

# Perception of human papilloma virus (HPV) vaccination during the COVID-19 pandemic

Ye Won Jung, MD, MS<sup>a</sup>, Soo Youn Song, MD, PhD<sup>a</sup>, Won Kyo Shin, MD, MS<sup>a</sup>, Su Min Chung, MD<sup>b</sup>, Ji Won Park, MD<sup>b</sup>, Heon Jong Yoo, MD, PhD<sup>a,\*</sup> 

## Abstract

The COVID-19 pandemic is far from over, and vaccines remain an important tool for fighting the disease. As the preventive effects of the COVID-19 vaccine emerge, it is likely that the perception of importance and safety of vaccines will have a positive effect on the acceptance of other vaccines. However, it is still unclear how the COVID-19 pandemic has affected the general vaccination perception and acceptance. Therefore, the objective of this study was to investigate the impact of the COVID-19 pandemic on the perception of HPV vaccination. This study involved an offline survey of 161 women aged between 20 and 49 years who visited the gynecologic clinic at Chung-nam National University Sejong Hospital from January 2021 to June 2021. The questionnaire consists of items related to experience and knowledge of COVID-19 and HPV viruses, as well as attitudes toward HPV vaccination. Knowledge about COVID-19 virus and HPV correlated positively with their experiences ( $P = .011$  and  $P = .045$ , respectively). Positive attitude was increased, and negative attitude was reduced toward HPV vaccination in the COVID-19 pandemic era. Participants stated that accurate information and cost reduction about HPV vaccine was needed to increase the HPV vaccination rate. During the COVID-19 pandemic era, positive attitudes towards HPV vaccination have tended to increase. To increase the HPV vaccination rate, public efforts are needed for further information and cost reduction.

**Abbreviation:** HPV = human papilloma virus.

**Keywords:** coronavirus, COVID-19, COVID-19 vaccine, HPV vaccine, human papilloma virus, pandemic

## 1. Introduction

SARS-CoV-2 infection was first confirmed in Wuhan, China at the end of 2019, and then spread worldwide,<sup>[1]</sup> leading to the declaration of a pandemic by the World Health Organization on March 11, 2020. As with the new infectious diseases of the past, the development of vaccines and treatments was spurred during the early days of fear, and in the summer of 2020, messenger RNA vaccines were developed by Pfizer and Moderna in the US<sup>[2]</sup> and viral vector vaccines by AstraZeneca in Europe<sup>[3]</sup> for inoculation of populations worldwide. As the number of people vaccinated against the COVID-19 virus increases, public knowledge about the disease and hopes of vaccination return life to normal are increasing, but there are still skeptics and negative views about the vaccine; sudden death, myocardial disease, genetic modification, and uselessness of vaccination. Some studies reported that three out of 10 U.S. citizens were uncertain whether they would receive the vaccine, and 1 in 10 said they would not get vaccinated against COVID-19.<sup>[4,5]</sup>

Meanwhile, cervical cancer by persistent infection with human papilloma virus (HPV) is the leading cause of death from cancer in women worldwide.<sup>[6]</sup> To reduce the HPV-attributable disease burden, vaccines against HPV have been introduced globally. These prophylactic vaccination has led to dramatic reduction of incidence of cervical cancer.<sup>[7,8]</sup> In 2019, 124 countries adopted the policy of HPV vaccination as part of their national immunization program for adolescent girls before they become sexually active.<sup>[9,10]</sup> Since June 2016, the Korea Disease Control and Prevention Agency has also introduced a two-dose schedule of bivalent or quadrivalent HPV vaccines for adolescent girls aged 12 to 13 years as part of the national immunization program.<sup>[11]</sup> The number of cervical cancer is predicted to decrease after five decades of comprehensive vaccination.<sup>[12]</sup> Despite the extensive use of the HPV vaccine worldwide, safety concerns about HPV vaccination have not diminished, and concerns about vaccine-related serious adverse events have undermined public confidence about immunization.<sup>[13]</sup> A survey of Korean parents who did not want their children to receive HPV vaccination indicated that 73.5% were reluctant because of

YWJ, SYS, and WKS contributed equally to this work.

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

This study was approved by the institutional review board of our institution. All participants completed the research participation agreement before response questionnaire (IRB no. 2021-06-005).

Supplemental Digital Content is available for this article.

<sup>a</sup> Department of Obstetrics & Gynecology, Chungnam National University School of Medicine, Chungnam National University Sejong Hospital, Sejong, Republic of Korea, <sup>b</sup> Department of Obstetrics & Gynecology, Chungnam National University School of Medicine, Daejeon, Republic of Korea.

\*Correspondence: Heon Jong Yoo, Department of Obstetrics & Gynecology, Chungnam National University School of Medicine, Chungnam National University

Sejong Hospital, 20, Bodeum 7 ro, Sejong 30099, Republic of Korea (e-mail: bell4184@gmail.com).

Copyright © 2022 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and build upon the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

How to cite this article: Jung YW, Song SY, Shin WK, Chung SM, Park JW, Yoo HJ. Perception of human papilloma virus (HPV) vaccination during the COVID-19 pandemic. *Medicine* 2022;101:43(e31389).

Received: 17 October 2021 / Received in final form: 25 September 2022 / Accepted: 28 September 2022

<http://dx.doi.org/10.1097/MD.00000000000031389>

concerns about a serious adverse reactions such as difficulty breathing and weakness.<sup>[14]</sup>

Because the preventive effects of the COVID-19 vaccine are emerging, it is likely that perceptions of importance and safety of vaccination have a positive overall effect on the acceptance of a newly developed vaccine. One study showed that the awareness of importance and safety of vaccination have a positive overall effect on the acceptance of a newly developed vaccine such as COVID-19 vaccine, and might positively affect individual's attitudes towards general vaccines including HPV vaccine.<sup>[5]</sup> However, data concerning about the awareness of COVID-19 vaccine and HPV vaccination are scarce. Therefore, we investigated the perception of HPV vaccination during the current COVID-19 pandemic, through survey. We also studied how exposure to COVID-19 and HPV affects attitudes toward vaccines. Finally, we investigated methods to improve the HPV vaccination rates.

## 2. Methods and materials

### 2.1. Study design and participants

This cross-sectional study was conducted in Chungnam National University Sejong Hospital and approved by the Institutional Review Board of the hospital (IRB No. 2021-06-005). Data were collected from women aged 20 to 49 years who visited the gynecologic clinic for HPV vaccination from January 2021 to June 2021.

### 2.2. Data collection

A paper questionnaire was designed by four expert gynecologists to collect the data. All survey data were self-reported by participants voluntarily. The questionnaire was distributed face-to-face after obtaining participants' written consent.

### 2.3. Questionnaires

- Demographic information:** This included items of age, body mass index, underlying disorder, smoking, occupation, education, marital status and income.
- Reasons for vaccination:** Women who were vaccinated for either COVID-19 or HPV were asked to select one reason for vaccination.
- Experiences of COVID-19 and HPV:** Yes/no questions of twelve items were asked about respondents' experience with COVID-19 and HPV (Tables S1 and S2, Supplemental Digital Content, <http://links.lww.com/MD/H766>). If the respondent answered yes to any one of the items, she was allocated to the experienced group. If the respondent answered no to all items, it was determined that she had no experience with the virus and was allocated to the inexperienced group.
- Knowledge of COVID-19 and HPV:** Yes/no questions of nine in COVID-19 and ten items in HPV were asked to evaluate the respondent's level of knowledge regarding COVID-19 and HPV (Tables S3 and S4, Supplemental Digital Content, <http://links.lww.com/MD/H767>). A total score was calculated by counting the number of questions with correct answer.
- Strategy to improve the rate of HPV vaccination:** All women were asked to select the best strategy to increase the rate of HPV vaccination (Table S5, Supplemental Digital Content, <http://links.lww.com/MD/H768>).
- Change of attitudes towards HPV vaccination after COVID-19 pandemic:** A questionnaire was administered using the 5-point Likert scale to determine whether the COVID-19 pandemic affected the perception and attitude towards the HPV vaccine (1, strongly disagree; 2 disagree;

3, neither agree nor disagree; 4, agree; 5, strongly agree). For a positive question, a higher score means a positive change of attitude, and for a negative question, a higher score indicates a negative change of attitude (Table S6, Supplemental Digital Content, <http://links.lww.com/MD/H769>).

### 2.4. Statistical analysis

Participants were classified into each group according to whether they had experience with Covid-19 or HPV. Knowledge scores of vaccines were compared between two groups divided by experience with Covid-19 or HPV using two-sample *t* test when the data were evenly distributed; otherwise, Mann-Whitney test was used. Attitude scores towards COVID-19 vaccines were compared according to different baseline characteristics using one-way ANOVA. Pearson correlation was used to evaluate the correlation between knowledge of COVID-19 and HPV vaccines. A *P* value < .05 was considered statistically significant. All the analyses were performed using IBM SPSS version 22.0 (IBM Corp., Armonk, NY).

## 3. Results

A total of 161 women completed the questionnaires. The baseline characteristics of the study participants are summarized in Table 1. The median age was 27 years, ranging from 19 to 49. One hundred and fifty-six participants were educated beyond college level and 111 participants were not married yet. Among the participants, 81.4% (131/161) were vaccinated with COVID-19 vaccine.

**Table 1**  
Baseline characteristics.

	Mean ± SD or N (%)
Age	29.22 ± 6.66
BMI	21.20 ± 2.73
Underlying disorder	
None	120 (82.76)
Cardiovascular disease	2 (1.38)
Pulmonary/Allergic disease	14 (9.66)
Endocrinologic disease	1 (0.69)
Others	8 (5.52)
Smoking	
Current smoker	1 (0.62)
Past smoker	3 (1.86)
Never smoker	157 (97.52)
Occupation	
Yes	148 (91.93)
On leave	2 (1.24)
No	11 (6.83)
Education	
High school	5 (3.11)
College	131 (81.37)
Graduate school	25 (15.53)
Marital status	
Single	113 (70.19)
Married	47 (29.19)
Cohabitation	0
Divorced	1 (0.62)
Widow	0
Income	
<2000,000	9 (5.59)
2000,000–4000,000	73 (45.34)
4000,000–6000,000	19 (11.80)
6000,000–8000,000	25 (15.53)
>8000,000	31 (19.25)

BMI = body mass index, SD = standard deviation.

Reasons for COVID-19 vaccination are provided in Figure 1. A majority of the patients were vaccinated to ensure personal safety and the safety of those around them (38.2%), or because their occupation required vaccination (35.1%). Other reasons include fear of COVID-19 infection (10.7%), and to achieve herd immunity according to government policy (6.9%). Figure 2 shows the reasons for willingness to get vaccinated for HPV. Fear of cervical cancer was the major reason for HPV vaccination (68.3%), followed by confidence in vaccine safety and efficacy (19.3%). Suggestions by others (19.3%), expert recommendations (5.6%) and wish for safe sex life (3.1%) were other reasons for HPV vaccination.

Knowledge scores of HPV and COVID-19 significantly correlated with experience with each viruses (Table 2). Women who had ever been tested for COVID -19 or who had close contact with a person diagnosed with COVID-19 showed higher scores in COVID-19-related knowledge ( $6.44 \pm 1.261$  vs  $6.93 \pm 1.155$ ,  $P = .011$ ). Similarly, women who were ever tested for cervical cancer or HPV had higher scores compared with those who were never tested ( $8.65 \pm 1.166$  vs  $8.27 \pm 1.080$ ,  $P = .045$ ). Questions about respondents' experiences with COVID-19 and HPV are listed in Tables S1 and S2, Supplemental Digital Content, <http://links.lww.com/MD/H766>. Questions evaluating the level of respondent's knowledge of COVID-19 and HPV are listed in Tables S3 and S4, Supplemental Digital Content, <http://links.lww.com/MD/H767>.

Scores of attitudes towards HPV and COVID-19 vaccination were compared between experienced and inexperienced groups.

Neither experience of COVID-19 nor HPV affected the attitudes towards HPV vaccination ( $P = .694$  and  $P = .225$ , respectively). Furthermore, no correlation was found between attitudes towards HPV vaccination and knowledge of either COVID-19 or HPV (Figures S1 and S2, Supplemental Digital Content, <http://links.lww.com/MD/H765>).

Table 3 shows the best strategy suggested by participants to improve the rate of HPV vaccination. The highest percentage of participants (47.2%) responded that the cost of the HPV vaccine should be lowered. Subsequently, information on the efficacy of the vaccine was required (38.1%), followed by information on the safety of the vaccine (8.7%), which were the next two frequent responses.

Changes in perception and attitudes towards HPV vaccination in COVID-19 pandemic are shown in Figure 3. Out of 60 points in total, the mean score among participants was  $40.9 \pm 5.7$ . The average percentage of very positive/positive response was 49.8%, whereas the average percentage of extremely negative/negative response was 16.9%. During the COVID-19 pandemic, 39.8% of respondents came to trust the national health care system, whereas 11.2% did not. For 64 out of 161 respondents (57.1%), the confidence towards medical staff increased and only 6.2% responded negatively. As for the perception of HPV vaccination, 62.7% of participants responded with increased interest towards HPV vaccination and 47.7% of participants answered that they understand the pharmacodynamics of HPV vaccination better after COVID-19 pandemic. Increased confidence in the effectiveness of HPV vaccine was reported by 56.5% of respondents. Increased

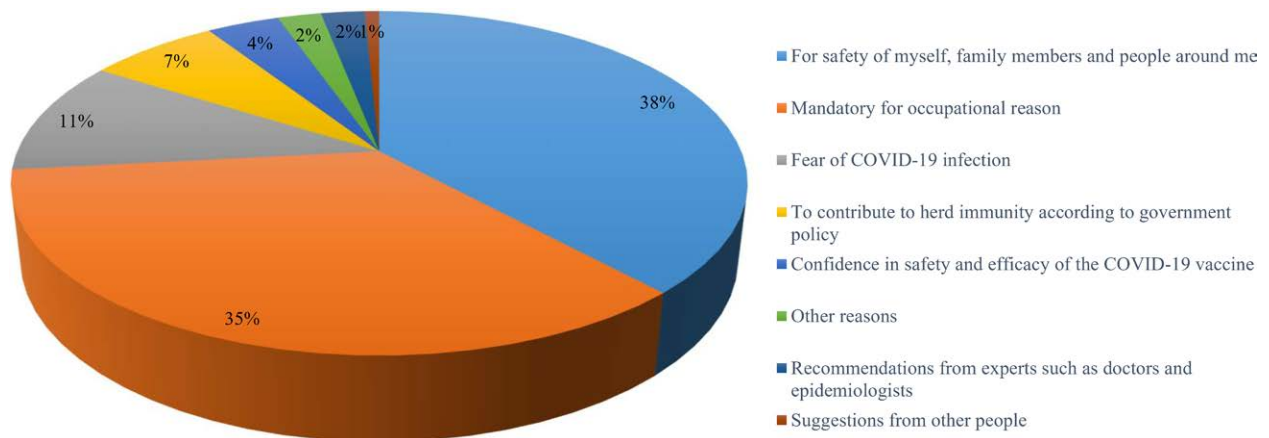


Figure 1. Reasons for COVID-19 vaccination among participants who were vaccinated with COVID-19 vaccine.

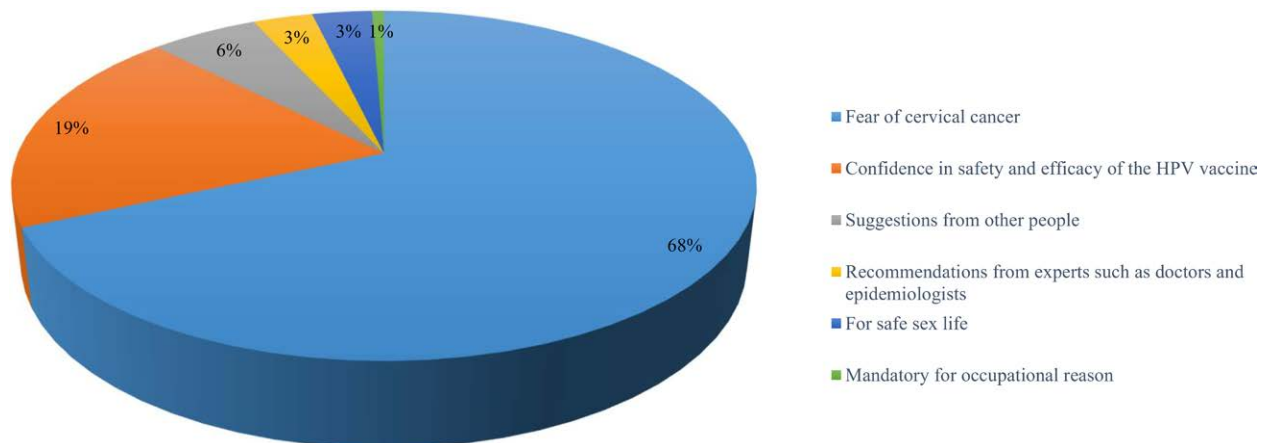


Figure 2. Reasons for willingness to get vaccinated for HPV among all participants. HPV = human papilloma virus.

**Table 2**  
Correlation between experience and knowledge of COVID-19 and HPV.

	Knowledge of COVID-19	Knowledge of HPV	P
No experience	6.44 ± 1.261 (n = 86)	8.65 ± 1.166 (n = 102)	.011
Any experience	6.93 ± 1.155 (n = 75)	8.27 ± 1.080 (n = 59)	.045

HPV = human papilloma virus.

**Table 3**  
Strategy to improve the rate of HPV vaccination.

Strategy to improve the rate of HPV vaccination	N (%)
Information on the efficacy of HPV vaccine	76 (47.2)
Reduced cost of HPV vaccine	67 (41.6)
Information on the efficacy of HPV vaccine	14 (8.7)
Information on the safety of HPV vaccine	2 (1.2)
Information on the target of HPV vaccination	1 (0.6)
Information on the pharmacodynamics	1 (0.6)

HPV = human papilloma virus.

concerns about the short-term complications of HPV vaccination after COVID-19 pandemic were reported by 42.2% of the participants. However, increased concerns regarding storage and storage for HPV vaccines were reported by only 27.3% of respondents, and only 26.1% responded with increased concerns for long-term safety of HPV vaccination during the COVID-19 pandemic.

#### 4. Discussion

In this cross-sectional study, we investigated the perception of HPV vaccination during the COVID-19 pandemic and how exposure to COVID-19 and HPV affects attitudes towards vaccines. We also investigated the methods to improve the rate of HPV vaccination. Our study showed that participants stated positive changes in the perception and attitudes towards HPV vaccination during the COVID-19 pandemic, and knowledge score of HPV and COVID-19 significantly correlated with experience with each viruses. Best strategy suggested by participants to improve the rate of HPV vaccination was the proper information on the efficacy and the safety of the vaccine, and the cost reduction.

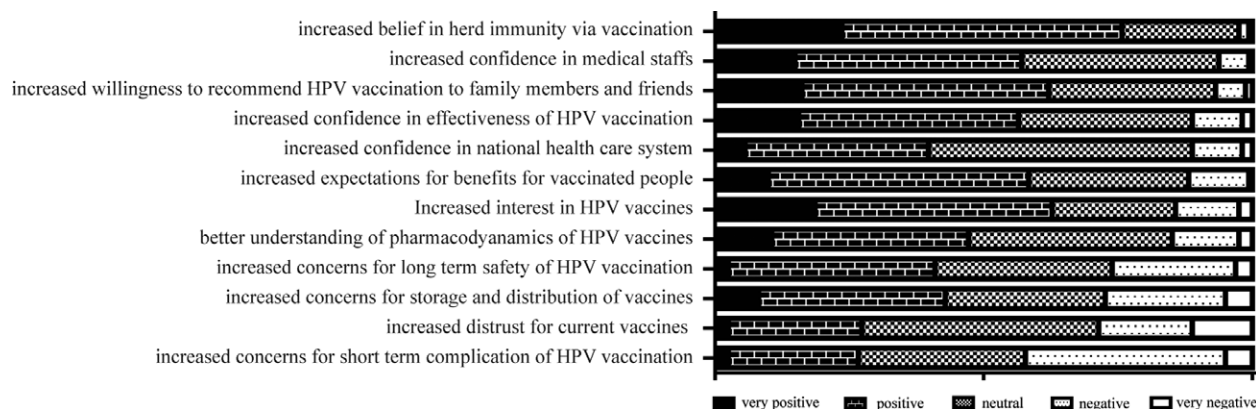
We found that positive attitudes toward HPV vaccine tend to increase during the COVID-19 pandemic by asking questions on changes of perception and attitude during COVID-19 era among participants. Several studies have investigated factors

affecting attitudes toward vaccination. Trust in the safety and efficacy of vaccines, individuals that administer vaccines or advise about vaccination, and the wider health system are all important factors influencing the vaccine decision-making process.<sup>[15,16]</sup> Another study showed that vaccine effectiveness, side effects and the proportion of acquaintances vaccinated were the most important factors influencing respondents' vaccination decisions.<sup>[17]</sup> In our study, the two items showing the most positive effect on attitude toward HPV vaccination were increased interest in the vaccine and increased belief in the efficacy of the vaccine. However, adverse events and safety concerns about HPV vaccines had the most negative effect on attitudes towards the vaccines, which was consistent with results of previous studies. Efforts to increase awareness of the efficacy and safety of vaccines are needed to increase the positive attitude toward HPV vaccines.

Our study indicate that awareness of the importance of vaccination expanded during the COVID-19 era. Recipients of HPV vaccine during the COVID-19 pandemic showed increased awareness of the importance of HPV vaccination. According to one study, COVID-19 vaccination increased the acceptance of influenza vaccination in previously eligible but unvaccinated people and inspired substantial increase in vaccination by newly eligible people.<sup>[18]</sup> Another study showed that an increase in efficacy from 50% to 90% was associated with a 10% higher mean willingness to receive COVID-19 vaccine. A reduction in the incidence of major side effects was associated with a 4% higher mean willingness to undergo vaccination.<sup>[19]</sup> A high level of knowledge concerning COVID-19 pandemic among Greek health care workers was significantly associated with positive attitudes and practices towards preventive health measures.<sup>[20]</sup>

According to our study, the majority of respondents replied that the vaccination rate can be raised by cost reduction and providing accurate information about the effectiveness and safety of the vaccine. This study also revealed that public trust in the national health system increased during the COVID era. Governmental recommendation is an important factor driving the vaccination rates.<sup>[21,22]</sup> If the vaccination rate increases via continuous government-level publicity and education on the importance of HPV vaccine, and cost reduction via the National Health Insurance system, it will greatly reduce the incidence of cervical cancer and the social costs related to cancer treatment.

The strength of our study was that the timing of the survey coincided with the peak time of the COVID-19 pandemic in Korea. The study period coincides with the period when the number of people with COVID-19 infection abruptly surged, which was from the end of 2020 to the spring of 2021. This is meaningful because, in the COVID-19 era, few studies investigated the effect of COVID-19 vaccination on other diseases and changing perceptions regarding vaccines. However, the limitation of the study relates to the participant selection. The participants'



**Figure 3.** Changes in perception and attitudes towards HPV vaccination during COVID-19 pandemic. HPV = human papilloma virus.

baseline characteristics, income and educational levels are similar. The survey included healthy young women without medical conditions and was limited to adults above 20 years of age, and adolescents who were recommended vaccination against cervical cancer were excluded.<sup>[11]</sup> Nevertheless, present study is an early study on the effect of exposure to COVID-19 on HPV vaccination, so it can be a good starting point for further investigation.

Public interest in the COVID-19 vaccine increased during the pandemic. We conducted a survey to determine the changes in public perception of HPV vaccination along with the COVID-19 vaccine during the current pandemic.

In conclusion, interest in HPV vaccines has increased along with positive attitudes in the COVID-19 era. In particular, the effectiveness and safety of vaccines and trust in the national health care system affected public attitude. Therefore, it will be possible to increase the vaccination rate by delivering accurate information on the efficacy and safety of the HPV vaccine.

## Author contributions

**Conceptualization:** Heon Jong Yoo.

**Data curation and analysis:** Soo Youn Song, Won Kyo Shin.

**Manuscript draft writing:** Ye Won Jung, Won Kyo Shin.

**Manuscript revision and review:** Ye Won Jung, Soo Youn Song, Won Kyo Shin, Sumin Chung, Jiwon Park, Heon Jong Yoo.

**Supervision:** Ye Won Jung, Soo Youn Song, Won Kyo Shin, Sumin Chung, Jiwon Park, Heon Jong Yoo.

**Visualization:** Soo Youn Song.

## References

- [1] Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497–506.
- [2] Baden LR, El Sahly HM, Essink B, et al. Efficacy and safety of the mRNA-1273 SARS-CoV-2 vaccine. *N Engl J Med*. 2021;384:403–16.
- [3] Voysey M, Clemens SAC, Madhi SA, et al. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *Lancet*. 2021;397:99–111.
- [4] Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine: a survey of U.S. adults. *Ann Intern Med*. 2020;173:964–73.
- [5] Harrison EA, Wu JW. Vaccine confidence in the time of COVID-19. *Eur J Epidemiol*. 2020;35:325–30.
- [6] de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. *Int J Cancer*. 2017;141:664–70.
- [7] Drolet M, Bénard E, Pérez N, et al. Population-level impact and herd effects following the introduction of human papillomavirus vaccination programmes: updated systematic review and meta-analysis. *Lancet*. 2019;394:497–509.
- [8] Machalek DA, Garland SM, Brotherton JML, et al. Very low prevalence of vaccine human papillomavirus types among 18- to 35-year old Australian women 9 years following implementation of vaccination. *J Infect Dis*. 2018;217:1590–600.
- [9] Human papillomavirus vaccines: WHO position paper, May 2017-Recommendations. *Vaccine*. 2017;35:5753–5.
- [10] Brotherton JM, Ogilvie GS. Current status of human papillomavirus vaccination. *Curr Opin Oncol*. 2015;27:399–404.
- [11] Kim MA, Han GH, Kim JH, Seo K. Current status of human papillomavirus infection and introduction of vaccination to the national immunization program in Korea: an overview. *J Korean Med Sci*. 2018;33:e331.
- [12] Hull R, Mbele M, Makhafola T, et al. Cervical cancer in low and middle-income countries (review). *Oncol Lett*. 2020;20:2058–74.
- [13] Bonanni P, Zanella B, Santomauro F, Lorini C, Bechini A, Boccalini S. Safety and perception: what are the greatest enemies of HPV vaccination programmes? *Vaccine*. 2018;36:5424–9.
- [14] Oh JK, Jeong BY, Yun EH, Lim MK. Awareness of and attitudes toward human papillomavirus vaccination among adults in Korea: 9-year changes in nationwide surveys. *Cancer Res Treat*. 2018;50:436–44.
- [15] Larson HJ, Jarrett C, Eckersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine*. 2014;32:2150–9.
- [16] Paterson P, Meurice F, Stanberry LR, Glismann S, Rosenthal SL, Larson HJ. Vaccine hesitancy and healthcare providers. *Vaccine*. 2016;34:6700–6.
- [17] Leng A, Maitland E, Wang S, Nicholas S, Liu R, Wang J. Individual preferences for COVID-19 vaccination in China. *Vaccine*. 2021;39:247–54.
- [18] Bachtiger P, Adamson A, Chow JJ, Sisodia R, Quint JK, Peters NS. The impact of the COVID-19 pandemic on the uptake of influenza vaccine: UK-Wide observational study. *JMIR Public Health Surveill*. 2021;7:e26734.
- [19] Kreps S, Prasad S, Brownstein JS, et al. Factors associated with US adults' likelihood of accepting COVID-19 vaccination. *JAMA Netw Open*. 2020;3:e2025594.
- [20] Papagiannis D, Malli F, Raptis DG, et al. Assessment of knowledge, attitudes, and practices towards new coronavirus (SARS-CoV-2) of health care professionals in Greece before the outbreak period. *Int J Environ Res Public Health*. 2020;17:4925.
- [21] Wong MCS, Wong ELY, Huang J, et al. Acceptance of the COVID-19 vaccine based on the health belief model: a population-based survey in Hong Kong. *Vaccine*. 2021;39:1148–56.
- [22] Schoch-Spana M, Brunson EK, Long R, et al. The public's role in COVID-19 vaccination: human-centered recommendations to enhance pandemic vaccine awareness, access, and acceptance in the United States. *Vaccine*. 2020;39:6004–12.