






**ORIGINAL RESEARCH:  
EMPIRICAL RESEARCH - QUANTITATIVE**

# Predictors of nursing students' intention to receive COVID-19 vaccination: A multi-university study in Saudi Arabia

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## Abstract

**Aims:** This study examined the predictors of student nurses' intention to vaccinate against COVID-19. We measured the nursing students' risk perceptions, anxiety, fears and beliefs on COVID-19 vaccine; attitudes towards it and vaccine literacy (VL).

**Design:** This study is a multi-university study utilizing the quantitative, cross-sectional and predictive approach.

**Methods:** Using convenience sampling ( $n = 1170$ ), we surveyed 10 Saudi universities from November 26, 2020, to December 31, 2020. Forward stepwise multinomial logistic regression was performed in identifying the factors predicting student nurses' intention to vaccinate against COVID-19.

**Results:** The overall mean in the risk perception, anxiety and fear was 9.59 ( $SD = 2.82$ , possible range = 1–15), 3.95 ( $SD = 4.77$ , possible range = 0–20) and 18.17 ( $SD = 6.65$ , possible range = 7–35) respectively. They also reported a mean of 29.90 ( $SD = 6.56$ , possible range = 8–40) on COVID-19 belief. COVID-19 positive and negative attitudes mean score was 3.64 ( $SD = 0.92$ ) and 2.72 ( $SD = 0.90$ ) in a 1–4 range of scores respectively. The functional and interactive-critical COVID-19 VL of the students were at moderate levels. More than half of the respondents (55.9%) intended to be vaccinated against COVID-19, 17.6% did not intend to do so and 26.5% were unsure. High-risk perceptions, low levels of COVID-19 anxiety, positive beliefs and attitudes towards

COVID-19 vaccine, and high levels of interactive-critical COVID-19 VL were significant predictors of student nurses' intentions to vaccinate against COVID-19.

**Conclusion:** Policymakers could consider the factors identified in this study and why the students did not intend to receive the vaccine in planning a nationwide vaccination program. The colleges of nursing could also utilize the findings in developing educational programs that aim to improve VL and beliefs and attitudes towards COVID-19 vaccine.

#### KEYWORDS

anxiety, attitudes, beliefs, COVID-19, COVID-19 vaccine, fear, nursing students, Saudi Arabia, vaccination, vaccine literacy

## 1 | INTRODUCTION

The COVID-19 pandemic remains a global concern affecting every aspect of life and cause fear and anxiety among people (Albaqawi et al., 2020; Inocian et al., 2021). In particular, it has challenged nurses as they act as frontline workers in managing patients infected with COVID-19. Moreover, with the involvement and contributions of nursing students in providing direct care to patients, they are also exposed to the potential risk of becoming infected with the virus (Albaqawi et al., 2020).

Although several interventions have been executed to allay the spread of the virus, the COVID-19 vaccine is critical in controlling and potentially ending this pandemic (Marco, 2020). However, as the COVID-19 vaccine has begun to be administered, several issues have been raised, including the level of effectiveness and protection, public mistrust and worries about the safety and adverse effects (Rhodes et al., 2020). These issues may negatively affect how people accept the vaccine and their intention to vaccinate, which could pose further challenges to the success of immunization programs. Therefore, studying the intention to vaccinate against COVID-19 and its predictors is essential for guiding immunization programs. Particularly for nursing students, understanding the contributing factors, such as fear, anxiety, risk perceptions, attitudes, beliefs and vaccine literacy (VL), on the intention to vaccinate against COVID-19 is essential in obtaining baseline information that could identify the possible maladaptive responses and provide recommendations in designing interventions to ensure positive reception to the COVID-19 vaccine among nursing students.

### 1.1 | Background

COVID-19 is a public health emergency concern that has caused confinement and movement restrictions, economic and educational shutdowns, overwhelmed healthcare systems and negative mixed emotions (e.g. fear, anxiety, worries, anger and sadness), thus affecting the overall wellbeing of the general public (Al Omari et al., 2020; Zhang, 2020). Vaccination is recognized as a way to lessen the spread of this infectious disease. Mallory et al. (2018) emphasized

### IMPACT

#### What problems did the study address?

- Several issues surrounding the COVID-19 vaccine may negatively affect how people accept it and their intention to vaccinate against the virus, which could pose further challenges to the success of immunization programs worldwide.
- Understanding the contributing factors on the intention to vaccinate against COVID-19 is vital to obtain baseline information that could identify possible maladaptive responses and provide recommendations in designing interventions to ensure a positive reception of nursing students to the COVID-19 vaccine.

#### What were the main findings?

- More than half of the respondents (55.9%) intended to be vaccinated, 17.6% did not intend to do so and 26.5% were unsure.
- High-risk perceptions, low levels of COVID-19 anxiety, positive beliefs and attitudes towards the COVID-19 vaccine and high levels of interactive-critical COVID-19 VL were significant predictors of intentions to vaccinate against COVID-19 among nursing students.

#### Where and on whom will the research have an impact?

- Various governments could use the study findings in advancing their COVID-19 vaccination program.
- The colleges of nursing could also utilize the findings in developing educational programs that aim to improve VL and beliefs and attitudes towards the COVID-19 vaccine.
- The Ministry of Health could benefit from the study in preparing a vaccination plan for nursing students to ensure their safety during their clinical rotation amid the ongoing pandemic

that vaccination programs help boost an individual's immune system and generate herd immunity without necessitating many individuals being infected.

Currently, countries around the world had rolled out their vaccination programs using different COVID-19 vaccines distributed under emergency use authorization (Cyranoski, 2020; Mahase, 2021). Vaccination success depends on people's intention to be vaccinated (Phillips et al., 2017). However, amid the implementation of vaccination programs, some safety issues and unfortunate events have been reported, which smeared public opinion and affected the intention to be vaccinated (Grady & Mazzei, 2021; Lauerman & Gale, 2021). These issues seemed to be also affecting the opinion of healthcare workers (HCWs) about the vaccine. Mixed opinions about the COVID-19 vaccine among HCWs have been reported in the literature. A study in Pennsylvania, USA, indicated that a vast majority (90.3%) of 16,158 HCWs had reported insufficiency of data and unknown risks as primary reasons for not being vaccinated (Meyer et al., 2021). In Israel, the majority (70%) of 829 HCWs have questioned COVID-19 vaccine safety (Dror et al., 2020). In hospitals in Greece, safety concerns and gaps in information were the main barriers to the HCWs' intention to be vaccinated (Maltezoou et al., 2021). In Hong Kong, suspicion of the vaccine's safety and effectiveness was the main reason to refuse vaccination in the majority (76.4%) of 856 nurses (Wang et al., 2020). Notwithstanding the potential adverse effects and uncertainty of the effectiveness of COVID-19 vaccines, some HCWs have expressed that they intend to be vaccinated due to their confidence in the scientific proof of the vaccines, the emergency authorization given, the effectiveness of the vaccines, and their desire to contribute to mitigating the pandemic by protecting themselves, their families and their patients (Maltezoou et al., 2021; Yu et al., 2021).

Vaccinating nursing students is undoubtedly crucial in protecting them from the disease. However, given the limited supply of vaccines, vulnerable groups, including HCWs, are likely to be prioritized (CDC, 2020). Notably, nursing students are also at risk of COVID-19 because of their continuous exposure to patients while undergoing hospital training (Albaqawi et al., 2020). Vaccinating nursing students is also important to ensure the continuous education of future nurses amidst the pandemic. Moreover, nursing students are the ones to administer vaccines and manage and organize immunization programs in the future. Therefore, they also need to be equipped with proper knowledge, attitudes and positive beliefs regarding COVID-19 vaccines as these factors are critical players in rendering public safety.

Along with this endeavour, the nursing education system is responsible for inculcating future nurses about vaccine education, which effectively helps students understand how vaccines could protect people (Jamshidi et al., 2016). Indeed, nursing education guarantees that future nurses have accurate information and positive attitudes and beliefs towards vaccines. Even though vaccines effectively protect the general public against infection, important challenges and gaps still exist in the literature about the intention to vaccinate against COVID-19, especially among future nurses.

Considering that no detailed information is available on nursing students' intention to be vaccinated as of this writing, their intention and the accompanying factors need to be investigated.

## 2 | THE STUDY

### 2.1 | Aims

This study examined the predictors of nursing students' intention to vaccinate against COVID-19. The nursing students' risk perceptions, anxiety, fears, VL, beliefs and attitudes towards the COVID-19 vaccine were measured and included as the predictor variables of their intention to be vaccinated.

### 2.2 | Design

The study is a multi-university study utilizing the quantitative, cross-sectional and predictive approach.

### 2.3 | Participants

Ten public universities in Saudi Arabia were surveyed in this study. Male and female Saudi nursing students who were enrolled in either of the following levels were included: second, third, fourth and internship year. All students were enrolled in Bachelor of Science in Nursing programs that are mainly taught in English. Students from other specializations and those who were not enrolled in any of the 10 universities were not included in the study. First-year students were also not included because they are in the preparatory department, and they do not have nursing courses and hospital placement. A sample of 1170 nursing students between the ages of 18 and 37 years ( $M = 21.31$ ,  $SD = 1.88$ ) was included using the convenience sampling technique. Among the samples, 54.6% ( $n = 639$ ) were females and 45.4% ( $n = 531$ ) were males. The highest proportion of respondents was in the second year of the nursing program (29.0%), whereas the lowest number of samples was in the internship year (16.6%, Table 1).

### 2.4 | Data collection

We collected the data for the specific variable under investigation using an online survey. The demographic variables collected included age, gender, university and year level. Questions on whether they were infected with COVID-19 and their primary source of COVID-19 vaccine information were also inquired.

The study evaluated the risk perception of COVID-19 using a three-item COVID-19 risk perceptions scale (C19RPS; Gerhold, 2020). The items asked about how likely the respondents think that they, their family and friends, and in general could get infected

TABLE 1 Nursing students' demographic characteristics

Variable	Overall (n = 1170) Mean (SD)	Intention to get vaccinated with the COVID-19 vaccine		
		Yes (n = 654) Mean (SD)	No (n = 206) Mean (SD)	Not sure (n = 310) Mean (SD)
Age	21.31 (1.88) <sup>a</sup> n (%)	21.31 (1.99) n (%)	21.41 (1.82) n (%)	21.31 (1.88) n (%)
Gender				
Male	531 (45.4)	314 (48.0)	91 (44.2)	126 (40.6)
Female	639 (54.6)	340 (52.0)	115 (55.8)	184 (59.4)
University				
University 1	222 (19.0)	120 (18.3)	43 (20.9)	59 (19.0)
University 2	106 (9.1)	59 (9.0)	10 (4.9)	37 (11.9)
University 3	82 (7.0)	43 (6.6)	17 (8.3)	22 (7.1)
University 4	138 (11.8)	114 (17.4)	22 (10.7)	2 (0.6)
University 5	150 (12.8)	81 (12.4)	28 (13.6)	41 (13.2)
University 6	146 (12.5)	66 (10.1)	30 (14.6)	50 (16.1)
University 7	63 (5.4)	31 (4.7)	14 (6.8)	18 (5.8)
University 8	91 (7.8)	51 (7.8)	14 (6.8)	26 (8.4)
University 9	112 (9.6)	53 (8.1)	21 (10.2)	38 (12.3)
University 10	60 (5.1)	36 (5.5)	7 (3.4)	17 (5.5)
Year level				
2nd year	339 (29.0)	176 (26.9)	53 (25.7)	110 (35.5)
3rd year	325 (27.8)	193 (29.5)	61 (29.6)	71 (22.9)
4th year	312 (26.7)	160 (24.5)	58 (28.2)	94 (30.3)
Nursing interns	194 (16.6)	125 (19.1)	34 (16.5)	35 (11.3)
Previous COVID-19 infection				
No	1009 (86.2)	575 (87.9)	172 (83.5)	262 (84.5)
Yes	161 (13.8)	79 (12.1)	34 (16.5)	48 (15.5)
Main source of COVID-19 vaccine information				
TV/radios	163 (13.9)	101 (15.4)	35 (17.0)	27 (8.7)
Social media	614 (52.5)	325 (49.7)	108 (52.4)	181 (58.4)
Newspapers/ magazines	32 (2.7)	21 (3.2)	7 (3.4)	4 (1.3)
Ministry of Health	294 (25.1)	170 (26.0)	42 (20.4)	82 (26.5)
Scientific journals	67 (5.7)	37 (5.7)	14 (6.8)	16 (5.2)

<sup>a</sup>Range = 18–37 years old.

with coronavirus in the near future. The scale asked the respondents to choose from 5-point options ranging from 'very unlikely' (1) to 'very likely' (5). Scores were obtained by summing the item score, which ranged from 3 to 15. High scores indicate high-risk perceptions.

The 'Coronavirus Anxiety Scale' (CAS) by Lee (2020) measured the COVID-19 anxiety of respondents. This 5-item scale used a 5-point option ranging from 'not at all' (0) to 'nearly every day' (4). The CAS items constitute different anxiety symptoms, including 'dizziness, sleep disturbances, tonic immobility, appetite loss and abdominal distress'. The CAS also reflects the 'cognitive, behavioural,

emotional and physiological' dimensions of anxiety related to COVID-19. The scores were obtained by summing the item scores, which ranged from 0 to 20. Scores below 9 indicate non-anxiety, while scores above 9 imply dysfunctional anxiety (Lee, 2020).

COVID-19 fears were measured using the 'Fear of COVID-19 Scale' (FCV-19S). This unidimensional tool assesses the fear from COVID-19 by using a 5-point response choice from 'strongly disagree' (1) to 'strongly agree' (5). The scores were obtained by adding the individual scores in the seven-item scale (range = 7–35). Higher scores denote higher levels of COVID-19-related fear (Ahorsu et al., 2020).

The researchers developed a tool to measure the students' COVID-19 vaccine belief based on the tools used in previous studies (Biasio et al., 2021; Magadmi & Kamel, 2020; Pogue et al., 2020). The resulting scale was named COVID-19 Vaccine Belief Scale (C19VBS). C19VBS comprises eight items, each assessing the beliefs of respondents on the 'effectiveness and safety of the COVID-19 vaccine, the ability of health authorities to vaccinate the entire population, the availability of free vaccines, that all age groups should receive the vaccine, the importance of the vaccine in avoiding COVID-19 complications, the need for greater public awareness about future COVID-19 vaccines, and the critical role of the vaccine in ending this pandemic'. Each item was structured to be responded in a 5-point Likert scale: 'strongly disagree' (1) to 'strongly agree' (5). The C19VBS is a single component scale; thus, scores were estimated by obtaining the sum of answers in each scale item, which ranged from 8 to 40. Higher scores denote more positive beliefs about COVID-19 vaccines.

For the COVID-19 vaccine attitudes, the Attitude towards Vaccination Scale developed by Szczerbińska, Brzyski, et al. (2017) and Szczerbińska, Prokop-Dorner, et al. (2017) was adopted. The tool was originally constructed to assess older people's attitudes towards vaccination. However, the items were modified in this study to suit the population and construct of interest. For example the item 'In your opinion, when undergoing vaccination, do we protect others against diseases?' was modified to 'When undergoing COVID-19 vaccination, one protects others against the coronavirus'. The revised scale was named as COVID-19 Vaccine Attitude Scale (CV19AS). The 7-item scale has two components: 'positive attitudes towards COVID-19 vaccine' (four items) and 'negative attitudes towards COVID-19 vaccine' (three items). The scale is responded by choosing from a 5-point Likert scale: 'strongly disagree' (1) to 'strongly agree'. The mean score in each component was calculated. For the positive attitude component, a higher mean score indicates a more positive COVID-19 vaccine attitude. For the negative attitude component, a higher mean score signifies a more negative COVID-19 vaccine attitude.

We used the Health Literacy Vaccinale Degli adulti in Italiano developed by Biasio et al. (2020) to measure the nursing students' functional and interactive-critical VL related to the COVID-19 vaccine. The scale has 12 items divided into two subscales: functional VL (four items) and interactive-critical VL (eight items). A 4-point Likert scale (4-'never' to 1-'often' [functional questions]; 1-'never' to 4-'often' [interactive-critical questions]) was utilized as a response option. Biasio et al. (2021) utilized the tool in their previous study to measure COVID-19 vaccine VL. To place the scale into context, the statements 'When reading or listening to information about future COVID-19 vaccines or current vaccines' and 'When looking for information about future COVID-19 vaccines or current vaccines' were added before the items under the functional VL and interactive-critical VL respectively (Biasio et al., 2021). The means were calculated for each subscale. Higher mean scores indicate better VL.

A single question, 'Will you get vaccinated with the COVID-19 vaccine once it is available?' was used to measure the intention to

be vaccinated against COVID-19. Three response options were provided: 'yes', 'no' and 'not sure'. Those who responded 'no' and 'not sure' were asked an additional question to elicit what makes them unwilling/unsure of getting vaccinated. The respondents were allowed to provide multiple reasons for their being unwilling/unsure of getting the COVID-19 vaccine.

The researchers forwarded the online survey link to the potential respondents. Students who agreed to participate were directed to continue with the survey. After the students completed the survey, their responses were automatically sent to the researchers' database. The online survey link was opened from November 26, 2020, to December 31, 2020.

## 2.5 | Ethical consideration

The Nursing Research Ethics Committee of King Abdulaziz University (NREC Serial No: Ref No 1F. 32) granted the ethical clearance for the study. The researchers provided full disclosure to the respondents concerning the study information, including the purpose and benefits of the study, the potential risks of participation, the participant's rights and voluntary participation. This information was presented in the first section of the online survey to ensure that the potential respondents are well informed. Those who agreed to participate were required to sign an electronic informed consent.

## 2.6 | Statistical analyses

SPSS version 22.0 was utilized for the analysis of data. For the estimation of the psychometric parameters of the C19RPS, C19VBS and C19VAS by using the present sample, content validity was supported by item level (I-CVI) and scale level using the averaging method (S-CVI/Ave; Polit & Beck, 2006). The corrected item-to-total correlations (ITCs) of each item were computed. Kaiser-Meyer-Olkin (KMO  $\geq 0.60$ ) estimation and Barlett's test of sphericity were carried out to indicate the adequacy of sample size and the appropriateness of the model respectively. Principal component analysis (PCA) and varimax rotation were carried out to establish construct validity. Component extraction was decided based on the Eigenvalue ( $>1$ ) and the factor loadings ( $>0.40$ ; DeVellis, 2012). Cronbach's alpha ( $\geq 0.70$ ) was calculated to establish the reliability of all the scales used in this study using the current sample (Nunnally & Bernstein, 1994).

Descriptive statistics were utilized for the study variables. Forward stepwise multinomial logistic regression was performed to determine the predictors of the student nurses' intention to vaccinate. The following were entered as predictor variables in the model: demographic characteristics, risk perception, anxiety, fear, beliefs, attitude towards and VL on COVID-19 vaccine. For the dependent variable (intention to be vaccinated), 'yes' was considered as the reference group, while 'no' and 'not sure' were considered as comparative groups.

TABLE 2 Descriptive analyses results of the study variables

Variables	Overall (n = 1170)		Intention to get vaccinated with the COVID-19 vaccine		
	Range	Mean (SD)	Yes (n = 654)	No (n = 206)	Not sure (n = 310)
			Mean (SD)	Mean (SD)	Mean (SD)
Risk perception	3.00–15.00	9.59 (2.82)	9.91 (2.90)	8.91 (2.86)	9.58 (2.82)
COVID-19 anxiety	0.00–20.00	3.95 (4.77)	4.04 (4.88)	5.32 (5.07)	2.84 (4.03)
Fear of COVID-19	7.00–35.00	18.17 (6.65)	18.21 (7.07)	19.25 (6.09)	17.36 (5.99)
Beliefs on the COVID-19 vaccine	8.00–40.00	29.90 (6.56)	31.34 (6.31)	27.10 (6.60)	28.71 (6.24)
Positive attitudes towards COVID-19 vaccine	1.00–5.00	3.64 (0.92)	3.89 (0.87)	3.21 (0.93)	3.39 (0.83)
Negative attitudes towards COVID-19 vaccine	1.00–5.00	2.72 (0.90)	2.57 (0.95)	2.94 (0.90)	2.87 (0.74)
Functional COVID-19 vaccine literacy	1.00–4.00	2.98 (0.72)	3.00 (0.72)	2.84 (0.67)	3.03 (0.76)
Interactive-critical COVID-19 vaccine literacy	1.00–4.00	2.70 (0.65)	2.80 (0.63)	2.61 (0.59)	2.70 (0.65)

## 2.7 | Validity and reliability/rigor

The validity and reliability of the C19RPS were examined using the present sample of the study. The ITC of the three items ranged from 0.59 to 0.64. The KMO was 0.70, and Bartlett's test of sphericity was significant ( $\chi^2 [3] = 963.49, p < .001$ ). PCA indicated a single component of the scale (Eigenvalue = 2.08) with a cumulative explained variance of 69.3%. Factor loadings were from 0.81 (item 3) to 0.85 (item 2). The Cronbach's coefficient was 0.78.

Lee (2020) reported the psychometric properties of the CAS and concluded that this tool is valid for clinical research and practice. PCA showed two components; however, only the first component with 59.85% variance explained was included in the CAS. Confirmatory factor analysis supported the single construct [ $\chi^2 (5) = 2.68, p = .75$ ] of the CAS with fit indices:  $\chi^2/df$  ratio = 0.54, CFI = 1.00, TLI = 1.00, SRMR = 0.01 and RMSEA = 0.00 (90% CI = 0.00, 0.05). The reliability of the CAS was at 0.93. The Cronbach's alpha used for the sample in this study was at 0.87.

For the FCV-19S, the ITCs of the seven items were acceptable (0.47–0.56), and their factor loadings were sufficient (0.66–0.74). The Rasch analysis, according to Rasch model, indicated satisfactory properties (infit MnSq values = 0.80–1.26, outfit MnSq values = 0.84–1.25). Furthermore, the Rasch analysis indicated satisfactory item separation reliability (0.99) and index (11.45), and person separation reliability (0.77) and index (2.82; Ahorsu et al., 2020). The internal consistency was also acceptable at an alpha of 0.82. Its positive associations with depression, anxiety, infectibility perceptions and germ aversion supported the concurrent validity of the scale (Ahorsu et al., 2020). An alpha of 0.89 was calculated in our sample.

The C19VBS and C19VAS were examined for content validity by a panel of five members (one epidemiologist, one assistant professor in community health nursing, one assistant professor in medical-surgical nursing, one infectious control nurse and one public health nurse). Both tools have an acceptable content validity (I-CVI = 1, S-CVI/Ave = 1). By using the sample in our study, the psychometric analyses

of the C19VBS and C19VAS were performed. For the C19VBS, the ITC of the eight items ranged from 0.57 (item 2) to 0.70 (item 8). The KMO was 0.90, and Bartlett's test of sphericity was significant ( $\chi^2 [28] = 3963.01, p < .001$ ). PCA revealed a single component with an eigenvalue of 4.33 and an explained variance of 54.1%. The factor loadings were adequate (0.67–0.79). The computed Cronbach's alpha was 0.88.

When examining the ITC values of the eight items of the C19VAS, one item had a value <0.30. In addition, the analysis revealed that if this item is deleted, the Cronbach's alpha of the scale could increase substantially. Therefore, this item was dropped, leading to the ITC values of the remaining seven items to range from 0.30 to 0.49. The computed KMO value was 0.76, and Bartlett's test of sphericity was found to be significant ( $\chi^2 [21] = 2349.85, p < .001$ ). The results of PCA indicated that the C19VAS comprised two components with a total explained variance of 64.4%. Component 1 (eigenvalue = 2.71) and Component 2 (eigenvalue = 1.79) had explained variances of 38.8% and 25.6% respectively. Four items loaded to Component 1 (factor loadings = 0.78–0.84) were labelled 'Positive Attitudes towards COVID-19 Vaccine', while three items loaded to Component 2 (factor loadings = 0.75–0.80) were labelled 'Negative Attitudes towards COVID-19 Vaccine'. The computed Cronbach's alpha coefficients for Components 1 and 2 were 0.83 and 0.73 respectively.

The construct validity of the tool assessing COVID-19 VL was established by PCA, which revealed a two-factor solution explaining 62.7% of the variance. The scale's internal consistency was acceptable with the following computed alphas: functional VL = 0.82 and interactive-critical VL = 0.94 (Biasio et al., 2020). When using the present study sample, the Cronbach's alphas of functional VL and interactive-critical VL were 0.80 and 0.81 respectively.

## 3 | RESULTS

Most of the students did not have prior COVID-19 infection (86.2%), but 13.8% of the sample had been infected with

the virus. More than half of the respondents acquired their COVID-19 vaccine information on social media platforms (52.5%), while the remaining reported that their primary source of information was the Ministry of Health (MOH; 25.1%), TV/radios (13.9%), scientific journals (5.7%) and newspapers/magazines (2.7%, Table 1).

### 3.1 | COVID-19-related risk perception, anxiety and fears

The findings of the descriptive analyses on the study variables are shown in Table 2. The overall mean in COVID-19 risk perception was 9.59 ( $SD = 2.82$ ) from a possible score of 1–15. For COVID-19-related anxiety, the mean score was 3.95 ( $SD = 4.77$ ) from a score between 0 and 20. The students recorded a mean score of 18.17 ( $SD = 6.65$ ) in the FCV-19S from a possible score range of 7–35.

### 3.2 | COVID-19 vaccine beliefs and attitudes and VL

Regarding students' beliefs on the COVID-19 vaccine, the overall mean score was 29.90 ( $SD = 6.56$ ; possible range of scores = 8–40) from a maximum score of 40. The students' mean score on the positive attitude towards the COVID-19 vaccine subscale was 3.64 ( $SD = 0.92$ ; possible range of scores = 1–5), while that on the negative attitudes towards the COVID-19 vaccine subscale was 2.72 ( $SD = 0.90$ ; possible range of scores = 1–5). For students' COVID-19 VL, the mean scores were 2.98 ( $SD = 0.72$ ; possible range of scores = 1–4) and 2.70 ( $SD = 0.65$ ; possible range of scores = 1–4) in the functional COVID-19 VL and interactive-critical COVID-19 VL subscales respectively. The means of items in each scale used in this study are summarized in File S1.

### 3.3 | Intention to vaccinate

As shown in Table 3, more than half of the respondents (55.9%) intended to vaccinate, 17.6% did not intend to do so, and 26.5% were not sure. Among the reasons reported by those who answered 'no' and 'not sure', 'I am concerned about the safety of the vaccine' (50.0%) was ranked as the main reason, followed by 'I am concerned about the side effects of the vaccine' (42.6%), 'I am concerned about the effectiveness of the vaccine' (38.8%), 'My immune system is enough' (26.6%), 'I think the clinical trials being conducted are unreliable' (25.8%), 'I don't believe that the vaccine will stop the infection' (18.4%), 'The COVID-19 vaccine is a conspiracy' (10.1%), 'The vaccine will be expensive' (9.7%), 'There is no need for the vaccine because I was already infected before' (6.4%), and 'I don't like needles' (6.2%).

**TABLE 3** Intention to get vaccinated with the COVID-19 vaccine and the reasons of not getting the vaccine ( $n = 1170$ )

Intention to get vaccinated	<i>n</i>	%
Yes	654	55.9
No	206	17.6
Not sure	310	26.5
Reasons for not intending to get vaccinated ( $n = 516$ )		
I am concerned about the safety of the vaccine	258	50.0
I am concerned about the side effects of the vaccine	220	42.6
I am concerned about the effectiveness of the vaccine	200	38.8
My immune system is enough	137	26.6
I think the clinical trials being conducted are unreliable	133	25.8
I don't believe that the vaccine will stop the infection	95	18.4
The COVID-19 vaccine is a conspiracy	52	10.1
The vaccine will be expensive	50	9.7
There is no need for the vaccine because I was already infected before	33	6.4
I don't like needles	32	6.2

### 3.4 | Predictors of students' intention to vaccinate

The results of the forward stepwise multinomial logistic regression on the intention to be vaccinated indicated good model fit [ $\chi^2(12) = 210.29, p < .001$ ]. The Pearson [ $\chi^2(2298) = 2300.24, p = .483$ ] and deviance [ $\chi^2(2298) = 2089.58, p = .999$ ] chi-squared values also suggested good model fit. The classification table showed that the percentage of correct classification with the predictor variables was 57.6%. As shown in Table 4, COVID-19 risk perceptions, COVID-19 anxiety, COVID-19 vaccine beliefs and attitudes and interactive-critical COVID-19 VL were significant predictors of the nursing students' intention to be vaccinated against COVID-19. In particular, an increase in one unit in the COVID-19 risk perception score could decrease the relative risk of preferring not to be vaccinated over being vaccinated by 0.91 (95% CI = 0.85, 0.98). A unit increase in the COVID-19 anxiety score could also increase the relative risk of choosing 'no' over 'yes' by 1.08 (95% CI = 1.04, 1.13). Moreover, if the students' score in the COVID-19 vaccine beliefs increases by one unit, the relative risk of responding 'no' and 'not sure' over 'yes' could decrease by 0.96 (95% CI = 0.93, 0.99) and 0.97 (95% CI = 0.95, 1.00) respectively. Similarly, a unit increase in the positive attitudes towards the COVID-19 vaccine subscale score could result in a 0.49 (95% CI = 0.38, 0.63) and 0.65 (95% CI = 0.52, 0.79) decrease in the relative risk of preferring 'no' and 'not sure' responses over 'yes' responses respectively. By contrast, a unit increase in the negative attitudes towards the COVID-19 vaccine subscale score could result in a 1.73 (95% CI = 1.40, 2.15) and 1.29 (95% CI = 1.08, 1.53)

TABLE 4 Results of the forward stepwise multinomial logistic regression on the students' intention to get vaccinated by the COVID-19 vaccine (n = 1170)

Predictor variables	No intention to get vaccinated					Not sure					
	B	SE	p	exp( $\beta$ )	95% CI	$\beta$	SE	p	exp( $\beta$ )	95% CI	
Risk perception	-0.07	0.03	.040*	0.93	0.87	1.00	0.03	.377	1.03	0.97	1.08
COVID-19 anxiety	0.08	0.02	<.001***	1.08	1.04	1.12	0.02	.009**	0.96	0.92	0.99
Beliefs on the COVID-19 vaccine	-0.04	0.02	.019*	0.96	0.93	0.99	0.01	.265	0.98	0.96	1.01
Positive attitudes towards COVID-19 vaccine	-0.62	0.12	<.001***	0.54	0.43	0.68	0.10	<.001***	0.60	0.49	0.74
Negative attitudes towards COVID-19 vaccine	0.46	0.10	<.001***	1.58	1.30	1.91	0.08	<.001***	1.40	1.18	1.64
Interactive-critical literacy	-0.10	0.15	.520	0.91	0.67	1.22	0.12	.009**	0.73	0.58	0.93

Significant at \*.05, \*\*.01 and \*\*\*.001 levels respectively.

increase in the relative risk of preferring 'no' and 'not sure' over 'yes' respectively. Finally, students who had high interactive-critical COVID-19 VL were more likely to choose to receive the vaccine than those who had low COVID-19 VL [exp( $\beta$ ) = 0.73, 95% CI = 0.58, 0.93].

#### 4 | DISCUSSION

This study examined the predictors of student nurses' intention to receive COVID-19 vaccination. More than half of the nursing students (55.9%) intended to be vaccinated. Similarly, studies reported above 50% acceptance rates of COVID-19 vaccine among HCWs in China (Fu et al., 2020) and adult population in Saudi Arabia (Al-Mohaithef & Padhi, 2020) and the USA (Malik et al., 2020; Thunstrom et al., 2020). However, the present study's findings showed that 17.6% and 26.5% of students do not have any intention to be vaccinated and are not sure if they prefer to receive the vaccine respectively. Schuster et al. (2015) mentioned that vaccine hesitancy is also high in non-COVID-19 vaccines, and COVID-19 vaccines are no exception. The clinical trials showed that issues on COVID-19 vaccine safety and effectiveness, side effects, immune system response and distrust were among the common reasons provided by the nursing students as to why they do not intend to get vaccinated. Overall, the findings showed the considerable challenges that complicate students' intention to be vaccinated, and these challenges could present problems in the vaccination programs for this group of population. These issues may have been deepened further by the COVID-19 outbreak, as one study reported that the pandemic causes stress and restrictions, which then cause anti-systemic views and beliefs of individuals (Bartusevicius et al., 2020). Moreover, 'pandemic fatigue' has been observed (Michie et al., 2020), which further negatively affects the willingness of students to be vaccinated, and this willingness is likely to be negatively influenced as the COVID-19 outbreak continues. This notion is supported by the present study results, which indicated that students with high COVID-19 anxiety are more likely to decline vaccination.

The findings have shown that the risk perceptions of nursing students in Saudi Arabia (M = 9.59) were slightly higher than the reported risk perceptions of German adults (M = 9.07) when using the same scale (Gerhold, 2020), while the level of fear in the present sample (M = 18.17) was lower than that of the nursing students in Mexico (M = 25.71) when using the same tool (Medina Fernández et al., 2021). Moreover, the mean score in the CAS was below 9, which could be interpreted as 'non-anxiety' (Lee, 2020). Our findings could be linked with the decreasing number of COVID-19 cases in Saudi Arabia during the data collection period and the strict implementation of rules and regulations about COVID-19 being observed in the Kingdom (Albaqawi et al., 2020; Alsolais et al., 2021).

Nursing students who had high COVID-19 risk perception were more likely to receive vaccination than those who had low-risk perception, and this result is consistent with that of previous studies (Alfageeh et al., 2021; Al-Mohaithef & Padhi, 2020). High COVID-19



risk perception may prompt individuals to increase their knowledge, awareness and understanding of the COVID-19 vaccine (Asefa et al., 2020), leading to better acceptance. Therefore, considering that nursing students are at high risk of becoming infected while on clinical training, the MOH should also include them as one of the priority groups to receive the vaccine. This inclusion could ensure that the students are protected while guaranteeing that their nursing education is not hampered.

The students' functional and interactive-critical COVID-19 VLs were slightly higher and lower than the general adult population in Italy when using the same tool (Biasio et al., 2021). The reported COVID-19 VL could be associated with the efforts of the health authorities and accurate information search by the respondents. The MOH implemented various information dissemination efforts aimed at increasing public awareness about the COVID-19 vaccine by using different platforms, such as social media, mainstream media in TV, radios and newspapers, and through coordination with different institutions in the country, including universities (Ministry of Health, 2021). These efforts are reflected in the top three main sources of COVID-19 vaccine information (social media, MOH and TV/ radio) reported by this study. Interactive-critical VL is defined as the cognitive ability, such as decision making and problem solving (Nutbeam, 2000), of the person being a significant predictor of the willingness to be vaccinated. The finding showed that the knowledge, awareness and understanding of COVID-19 vaccines help students decide whether to be vaccinated, further implying that a student's cognitive skills are important in understanding, interpreting and processing data or information about the COVID-19 vaccine. Their skills to comprehend information help them develop enhanced decision-making skills when it comes to accepting the COVID-19 vaccine. Sherman et al. (2021) also reported a similar finding, who found that having sufficient information about the COVID-19 vaccine was associated with greater intention to be vaccinated among UK adults.

The results showed that a more positive attitude towards COVID-19 vaccine is more likely to result in vaccination. The positive attitude of respondents indicates their trust in the efficacy of COVID-19 vaccines because most of the population base their attitude towards a vaccine on its efficacy (Kempe et al., 2020). An initial study on COVID-19 vaccines showed that those willing to be vaccinated have high trust in scientists (Rozenbeek et al., 2020). The respondents' trust in Saudi Arabian health authorities plays a significant role in accepting the COVID-19 vaccine. The health authorities and government of Saudi Arabia are very dedicated to providing information on the importance of this vaccine. This notion is supported by Gollwitzer et al. (2020), who found that during this COVID-19 pandemic, political ideology influences compliance with health advice.

The results also supported that having positive beliefs on the COVID-19 vaccine more likely leads to vaccination. This finding is consistent with the result of the studies among adults in the UK (Sherman et al., 2021) and the health belief model, which posits that specific beliefs of individuals (i.e. COVID-19 susceptibility and

risk and perception on the COVID-19 vaccine's benefits and risks) influence health behaviours (i.e. intention to vaccinate). Previous studies have supported the significant influences of the different components of the health belief (i.e. perceived severity, susceptibility, benefits and barriers) of individuals on their intention to be vaccinated against COVID-19 (Wong et al., 2020; Zampetakis & Melas, 2021). Therefore, the influence of the positive belief of nursing students on their intention to be vaccinated could result from their desire to protect themselves from being infected with COVID-19.

#### 4.1 | Implications to nursing research, practice and education

The findings provide valuable contributions for uncovering nursing students' beliefs on and attitudes towards the COVID-19 vaccine and their COVID-19 VL and how these variables influence the students' intention to get a COVID-19 vaccine. The study provides significant implications in various aspects. Various governments could use the study findings in advancing their COVID-19 vaccination program. Policymakers could consider the factors identified in this study and why the students did not intend to get the vaccine in planning a nationwide vaccination program. The Ministry of Education should work with the MOH to strategize a vaccination plan for nursing students to ensure a high vaccination rate. The government should also strengthen its information drive about COVID-19 to combat misinformation and allay people's fears and anxiety, thereby increasing the confidence and trust of people in the COVID-19 vaccine. The colleges of nursing could also utilize the findings in developing educational programs that aim to improve the literacy, beliefs and attitudes towards the COVID-19 vaccine. Nursing education has a critical role in ensuring that future nurses are pro-vaccine and immunization advocates. Providing adequate evidence-based education on vaccines will guarantee that students' beliefs and attitudes towards vaccination will be positive and that they could become positive role models to the public. Nursing education should mould future nurses' beliefs, attitudes and literacy on the vaccine to become effective health promoters in the future. The study also provides an avenue for future research studies to be conducted on this area to ensure evidence-based policies, education and interventions on future vaccination programs and education. Future research studies may also focus on developing, implementing and evaluating interventions to foster positive beliefs, attitudes and literacy on the COVID-19 vaccine and vaccination in general among nursing students.

#### 4.2 | Limitations

First, the samples from each university were selected non-randomly, which could affect the generalizability of the results.

However, this study is one of the largest multi-university studies conducted on this topic and population. Therefore, the merit of the findings should not be disregarded. Second, only the intention to be vaccinated was included and not the actual prevalence of COVID-19 vaccination among this group of samples. Further studies should be conducted to examine the vaccination rate among these students and its influencing factors. Third, some degree of response bias may have been present, as students may be either more inclined to provide a positive or negative response. Thus, this bias should be considered in interpreting the findings of the study.

## 5 | CONCLUSION

The study showed that having high-risk perceptions, low levels of COVID-19 anxiety, positive beliefs and attitudes towards the COVID-19 vaccine; high levels of interactive-critical COVID-19 VL were predictors of the intention to be vaccinated. Nursing students provided several reasons as to why they either do not intend to be vaccinated or are unsure of doing so, including concerns on the vaccine's safety, side effects, effectiveness and price; the reliability of the clinical trials that had been conducted; and the belief that the vaccine does not stop the infection. Thus, the study findings could be used by various governments in advancing their COVID-19 vaccination program.

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## DATA AVAILABILITY STATEMENT

Data available on reasonable request from the authors.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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