05 were considered statistically significant.

Ethics approval

The researchers obtained informed consent from the participants through the web survey and included only those who provided consent in this study. Ethical approval was obtained from the Ethics Committee of Okayama University Hospital (No. 2212-038), ensuring that the research was conducted in alignment with the principles outlined in the Declaration of Helsinki.

Results

A total of 962 responses were received for the web survey. After excluding 14 responses from individuals who did not provide consent to participate in the study, and 15 responses from students not enrolled in regular courses, 933 responses were included in the study, resulting in a final response rate of 36.3% (**Fig. 1**). The background information and response rates of the participants is presented in **Table 1**. Of the 933 responses, 181 (19.4%) were from male students (with a response rate of 17.1%), 739 (79.2%) were from female students (with a response rate of 49.0%), and 13 (1.4%) were from participants of unspecified gender. The median age of respondents was 20 years [IQR: 19–21], with a mean age of 21.5 years in the Department of Medicine, 19.7 years in the Department of Health Science, 22.0 years in the Department of Dentistry, and 20.7 years in the Department of Pharmacy.

The HPV vaccination status of the students is provided in **Fig. 2**. In total, 411 female (55.6%) and three male students (1.7%) had already received the HPV vaccination. Among the respondents, 251 female (34.0%) and 46 male students (25.4%) intended to receive the vaccine. A lack of interest in vaccination was indicated by 73 female (9.9%) and 129 male students (71.3%). One female student (0.1%) and 12 male students (6.6%) answered they had never heard about the HPV vaccine. The HPV vaccination rates varied among female students across different grades, with the rate for 6th year female students (90.6%) being significantly higher than that of female students in other grades; 51.9%, 47.6%, 48.5%, 60.0%, and 58.0% in the 1st, 2nd, 3rd, 4th, and 5th years, respectively. The HPV vaccination proportion was significantly higher among Medical students (73.8%) than among Health Science (49.1%) and Pharmaceutical students (53.1%).

Awareness among students regarding the history of policy change related to HPV vaccine recommendations in Japan is depicted in **Fig. 3**. Stratified by gender, awareness among females (660, 89.3%) was significantly higher than among males (100, 55.2%). Forty-seven male students (26.0%) were unaware of both the suspension and reinstatement phases of the vaccination policy, and twelve male students (6.6%) were entirely unaware of the existence of the HPV vaccine. While no significant differences were observed across various academic levels among female students, a notable ascending trend in awareness was identified among male students with the advancement of their academic grades. Specifically, up to 85.3% of the male students in their 6th year were informed about the historical changes in the vaccination policy in Japan.

Subsequently, the results of healthcare students' self-assessment of their knowledge regarding cervical cancer were presented in **Fig. 4**. Of the respondents, 116 (64.1%) male and 551 (74.6%) female students reported being well-informed about cervical cancer. Furthermore, 61 (33.7%) male and 187 (25.3%) female students indicated they had heard of the disease. The proportion of students answering comprehensive knowledge about cervical cancer increased significantly with academic progression, with percentages ascending from the 1st to 6th years at

57.4%, 54.6%, 76.8%, 81.8%, 91.4%, and 94.9%, respectively. Compared to Health Science (73.0%) and Pharmaceutical students (64.7%), Medical students reported a higher level of awareness of cervical cancer (81.9%).

Fig. 5 shows the primary reasons for the HPV vaccination. Among the vaccinated students, 165 (40.2%) reported that their decision to receive the vaccination was self-initiated, while 225 students (54.7%) attributed their vaccination to parental influence. The remaining 21 students (5.1%) cited other reasons for vaccination, encompassing peer recommendations and initiatives by local authorities.

The major reasons provided by unvaccinated students are summarized in **Table 2**. Of the 251 students not vaccinated but considering future HPV vaccinations, 119 (47.4%) expressed concern about potential adverse reactions. Forty-two students (16.7%) were not aware that the HPV vaccine was available, and 90 students (35.9%) provided other explanations for their unvaccinated status. These other reasons were classified based on their open-ended responses into i) difficulties in arranging vaccination schedules (73 students, 29.1%), ii) a general disinclination towards vaccinations or injections (7 students, 2.8%), and iii) dissenting opinions from family members (5 students, 2.0%). Furthermore, of the 73 students who were unvaccinated and not interested in vaccinations, 61 students (83.6%) indicated apprehension about adverse reactions as the primary deterrent to considering having the vaccine in the future.

Discussion

In the present study, we investigated the cognizance and uptake of HPV vaccination among healthcare students in Japan. Previous research has explored immunization rates and attitudes towards HPV vaccination in Japan, utilizing surveys of particular cohorts or inquiries conducted by municipalities [18-20]. Our effort is thus unique in focusing on healthcare students who are assumed to have higher health literacy. Notably, the vaccination rate among female healthcare students was 55.6%, with the rate reaching nearly 90% among 6th year students. The vaccination

rate among the Medical students was higher, at almost 70%, compared to their counterparts in other affiliations. These results are consistent with previous research [5,20-22], indicating a high vaccine literacy within these demographics.

Disparity in the awareness of the suspension and resumption of HPV vaccine recommendation was observed between female and male students. Among the female population, awareness of the policy changes related to the HPV vaccine was pervasive, even among students in the earlier academic years. However, the awareness of male students increased with their academic progression; from approximately 30% among 1st to 3rd year students to over 80% among final-year students. These results suggest that female healthcare students were well informed about the HPV vaccine before university matriculation. In contrast, HPV vaccine literacy among male students in younger grades was equivalent to that of the general population, and they acquired a deeper understanding of the HPV vaccine as they progressed in their medical education. This suggests that medical education enhances awareness of the HPV vaccine, in addition to generic awareness campaigns conducted by local governments [5,23].

In-depth discussion about the HPV vaccination is indispensable to encourage take-up. Unlike routine vaccinations for children stipulated under Japan's Immunization Law, the HPV vaccine primarily targets individuals aged 12–16 years, necessitating the involvement of both parents and adolescents in the decision-making process. Thus, it is essential to approach both parents and their teenagers to augment vaccination rates [5]. Parent literacy about the HPV vaccine is also important for healthcare students to decide to undergo immunization. Over half of the students opted for vaccination following their parent's recommendations, suggesting that the family environment and parental vaccine literacy impacts students' vaccination behaviors [23]. Additionally, logistical challenges such as conflicts with school entrance exams, private events, and relocations can obstruct vaccination efforts. Although mass vaccination in school settings is prohibited in Japan, enhancements in this situation are anticipated to boost vaccination rates.

The absence of public subsidies and recommendations for male vaccination in Japan

may correlate with their lower interest. The present study indicates that the proportion of male healthcare students with knowledge of the HPV vaccine increases with academic progression. When vaccination rates among women are low, the cost-effectiveness of vaccinating men is deemed to be substantial [24]. Medical professionals are also expected to disseminate accurate information and elevate awareness, underscoring the necessity to initiate vaccination campaigns for all students, including males, to potentially increase men's interest in the HPV vaccine. Some local authorities in Japan have already commenced providing public funding for HPV vaccinations for men.

The present study has some limitations. First, we only collected the data from two Japanese universities, with a final eligible rate of 36.3%. Thus, the generalizability of the results should be carefully evaluated. Second, the data was based on voluntary responses; thus, reporting bias is inevitable. Additionally, there were disparities in response rates across faculties and academic grades. Third, high immunization rates among higher-grade students may be attributed more to their year of birth rather than their high literacy levels as healthcare students. Finally, concerns about adverse reactions were identified as a significant reason for avoiding vaccination. However, the details of this response could not be elucidated in this questionnaire-based study.

In conclusion, this study demonstrates that HPV vaccination rates among healthcare students exceed those in the general population. Nearly 50% of female healthcare students had already been vaccinated, and the remaining 40% of them were willing to be vaccinated. Although male healthcare students exhibit less interest in HPV vaccination, acquiring knowledge about cervical cancer through medical education may positively influence their vaccination behaviors. To enhance HPV vaccination rates in Japan, it is deemed essential to ensure vaccination opportunities and to implement educational activities targeting a broad audience—including vaccine-target individuals and their parents.

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Conflicts of interest

The authors declare no competing interests.

Availability of data and material

Detailed data are available upon reasonable request to the corresponding author.

Ethics approval

Ethical approval was obtained from the Institutional Review Board of Okayama University Hospital (No. 2212-038).

Consent for publication

Informed consent was obtained from the study participants through the questionnaire.

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329 ***Figure legend***

330 **Figure 1. Study flow**

331 A total of 2,567 healthcare students from two Japanese universities were invited to participate in

332 a web-based survey. After excluding 29 responses, 933 responses were included in the analysis.

333

334 **Figure 2. HPV vaccination status of healthcare students, by (A) sex, (B) academic year**

335 **(female), and (C) affiliated department (female)**

336 (A) The completion rate of HPV vaccination was significantly higher in female students.

337 (B) The completion rate of HPV vaccination in the final year (90.6%) was significantly higher

338 than those in each of the other grades.

339 (C) Medical female students (MS) exhibit a significantly higher HPV vaccination completion rate

340 (73.8%) compared to each of Health Science students (HS) and Pharmaceutic students (PS).

341 * $p<0.001$, NS, not significantly different. Chi-square test and/or Fisher's exact test were

342 performed to compare between (B) the 6th year and the other academic years, as well as (C)

343 medical students and the other students.

344

345 **Figure 3. Awareness of policy change for HPV vaccine recommendation in Japan**

346 (A) A significantly greater percentage of female medical students (89.3%) exhibited awareness of

347 both the suspension and the subsequent reinstatement of the vaccination policy in comparison to

348 their male counterparts (55.2%).

349 (B) Minimal disparities were detected across academic levels among female students.

350 (C) An elevation in awareness was observed concomitantly with the advancement of academic

351 year among male students.

352 * $p<0.001$, ** $p<0.05$, NS, not significantly different. Chi-square test and/or Fisher's exact test

353 were performed to compare between the 6th year and the other academic years.

354

Figure 4. Healthcare students' self-assessment of knowledge regarding cervical cancer by (A) sex, (B) academic level, and (C) affiliated department

(A) The proportion of female students reporting that they were well-informed about cervical cancer was significantly higher than that of male students (74.6% vs. 64.1%).

(B) The proportion of sixth-year students asserting well-informed status regarding cervical cancer was significantly higher compared to students in the first to fourth years (94.9% vs. 57.4%, 54.6%, 76.8%, and 81.8%, sequentially by academic level).

(C) Medical students (MS) reported a significantly higher proportion of well-informed status regarding cervical cancer compared to Health Science (HS) and Pharmaceutical students (PS) (81.9% vs. 73.0% and 64.7%, respectively).

* $p<0.001$, ** $p<0.05$, NS, not significantly different. Chi-square test and/or Fisher's exact test were performed to compare between (B) the 6th year and the other academic years, as well as (C) medical students and the other students.

Figure 5. The primary reasons for the HPV vaccination