



# Association of COVID-19 vaccine attitudes and cognitions of COVID-19-related stigma with vaccine hesitancy among college students

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**Purpose:** This study aimed to examine the association of COVID-19 vaccine attitudes and cognitions of COVID-19-related stigma with vaccine hesitancy among college students. **Methods:** This cross-sectional study using a web-based survey was conducted with 242 college students in April 2021 before Korea's national COVID-19 vaccination program had begun. Data were analyzed using multinomial logistic regression analyses. **Results:** Of the participants who were unsure of their intention to receive the COVID-19 vaccine, 66.0% had less experience with flu vaccinations and were 1.43 times more likely to report a mistrust of vaccine benefits (OR=1.43, CI=1.22, 1.68). Those with no intention of receiving the vaccine were 25.0% less likely to be aware of COVID-19 stigma (OR=0.75, CI=0.65, 0.86), 2.08 times more likely to mistrust vaccine benefits (OR=2.08, CI=1.62, 2.68), and 1.53 times more likely to worry about an unforeseen future negative side effects from vaccination (OR=1.53, CI=1.16, 2.00). **Conclusion:** Nurses could play an important role in educating college students about vaccination benefits, including reviewing vaccines' side effects with evidence, to reduce vaccine hesitancy. College students who have less empathy for others regarding COVID-19 infection might have higher COVID-19 vaccine hesitancy. Accordingly, explaining to students the necessity of their vaccination in preventing transmission to the surrounding community and vulnerable populations is critical.

**Keywords:** COVID-19, Vaccine hesitancy, Students

## Introduction

Since the World Health Organization (WHO) has declared that Coronavirus disease 2019 (COVID-19) was a global pandemic in March 2020, more than 400 million people had been infected, including more than 5.9 million deaths globally by February 2022 [1]. Although various preventative measures, such as social distancing, facial masks, extensive diagnostic testing, and lockdowns, have been implemented as strategies to hinder the spread of the virus, the outbreak continued [2]. Fortunately, by December 2020, several vaccines against COVID-19 with established efficacy and safety had been developed, and their approval and roll-out had begun in the United Kingdom and the

United States [3]. While rare vaccine-related side-effect of severe allergic reaction have been reported [4], the availability of effective COVID-19 vaccinations was identified as the viable solution for the successful control of the pandemic [5].

Reaching a high level of community-level vaccination (i.e., COVID-19 vaccination for 60-70% of the overall population) is crucial for achieving herd immunity against COVID-19 [6]. Although the pandemic's severity and its pervasive influence on daily life might be expected to lead to high levels of vaccination acceptance in the general population [3], previous research has reported that the global COVID-19 vaccine acceptance rates ranged from 24% to 97% among adults by country, indicating that current vaccine acceptance is insufficient to reach herd

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immunity [7]. In addition, COVID-19 vaccine acceptance has declined as the pandemic progresses, and vaccine hesitancy has increased [3,7]. Vaccine hesitancy has been defined as the “delay in acceptance or refusal of vaccines despite availability of vaccination services” [8], and younger adults are more likely than older adults to be hesitant about receiving the COVID-19 vaccine [7,9]. Indeed, global growth trends of COVID-19 infection rates, including those in South Korea, have been driven by young adults (i.e., adults aged 18-29 years) [10,11].

In South Korea, the vaccine supply was initially insufficient to meet the vaccination demand. Thus, the national COVID-19 vaccination program only began on 26 February 2021, with vaccine priority given to the staff and residents of long-term care institutions and those 75 years or older, followed by healthcare workers [11]. Beginning 26 August 2021, COVID-19 vaccinations were allocated for adults aged 18-49. While the COVID-19 vaccination rate in South Korea reached 85.7% by 28 February 2022, the vaccinated rate of young adults aged 18-29 was the lowest compared to other adult populations [12]. A previous study reported that most Korean college students recognized the necessity for COVID-19 vaccination for herd immunity; however, 35.4% of college students had negative perceptions regarding COVID-19 vaccine safety, suggesting a reason for vaccine hesitancy [13].

Sociodemographic factors, including age, sex, income, and education level, have been related to COVID-19 vaccine hesitancy in previous research using samples from the general population [7,9,14,15]. In addition, past influenza vaccination compliance, perceived health status, and perceived risk of COVID-19 infection have been associated with COVID-19 vaccine hesitancy [14,15]. Attitudes toward the COVID-19 vaccine, such as mistrust of the vaccine’s safety or efficacy and side-effect concerns, have also been related to COVID-19 vaccine hesitancy [9,16]. One study of university students reported that healthcare students had lower COVID-19 vaccine hesitancy than students not in healthcare programs [17]. Understanding the various factors associated with young adults’ COVID-19 vaccine hesitancy is crucial for developing mitigation strategies; however, only a few studies have been conducted with this age group [17,18].

COVID-19 stigma emerged worldwide during the pandemic, presenting further difficulties in controlling the pandemic. COVID-19 stigma refers to a social integration process resulting in negative perceptions or discrimination towards those infected

with COVID-19 and excluding those suspected to spread the virus [19]. In a previous study, healthcare workers intending to be vaccinated for COVID-19 were less likely to hold stigmatizing beliefs toward the vaccine [20], suggesting that COVID-19 vaccine hesitancy might be associated with COVID-19-related stigma. However, little is known of the relationship between COVID-19 vaccine hesitancy and COVID-19-related stigma in young adults.

Although the COVID-19 vaccination rate has highly reached in South Korea, booster vaccination rate reached only 60.8% by 28 February 2022 [12]. Therefore, it is important to examine the factors affecting COVID-19 vaccine hesitancy during pandemic. This study examined college students’ (young adults aged 18-29) COVID-19 vaccine hesitancy and identified the factors associated with vaccine hesitancy. Based on previous research [9,13,14,16,20], perceived risk of COVID-19 infection, COVID-19 vaccine attitudes, and cognitions about COVID-19-related stigma were selected as the main variables.

## Materials and Methods

### Participants

This descriptive cross-sectional study used a web-based survey. The participants were college students recruited by convenience sampling. Inclusion criteria for participation were: a) being a college student between 18 and 29 years and b) having not received a COVID-19 vaccination. The exclusion criteria included: a) being currently or having a history of COVID-19 infection, and b) having any history of quarantine or being currently in quarantine. The necessary sample size was calculated using G\*Power 3.1.9.4. The minimum sample size required for a logistic regression analysis was 233, assuming a significance level of .05, a power of .80, probability of vaccine hesitancy .05,  $R^2=.5$  and an odds ratio of 1.75 for the perceived risk of COVID-19 infection [21]: suggesting 1.75 times more likely to having vaccine hesitancy as increasing one point infection risk. However, considering the responses’ dropout rate, the web-based survey continued until there were 250 participants. In total, 250 participants completed the web-based survey; however, eight participants who did not meet the study’s age criteria were excluded. Thus, the final analytic sample included 242 surveys.

## Data collection

Data were collected in April 14th-30th 2021 before the national COVID-19 vaccination distribution began for young adults in South Korea. An online questionnaire using Google Forms® form was created, and a recruitment notice with a hyperlink was distributed via the author's social media platform (Kakao Talk®), and the link was also shared on internet blogs for college students by author. Prior to accessing the online questionnaire, participants could review the recruitment notice that included details on the study's purpose and the voluntary nature of participation. On the first page of the e-questionnaire accessed via the hyperlink, participants provided their written informed consent form by selecting the box that indicated their agreement to voluntarily participate in the study. The option for only one questionnaire per user in Google Forms was used to prevent potential duplicate entries. All items on the electronic survey were required responses, preventing the submission of blank or incomplete responses. The e-questionnaire took approximately five minutes to complete. On the last page of the questionnaire, there was a box that participants could check to show their agreement to provide their personal information to receive an online gift for their participant and a request for providing their e-mail address. After 250 completed responses were recorded for the e-questionnaire, a research assistant downloaded the survey data.

## Measures

The online survey included 26 items regarding participants' characteristics (age, sex, marital status, taking health-related courses, living arrangement, residence area, experience with flu vaccination, perceived health status), perceived risk of COVID-19 infection, COVID-19 vaccine hesitancy, COVID-19 vaccine attitudes, and cognitions regarding COVID-19-related stigma. The perceived risk of COVID-19 infection was measured on a numerical rating scale (0 = not at all to 10 = absolutely yes) to the statement, "I am afraid of being infected with COVID-19." The COVID-19 vaccine hesitancy was measured on a 5-point Likert scale (1 = very likely to 5 = very unlikely) to the statement, "If the COVID-19 vaccination becomes available soon, how likely are you to receive COVID-19 vaccine?"

### ● COVID-19 vaccine attitudes

The vaccine attitude examination (VAE) scale developed by Martin and Petrie [22] was used to assess COVID-19 vaccine attitudes. This scale consists of 12 items on four subscales with three items: mistrust of vaccine benefit, worries about unforeseen future, concerns about commercial profiteering, and preference for natural immunity. After receiving permission from the authors to translate and use the scale, this scale was translated into Korean from English by a bilingual English professor. Then two nursing professors reviewed the translated scale to clarify the items' meaning, and several phrases and words were corrected on the self-report questionnaire. The scale was then back-translated by a professional translator and a bilingual nursing professor. Finally, the researchers compared the back-translation of the scale to the original scale, reviewed their similarity, and the final translated scale was modified to focus on COVID-19 vaccination (e.g., "I will feel safe after being vaccinated for COVID-19"). The reliability (Cronbach's alphas) of the final scale was .82 in the pilot study of 20 college students who were not participants in the main survey. Each item was answered on a 6-point Likert scale (1 = strongly disagree to 6 = strongly agree). Total scores ranged from 12 to 72, and higher scores indicated having a more accepting attitude to the COVID-19 vaccination. The Cronbach's alphas for the subscales' internal consistency were .86-.93 in original study [22]. In the present study, the Cronbach's alphas for the subscales were .85 for preference natural immunity, .86 for worries about unforeseen future, .90 for mistrust of vaccine benefit, and .92 for mistrust of vaccine benefit.

### ● Cognitions of COVID-19-related stigma

The cognitions of social stigmatization scale developed by Choi and Kim [23] was used to measure the participants' cognitions about COVID-19-related stigma. This scale was originally developed to measure the nurses' cognitions of ostracism or disadvantage if people were aware of their employment in emergency departments during the Middle East respiratory syndrome-coronavirus outbreak. After receiving permission from the authors to use a modified version of this scale, words or phrases were modified to be appropriate for the COVID-19 pandemic. An example item was, "I am afraid that I could transmit COVID-19 to my family or friends." The content validity index (CVI) of the modified scale was rated by three nursing professors and one infection control nurse practitioner on a 4-point scale (1 = not relevant to 4 = very relevant) was .94.

Participants rated each item on a 4-point scale (1 = not at all to 4 = absolutely yes), with the total score ranging from 4 to 16. Higher scores indicated that the college students were more afraid they could transmit COVID-19 to others or were more afraid that if they became infected with COVID-19, they or their family might experience discrimination or disadvantage. The Cronbach's alpha for internal consistency was .85 in the original study [23] and was .82 in the present study.

### Ethical consideration

Prior to data collection, this study was approved by institutional review board at Gachon University (IRB No.1044396-202103-HR-065-01). All participants provided their web-based informed consent on the first page of the online questionnaire. Before beginning the survey, participants were informed that their anonymity was guaranteed and that no personal information would be known. The form also explained that the collected data would only be used for research purposes and not be provided to third parties. Participants were also informed that they could withdraw their consent for their participation at any time. On the last page of the online questionnaire, participants were informed that if they provided their e-mail address, an online gift would be provided as a token of appreciation for their cooperation. The research assistant downloaded the survey data and participants' e-mail addresses. The participants who provided e-mail addresses were sent the online gift and provided e-mail addresses were discarded immediately.

### Data analysis

Data were analyzed using SPSS Statistics 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means with standard deviations (SD) and frequencies with percentages, were calculated to describe participants' sociodemographic characteristics, perceived risk of COVID-19 infection, cognitions of COVID-19 stigma, mistrust of vaccine benefit, worries about unforeseen future, concerns about commercial profiteering, and preference for natural immunity subscales, and intent to receive a COVID-19 vaccine. Chi-square tests and analysis of variance (ANOVA) using Scheffe's post-hoc tests were used to examine the relationships between intent to receive a COVID-19 vaccine and the participants' characteristics. Multinomial logistic regression analyses with enter method were conducted to examine the

factors associated with the no intention or unsure about receiving a COVID-19 vaccine.

## Results

### Participants' characteristics and intent to receive COVID-19 vaccine

The participants' mean age was  $21.59 \pm 2.09$ , and 79.8% were women. Most of the participants (77.3%) had received a flu vaccination. Participants' mean score for their perceived risk of COVID-19 was  $7.62 \pm 1.97$  out of 10, and their mean score for their stigmatization cognitions was  $14.05 \pm 3.80$  out of 20. The mean score for the worries about unforeseen future was  $14.25 \pm 2.45$  out of 18, which was the highest of the four subscales on the COVID-19 VAE scale. The mean score for the preference for natural immunity was  $7.95 \pm 3.06$  out of 18 and had the lowest mean score of the subscales. In total, 1.2% responded that they were very unlikely to receive a COVID-19 vaccine, and 12.0% responded that they were unlikely to receive a COVID-19 vaccine. Conversely, 36.0% responded that they were likely to receive COVID-19 vaccine, and 20.2% was responded very likely (Table 1). The response categories for the participants' intent to receive the COVID-19 vaccine after they were collapsed into three groups—56.2% reported having an intention of receiving a COVID-19 vaccine (likely or very likely), 13.2% did not intend to receive a vaccine (very unlikely or unlikely), and 30.6% were unsure about receiving a vaccine.

### Association between intent to receive COVID-19 vaccine and participants' characteristics

The participants' intent to receive the COVID-19 vaccine were collapsed into three groups—56.2% reported having an intention of receiving a COVID-19 vaccine (likely or very likely), 13.2% did not intend to receive a vaccine (very unlikely or unlikely), and 30.6% were unsure about receiving a vaccine.

In a bivariate analysis, the intent to receive a COVID-19 vaccine was related to having experience with flu vaccination ( $p = .025$ ). The intent to receive a COVID-19 vaccine was also related to cognitions of COVID-19 stigma ( $p < .001$ ). In a post-hoc test, those who did not intend to receive a COVID-19 vaccine had more cognitions of COVID-19 stigma those who said they intended to receive a COVID-19 vaccine or were unsure if they

would receive the vaccine ( $p<.05$ ).

Among the subscales of the COVID-19 VAE, mistrust of vaccine benefit, worries about unforeseen future, and concerns about commercial profiteering were related to the intent to receive a COVID-19 vaccine ( $p<.001$ ). In a post-hoc test, those who reported that they did not intend to receive a COVID-19 vaccine reported higher scores on the mistrust of vaccine benefit, followed by those who reported being unsure of their intent to receive a COVID-19 vaccine with those intending to receive a vaccine having the lowest scores on the subscale. Those who were unsure of their intent or did not intend to receive a COVID-19 vaccine had higher scores on the worries about unforeseen future subscale than those who reported that they intended to receive a vaccine. Moreover, those who were unsure of their intent or did not intend to receive a COVID-19 vaccine had higher scores on the concerns about commercial profiteering subscale compared to those who intended to receive a vaccine.

### Factors associated with COVID-19 vaccine hesitancy

Table 3 shows the odds ratios and confidence intervals for the multinomial logistic regression analyses after adjusting for the variables significantly related to the intent to receive a COVID-19 vaccine in the bivariate results (Table 2). Those who were unsure about receiving a COVID-19 vaccine had 66.0% less experience with flu vaccination than those who intended to receive a COVID-19 vaccine ( $p=.004$ ). Those who were unsure were 1.43 times more likely to report mistrust of vaccine benefit than those who intended to receive a COVID-19 vaccine ( $p<.001$ ). Those who did not intend to receive a COVID-19 vaccine were 25.0% less likely to have cognitions of COVID-19 stigma, were 2.08 times more likely to have mistrust of vaccine benefits, and were 1.53 times more likely to worry about the unforeseen future regarding their vaccination than those who intended to receive a COVID-19 vaccine ( $p<.001$ ; Table 3).

## Discussion

This study found that Korean college students had a somewhat high (43.8%) vaccine hesitancy rate compared to French

Table 1. Participants' Characteristics

(N=242)

Variable	n (%)	Mean±SD (range)
Age (year)		21.59±2.09 (21-28)
Gender	Male Female	49 (20.2) 193 (79.8)
Course in healthcare-related	Yes No	49 (20.2) 193 (79.8)
Experience of flu vaccination	Have received Not	187 (77.3) 55 (22.7)
Perceived health status	Poor Fair Good Very good	15 (6.2) 102 (42.1) 91 (37.6) 34 (14.0)
Perceived risk of COVID-19 infection		7.62±1.97 (2-10)
Cognitions of COVID-19-related stigma		14.05±3.80 (4-20)
COVID-19 vaccine attitudes examination		
Mistrust of vaccine benefit		9.05±2.64 (3-18)
Worries about unforeseen future		14.25±2.45 (6-18)
Concerns about commercial profiteering		9.50±3.07 (3-18)
Preference for natural immunity		7.95±3.06 (3-17)
Intent to receive COVID-19 vaccine	Very unlikely Unlikely Unsure Likely Very likely	3 (1.2) 29 (12.0) 74 (30.6) 87 (36.0) 87 (20.2)

COVID-19=Coronavirus disease 2019; SD=standard deviation

university students [17]. Due to insufficient vaccine supply, adults in South Korea could not select the type of COVID-19 vaccine they would receive and were required to get the vaccine allocated by the government [24]. In addition, serious side effects in young adults have also been reported for the COVID-19 vaccine first introduced in Korea [25]. Previous studies have reported that vaccine hesitancy differed by the specific vaccine efficacy, risk of side effects, and manufacturer [15,26]. Korean college students'

COVID-19 vaccine hesitancy might be heightened because the type of vaccine they would receive was unknown. Although this present study did not examine the selection of a COVID-19 vaccine, research including COVID-19 vaccine choice as a possible confounding variable may be necessary in future research on vaccine hesitancy.

The mistrust of vaccine benefit was associated with COVID-19 vaccine hesitancy (unsure and no intent), similarly to previous

Table 2. Intent to Receive COVID-19 Vaccine and Participants' Characteristics (N=242)

Variables		Yes <sup>a</sup> (56.2%) n (%) or Mean ±SD	Unsure <sup>b</sup> (30.6%) n (%) or Mean ±SD	No <sup>c</sup> (13.2%) n (%) or Mean ±SD	$\chi^2$ or F	$\rho$	Scheffé's test
Age (year)		21.54±2.15	21.69±2.08	21.59±1.89	0.13	.881	
Gender	Male	30 (61.2)	15 (30.6)	4 (8.2)	1.47	.481	
	Female	106 (54.9)	59 (30.6)	28 (14.5)			
Course in healthcare-related	Yes	28 (57.1)	16 (32.7)	5 (10.2)	0.52	.810	
	No	108 (56.0)	58 (30.1)	27 (14.0)			
Experience of flu vaccination	Have received	112 (59.9)	49 (26.2)	26 (13.9)	7.44	.025	
	Not	24 (43.6)	25 (45.5)	6 (10.9)			
Perceived health status	Poor	9 (60.0)	4 (26.7)	2 (13.3)	11.37	.078	
	Fair	51 (50.0)	30 (29.4)	21 (20.6)			
	Good	59 (64.8)	26 (28.6)	6 (6.6)			
	Very good	17 (50.0)	14 (41.2)	3 (8.8)			
Perceived risk of COVID-19 infection		3.40±0.98	3.20±0.86	3.25±0.80	1.26	.285	
Cognitions of COVID-19-related stigma		14.54±3.72	14.19±3.59	11.59±3.77	8.37	<.001	a,b>c
COVID-19 vaccine attitudes examination							
Mistrust of vaccine benefit		7.99±2.28	9.82±2.13	11.81±2.58	42.68	<.001	a<b<c
Worries about unforeseen future		13.68±2.58	14.70±2.07	15.63±1.93	10.86	<.001	a<b,c
Concerns about commercial profiteering		8.73±3.17	10.22±2.24	11.13±3.33	11.79	<.001	a<b,c
Preference for natural immunity		7.58±3.03	8.31±2.91	8.66±3.37	2.39	.094	

COVID-19=Coronavirus disease 2019; SD=standard deviation

Table 3. Multinomial Logistic Regression Analysis Predicting Factors Associated with COVID-19 Vaccine Hesitancy (N=242)

Variables		B	SE	Wald	OR	95% CI	$\rho$
Unsure	Experience of flu vaccination (ref: Not)	-1.08	0.38	8.17	0.34	0.16, 0.71	.004
	Cognitions of COVID-19-related stigma	-0.06	0.05	1.68	0.94	0.86, 1.03	.195
	Mistrust of vaccine benefit	0.36	0.08	18.69	1.43	1.22, 1.68	<.001
	Worries about unforeseen future	0.15	0.08	3.47	1.16	0.99, 1.36	.063
	Concerns about commercial profiteering	0.10	0.07	2.12	1.10	0.97, 1.25	.145
No	Experience of flu vaccination (ref: Not)	-0.57	0.61	0.88	0.57	0.17, 1.86	.348
	Cognitions of COVID-19-related stigma	-0.29	0.07	16.28	0.75	0.65, 0.86	<.001
	Mistrust of vaccine benefit	0.73	0.13	32.70	2.08	1.62, 2.68	<.001
	Worries about unforeseen future	0.42	0.14	9.32	1.53	1.16, 2.00	.002
	Concerns about commercial profiteering	0.28	0.10	0.08	1.03	0.84, 1.25	.784

CI=confidence interval; COVID-19=Coronavirus disease 2019; OR=odds ratio; ref=reference; SE=standard error

research on vaccine refusal reasons reported among college students [13]. The COVID-19 vaccines were developed at an unprecedented speed, potentially causing concerns about their efficacy or benefits [16]. Further, college students' lack of knowledge about COVID-19 vaccines was previously associated with increased COVID-19 vaccine hesitancy [17]. Nurses as the trusted health professionals could provide adequate and accurate information about the COVID-19 vaccine benefits through health education with college students in the community or university.

Except for the mistrust of vaccine benefit subscale, there were several differences in the factors associated with the no intent and unsure about receiving the COVID-19 vaccine. Being unsure about receiving the vaccine was significantly associated with having experience with the flu vaccine. Similarly, a previous study in the general population reported that those who had received the flu vaccine were more likely to intend to receive a COVID-19 vaccine compared to those who had not received the flu vaccine [14]. Another study found that those who did not intend to receive a flu vaccine were more likely to be hesitant about COVID-19 vaccination [27]. Having experience with flu vaccination might increase college students' reception to receiving a new vaccination. It needs to inform students annually of the importance of a flu vaccination and campaign to increase flu vaccination among students, which might contribute to acceptance of new vaccination.

Another factor associated with college students' no intent of receiving COVID-19 vaccine was their worries about the unforeseen future of the vaccination. Concerns regarding vaccine side effects have been reported as a barrier for COVID-19 vaccination in a previous study of college students [13]. Similarly, the primary reason for COVID-19 vaccine refusal in a sample of nursing students was their fear of adverse effects [28]. Proactive preparation for vaccine side effects and having professionals relieve unnecessary fears before vaccination might be necessary to mitigate vaccine hesitancy among college students [30]. Nurses could play a critical role in counseling college students about their vaccine concerns and addressing questions regarding vaccine safety, which could alleviate college students' fear about COVID-19 vaccine risks. Furthermore, vaccine preparation programs that emphasize the importance of COVID-19 vaccination and review evidence on vaccine side effects should be developed and provided to college students.

This study highlighted that no intent of receiving COVID-19 vaccine was associated with fewer cognitions about

COVID-19-related stigma, suggesting college students who have less empathy of others might have higher COVID-19 vaccine hesitancy. Similarly, other research with nursing students has reported that COVID-19 vaccine adherence was to protect others, such as family and friends [28]. Young adults represent a major source of community transmission; however, they perceived fewer risks from a COVID-19 infection because they believe their age group has a low risk of severe symptoms and COVID-19 complications [18]. However, young adults, such as college students, need to understand the importance of their participation in safeguarding their own and others' health through vaccination [30]. Nurses could play a critical role in educating students about the benefits of COVID-19 vaccination for herd immunity, such as preventing community transmission and reducing mortality of vulnerable populations (e.g., older family members). Furthermore, the government needs to develop individualized risk communication strategies on COVID-19 vaccination for young adults receptive to social issues.

### Limitations and recommendations

This study had several limitations. First, this study used an online survey to recruit participants and may not represent all populations of college students. Second, numerous variables may be associated with vaccine hesitancy; however, this study could not include all potential confounding variables. Third, data collection occurred before implementing the national vaccination plan for young adults, and participants did not know which vaccines they would receive or when they would be vaccinated. Having an informed vaccination plan that was confirmed or the severity of the COVID-19 situation could have influenced participants' vaccine hesitancy. Future research should examine the factors that might influence vaccine hesitancy in booster shot based on this study results. Fourth, the purpose of this study was to examine the association of COVID-19 vaccine attitudes and cognitions of COVID-19-related stigma with vaccine hesitancy, however, theoretical models were absent. Therefore, it is difficult to postulate a conceptual framework for the result of this study. Finally, the vaccine attitude scale used in this study was not developed and validated in Korean, which might affect the reliability and validity of this study results. It is recommended to conduct the study of Korean validation of vaccine hesitancy scale.

## Conclusion

This study findings indicate that vaccine hesitancy among college students was associated with concerns about vaccine efficacy or side effects. Nurses could provide adequate and accurate information about the COVID-19 vaccination and side effects through health education with college students in the community or university. This study was significant finding the cognitions of COVID-19-related stigma was associated with no intent to receive COVID-19 vaccine. Although college students might not experience serious symptoms from COVID-19, they could infect other vulnerable populations. Vaccine preparation programs that emphasize the benefits of COVID-19 for own and others should be developed and provided to college students to reduce their COVID-19 vaccine hesitancy. It is expected that this study results would contribute to develop strategies to enhance young adults' vaccine acceptance for future emerging infectious disease.

## Conflict of interest

No potential conflict of interest relevant to this article was reported.

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## Supplementary materials

None

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