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Examination of Nursing Staffs’ Perceptions of the COVID-19 Vaccine Using the Health Belief Model

Aidan Cossio1, Wilson Cobb1, Addison Fugitt1, Sandra Nielsen1, Matthew Hesson-McInnis2, and Marilyn A. Prasun3

Abstract


Objective: To examine nursing staffs’ perceptions of the COVID-19 vaccine using the Health Belief Model (HBM) as a theoretical framework.

Methods: A cross-sectional, anonymous, web-based survey was completed by practicing nursing staffs throughout the United States. Analyses involved descriptive and comparative statistics.

Results: Of the 294 nursing staff who completed surveys, 50% were between 18 and 37 years of age, and 73.1% were registered nurses, with 49.3% employed in a hospital setting. Nursing staff reported their primary reason for vaccination was concern for others (mean: 84.44; SD: 28.26), vaccine prevents spread (mean: 81.85; SD: 28.94), and own health (mean: 79.63; SD: 30.0). Influencing factors that predicted vaccination included age, Wilks’ Λ = 0.76, F(32, 919.86) = 2.20, p < .001, η² partial = 0.066, and the vaccine mandate, Wilks’ Λ = 0.63, F(8, 249) = 18.61, p < .001, η² partial = 0.374.

Conclusion: Nursing staffs’ perceptions using the HBM as a theoretical framework provided insight into their decisions to receive the COVID-19 vaccine. Further research is warranted to examine nurses’ attitudes and factors that influence their decision-making regarding vaccination.

Keywords
nurses, perceptions, COVID-19 vaccine, Health Belief Model, vaccination hesitancy, mandatory vaccination

As the SARS-CoV2 (COVID-19) virus spread, providing care for acutely ill patients with COVID-19 became a health care priority.1 Nurses were frontline care providers in response to the escalation in COVID-19 cases. The Centers for Disease Control and Prevention consistently reported that the COVID-19 vaccines reduced the risk of contracting the virus and could reduce illness severity.2 Emergency authorization for the use of a novel COVID-19 vaccination was given by the Food and Drug Administration on December 11, 2020, to address the pandemic.3 This report provides findings from a survey of COVID-19 vaccinated nurses that reveal opinions on the benefits of the vaccination and of COVID-19 vaccination mandates. Grasping nurse perceptions regarding vaccination, vaccination mandates, and infectious disease health beliefs is vital to understanding the ongoing COVID-19 vaccination challenges.

Concern for Nurses’ COVID-19 Vaccination Practices

When the COVID-19 vaccination first became available, nurses were vaccinated at a lower rate than other health care workers (HCWs).4-6 Nurses are the most trusted profession.7 Nurses influence and provide patient education. The teaching role of nurses’ makes their vaccination rates and perceptions relevant to the overall vaccination effort. Following the example of an increase in influenza HCW vaccination rates by creating mandatory influenza vaccination policies, in November 2021, COVID-19 vaccination was required for all HCWs who work in facilities reimbursed by Medicare and Medicaid.8 This mandate was not without opposition, but in January 2022, the Supreme Court upheld the Center for Medicare and Medicaid Services (CMS) mandate requiring all HCWs who work for a facility receiving CMS funding to be vaccinated against COVID-19.9 While the mandate

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benefited the vaccination effort among CMS-funded nursing facilities, nurses who worked for private pay facilities were excluded from the federal COVID-19 vaccination requirement. We sought to explore which factors influenced nurses’ decisions to become vaccinated.

Health Belief Model

In this study, we used the Health Belief Model (HBM) to evaluate how nurses regarded their COVID-19 vaccination decision. Recognition of beliefs and attitudes is vital to understanding vaccination action and prior researchers have used the HBM to predict COVID-19 vaccination uptake. The HBM indicates individual perceptions and modifying factors that can explain behavior. We sought to determine which perceptions and factors influenced vaccine acceptance or rejection. The HBM suggests that individual perceptions of threat, susceptibility, and other modifying factors, such as age or education, influence decisions. We assumed from the model that individuals’ perceptions of risk as measured by susceptibility to the virus and perceived benefits of vaccination would positively influence vaccination. The belief that the vaccine was unsafe or the perception that natural immunity is superior might reduce nurses’ vaccination uptake. We surveyed nursing staff after the vaccination became available. The federal HCW COVID-19 vaccine mandate also preceded the survey. Therefore, nursing staffs’ vaccination self-efficacy was assumed since the vaccine was readily available. The mandate potentially influenced their decision to become vaccinated. Nursing staff might even act against their health perceptions when threatened with job loss due to remaining unvaccinated. Nurses are a distinct population, and unlike the public, their beliefs about COVID-19 vaccination may influence others’ vaccination uptake.

Given the lack of evidence related to nursing staffs’ perceptions, attitudes, and beliefs regarding the COVID-19 vaccination, the purpose of our study was to examine nursing staffs’ perceptions of the COVID-19 vaccine. We addressed 5 research questions: (1) Which factors influenced nursing staff to accept or reject the COVID-19 vaccine? (2) Which factors influenced nursing staffs’ COVID-19 vaccination sentiment? (3) Which factors influenced nurses’ COVID-19 vaccination mandate sentiment? (4) Which factors influenced nursing staffs’ perceptions of COVID-19 vaccination effectiveness? (5) To what extent do certain factors (age, gender, education, licensure, mandate, presence of vaccination exemptions, belief in vaccine efficacy, concerns about vaccine safety, or preference for natural immunity) predict nursing staffs’ vaccination status?

Methods

Design and Sample

The study used a prospective, descriptive, cross-sectional survey design. Data were collected between March 15, 2022, and May 13, 2022. The Illinois State University Institutional Review Board (IRB) approved the anonymous survey as exempt research (IRB-2022-53). The first page of the survey included the informed consent information, and the completion of the survey implied consent. Recruitment was undertaken utilizing social media (Facebook, Instagram, and Twitter) and email. Participants were encouraged to aid in snowball sampling by sharing the study information and survey link to nursing staff colleagues. Participants received a description of the study and a Qualtrics survey link to electronically access the survey. G*Power 3.1 was used to compute the required sample size to detect a moderate effect size with a significance level of .05 and a power of 0.95, resulting in a minimum sample size of 240. A total of 392 surveys were initiated by respondents and 294 were completed.

Instrument

The survey was developed and based on the HBM. See Table 1 for a list of HBM topics and questions included in the survey. The 16-item survey incorporated components of demographics, whether they fell under a vaccination mandate, whether they received a vaccine dose, if they received an exemption, their primary reason for their decision, and influences of their decision. Content validity was established through peer review by 4 experts (nurse researchers). The scale was divided into two 5-item scales (positive and negative vaccine sentiments) which displayed good internal consistency for a new instrument with a Cronbach’s alphas of 0.84 and 0.88, respectively.

Data Analysis

All data were entered electronically by respondents into Qualtrics and analyzed in IBM SPSS Statistics for Windows (Version 28.0). Descriptive statistics were computed to describe sample characteristics and survey responses using frequency with the corresponding percentage for categorical variables and mean with standard deviation for continuous variables. Data were then analyzed using multivariate analysis of variance (MANOVA) to examine vaccine influences and multinomial logistic regression to predict vaccine sentiment using a .05 significance level for all analyses.

Data screening. Of the 392 responses recorded on Qualtrics, 45 participants did not finish the survey (ie, they did not reach the end of the survey and left all responses blank). Two participants skipped all demographic questions, and an additional 51 participants skipped 5 or more (over half) of the attitude ratings that form the core of this survey. Therefore, due to the limited response, these participants were removed from further analysis resulting in a final sample size of 294.

Of the responses from the 294 participants on the study variables, 454 values (7.35%) were missing. Only 115 participants (39%) provided complete data, necessitating a
Table 1. Implementing the Health Belief Model for Nurses’ COVID-19 Vaccine Perceptions.

<table>
<thead>
<tr>
<th>Influences</th>
<th>Theory construct</th>
<th>Survey question</th>
<th>Survey subsection</th>
</tr>
</thead>
</table>
| Individual perceptions         | Perceived susceptibility/sensitivity  | On a scale from 0 to 100 indicate to what degree these things influenced your vaccination status . . . | 1. Concern for own health?  
2. Concern for others’ health? |
|                               | Perceived threats                     | On a scale from 0 to 100 indicate to what degree these things influenced your vaccination status . . . | 1. Concern that the vaccine harms one’s health?  
2. The vaccine may be unsafe?  
3. Concern that the vaccine harms others’ health? |
|                               | Perceived benefit of inaction/action   | On a scale from 0 to 100 indicate to what degree these things influenced your vaccination status . . . | 1. Natural Immunity is sufficient?  
2. The vaccine prevents serious illness?  
3. The vaccine prevents the spread of COVID-19? |
| Modifying Factors             | Demographics                           | What is your . . .                                                                 | 1. Age?  
2. Gender?  
3. Ethnicity?  
4. Type of work facility? |
|                               | Socio-psychological variables          | Indicate your . . .                                                               | 1. Education: Highest Degree?  
2. Licensure?  
3. Current Practice? |
|                               | Cues to action                         | Are you?  
Do you have an?                                                                  | 1. Mandated to receive vaccination?  
2. Available Exemption? |

Closer examination of missing values. For the demographic variables, data were nearly complete with 0 missing values from 282 participants (96%) and no more than 2 missing values for the remaining 12 participants (4%). The attitude rating variables included most of the missing values, and Little’s missing completely at random (MCAR) test suggests that these values are not MCAR ($\chi^2[370] = 530.05, p \leq .001$). This significant departure from MCAR suggests that complete case analysis may be biased, but it also calls into question the veracity of imputed values. To check for bias and systematic patterns of missing data, we examined the independence of cases with missing values and the key variables and found no evidence of association with vaccination status ($\chi^2[1, N = 294] = 1.72, p = .19$), being exempt from vaccine mandates ($\chi^2[1, N = 294] = 2.13, p = .14$), comment sentiment classifications concerning vaccination ($\chi^2[2, N = 294] = 1.85, p = .40$), or vaccine mandates ($\chi^2[2, N = 294] = 2.72, p = .26$). We therefore estimated 10 imputed values for each missing score and used the average as a replacement for missing values.

Agreement ratings. Researchers received varied responses to the open-ended question “Did any other factors influence your vaccination status?” Two raters independently classified each open-ended response as expressing a pro-vaccine sentiment, an anti-vaccine sentiment, or mute regarding vaccination. Examples of narrative open-ended responses for a pro-vaccine statement were “worry that harm may come to a patient or my family” and “it was common sense to get the vaccine.” Examples of anti-vaccine sentiment were “the vaccine came out too soon, political, don’t trust it” and “what I put into my body is my choice not a choice the gov’t makes for me.” A neutral or mute response was “I want my life to be normal again.” The raters agreed on 272 (93%) of 294 classifications. The research team met as a group to discuss the 22 responses that were discrepant and identify a consensus classification.

The same 2 raters independently classified each open-ended response as expressing a pro-mandate sentiment, an anti-mandate sentiment, or expressing no mandate sentiment, such as “Vaccine and following mitigation strategies (masking, distancing, etc) as the best and frankly, only options available to us.” While raters agreed that an anti-mandate sentiment was, for example, “What I put in my body is my choice.” Other open-ended questions were thought to express no mandate sentiment such as the statement, “After reading available research, both published and unpublished, my decision was made based upon risk vs. benefit for my health status.” These raters agreed on 262 (89%) of 294 classifications, and the research team again met as a group to discuss the 32 discrepant ratings to identify a consensus classification.

Results

The final sample of nursing staff ($n = 294$) identified predominately as female (91.8%; $n = 270$), age ranged between 18 and 37 years for 50% of the sample, and most had a bachelor’s degree or higher. Professionally, participants identified as a certified nurse aid (7.16%; $n = 22$), registered nurse (73.1%; $n = 215$), or APRNs (19.4%; $n = 57$). The majority (78.9%, $n = 232$) of the respondents who identified vaccine status indicated receiving at least 1 dose of COVID-19 vaccine (see Table 2).
The overarching analytic strategy was to use the demographic characteristics to predict the ratings of influences of vaccine use, to use demographics and influences to predict vaccine and mandate sentiments, and then to use demographics, influences, and vaccine/mandate sentiments to predict vaccination status.

Table 2 provides the sample sizes, means, and standard deviation for the key study variables. It is important to note that several categorical variables exhibited very small cell sizes, which required categories to be collapsed to provide usable variables for the analyses that follow. Specifically, responses to the question on gender identity included only 5 participants who did not express a binary gender identity, which is not a sufficient sample size to be included in meaningful analyses. Similarly, the sample included only 5 respondents identifying their ethnicity as Asian, 5 as Hispanic, and 1 as Native Hawaiian/Pacific Islander, which is also insufficient for treatment as a separate group, resulting in black, indigenous, and people of color (BIPOC) respondents being classified as such in a single group. Finally, only 5 participants reported having an associate degree, 19 having some college, and 3 having a high school diploma, and thus we collapsed all participants with less than a baccalaureate degree into a single category.

Nursing staffs’ health beliefs were then examined by their reports of what influenced their decision to become vaccinated. The scale ranged from 0 (not being a reason to obtain or decline vaccination) to 100 (the primary reason to obtain or decline vaccination). Table 3 provides the means and standard deviations of the 5 highest and lowest reported health beliefs. The reported reasons for vaccination were concern for others’ health, vaccination prevents illness, concern for own health, vaccination prevents spread, and availability of the vaccine. The nursing staffs’ lowest reported reasons were the vaccine will harm others, natural immunity, the degree to which natural immunity precluded the need for a vaccine, and concerns that the vaccines were unsafe.

Predicting Vaccine Influences

We first tested the relationships between the demographic variables (age, binary gender, binary BIPOC identity, type of facility, employer accepting Medicare/Medicaid payments, licensure, whether nursing staffs were practicing in a health care setting, education/degree, being mandated to receive a COVID vaccine, and being exempt for such a mandate) and the influence variables (ie, the ratings of the degree to decisions about getting vaccinated were influenced by a COVID vaccine mandate, concerns for one’s own health, concern for others’ health, vaccination prevents illness, concern for own health, vaccination prevents spread, and availability of the vaccine). The nursing staffs’ lowest reported reasons were the vaccine will harm others, natural immunity, the influence of the mandate on vaccine decision, the vaccine is unsafe, and the vaccine will harm me.
that there were significant differences among the influence ratings based on age categories (Wilks’ Λ = 0.76, \(F[32, 919.86] = 2.20, p < .001, \eta^2_{\text{partial}} = 0.066\)), although no significant differences between the collapsed education/degree categories (Wilks’ Λ = 0.87, \(F[24, 722.78] = 1.48, p = .067, \eta^2_{\text{partial}} = 0.049\)), and significant differences between those who were or were not exempt from vaccine mandates (Wilks’ Λ = 0.63, \(F[8, 249] = 18.61, p < .001, \eta^2_{\text{partial}} = 0.374\)). It was not surprising that this final characteristic, vaccine exemption, exhibited a higher effect size, explaining over one-third of the generalized variance among the dependent variables that characterize influence rates in the decision to be vaccinated.

### Predicting Vaccine/Mandate Sentiment Categories

Next, we attempted to use these same demographic characteristics to predict the classification of the 2 open-ended vaccine/mandate sentiment questions using multinomial logistic regression. We set the reference category to that representing “no (relevant) sentiment expressed” in both analyses. In the model using the demographic variables to predict vaccine sentiment, estimation issues were encountered that resulted in singularities in the Hessian Matrix, prompting us to remove the associated predictors representing the type of facility, accepting Medicare payments, and licensure. The resulting model, however, did not represent a significant prediction of the vaccine sentiment categories (\(\chi^2[22, N = 294] = 25.33, p = .282\)). Similarly, the demographic variables failed to provide a significant prediction of the vaccine mandate sentiment categories (\(\chi^2[22, N = 294] = 19.84, p = .593\)).

### Predicting Perceptions of Vaccine Effectiveness

The next step was to examine the effects of the demographic factors (identified above as significant predictors of the influence ratings) and those influence ratings as predictors of perceptions of the effectiveness of vaccination (ie, perceptions that vaccination prevents infection and prevents serious illness). We found that a number of the influence ratings exhibited significant effects on the nursing staffs’ perceptions of vaccine effectiveness: concern for one’s own health (Wilks’ Λ = 0.96, \(F[2, 255] = 5.20, p = .006, \eta^2_{\text{partial}} = 0.039\)), concern for others’ health (Wilks’ Λ = 0.86, \(F[2, 255] = 20.40, p < .001, \eta^2_{\text{partial}} = 0.138\)), vaccine availability (Wilks’ Λ = 0.92, \(F[2, 255] = 11.91, p < .001, \eta^2_{\text{partial}} = 0.085\)), belief that natural immunity is sufficient (Wilks’ Λ = 0.90, \(F[2, 255] = 14.81, p < .001, \eta^2_{\text{partial}} = 0.104\)), and concerns that the vaccines are unsafe (Wilks’ Λ = 0.96, \(F[2, 255] = 4.94, p = .008, \eta^2_{\text{partial}} = 0.037\)). Of the demographic variables, only age significantly predicted these effectiveness perceptions (Wilks’ Λ = 0.94, \(F[8, 508] = 1.96, p = .049, \eta^2_{\text{partial}} = 0.030\)), but this effect was qualified by a significant Age*Vaccine Exemption interaction, (Wilks’ Λ = 0.91, \(F[8, 510] = 3.22, p = .001, \eta^2_{\text{partial}} = 0.048\)).

### Predicting Vaccination Status

The final modeling endeavor was an attempt to predict which nursing staff would have received at least 1 dose of a COVID-19 vaccine using demographic characteristics, vaccine influences, and vaccine sentiments. This effort, however, was thwarted by issues with our data. Not only was there an extremely strong association between the dependent variable, vaccination status, and one of the demographic variables, exemption from a vaccination mandate (\(\chi^2[1, N = 294] = 186.26, p < .001\)), but this association also reflected the fact that our data set included only 22 nursing staff who had not been vaccinated, and of these 22 individuals, 17 were exempt from vaccine mandates. Thus, this last modeling effort could not be addressed with the extant data.

### Discussion

In this study, nursing staff reported their perceptions regarding the COVID-19 vaccine. We hypothesized that nursing staffs’ perceptions of risk as measured by susceptibility to the virus and perceived benefits of vaccination would positively influence vaccination uptake. Using the HBM, we supposed that perceptions of threat from the vaccine or the perception that natural immunity was sufficient might reduce nurses’ vaccination uptake.

Age and level of education would be factors one would anticipate influencing and predicting vaccination status. Greater knowledge about vaccines and beliefs that align with scientific evidence would lead to a more favorable attitude and would be more associated with greater intent. Even though the model did not predict vaccine sentiment, the open-ended responses provided depth to nursing staff sentiments that indicated attitudes changed as more data substantiated the vaccine’s successes. One nursing staff member indicated,

> Our attendings . . . debunked a lot of rumors/ myths around the vaccine . . . Seeing how sick these patients were getting first-hand made me want to get the vaccine to protect my family, my other patients, and myself.

Although in this study, age revealed significant differences among influence, the level of education only marginally displayed differences. Study participants were predominantly under the age of 37 years and educated at a baccalaureate level or higher. The interaction between age and the presence of a vaccine exemption suggests that an unknown third independent variable affected nursing staffs’ perceptions of vaccine effectiveness. Interestingly, there was a significant difference in vaccination status between those mandated to receive the vaccination and participants exempt from vaccine mandates.
Most nursing staff not receiving vaccinations were exempt (77%). Although people maintain different attitudes toward vaccine mandates, respondents in a nationally representative survey in the United States differentiated their support for mandates targeting specific subgroups.13 Approximately half of the national survey respondents strongly agreed/agreed with mandates for HCWs and those living or working in residential group settings such as nursing homes.

**Influencing Factors/Perceptions of Vaccine Effectiveness**

Nursing staff indicated that protecting others’ health was the primary influential factor regarding COVID-19 vaccination, followed closely by the belief that the vaccine will prevent illness and concern for one’s health. Similarly, Peterson et al.,14 in a vaccination survey among another sample of nurses in West Texas hospitals, also found a protection motivation rather than the threat of job loss due to a mandate for COVID vaccination was the deciding factor for a highly vaccinated population of nurses. However, Peterson indicated that concerns over vaccine side effects were significant among unvaccinated nurses. The nursing staff in our sample determined that vaccination was more protective than declining vaccination despite doubts about COVID-19 vaccine safety. Xavier and Lambert15 established that nurses’ sentiments about the risk of COVID-19 also changed over time. Most nursing staff in our highly vaccinated sample believed the vaccine would be protective despite concerns over vaccination safety or a preference for natural immunity.

As vaccines and boosters are readily available, addressing vaccination intentions among nurses who vaccinate the public remains essential to address vaccine hesitancy. Media messaging to HCWs should consider vaccine concerns regarding the development process, side effects, and safety.16 Some participant statements indicated doubt of media messages as one participant stated, “The media only put out one message and suppressed anything against the vaccine. I believe this was really wrong.” Addressing vaccine concerns among nurses may have additional public health effects as nurses vaccinate others. More research is needed to explore vaccination messaging to nurses.

**Limitations**

In this research, we utilized a web-based survey on social media platforms and author-accessible email lists which may lead to selection bias. Our analysis of a small amount of missing not at random data was not associated with vaccine status, exemption, or narrative responses regarding vaccination or vaccine mandate outcomes. Nonetheless, the inclusion of imputed data may lead to omitted variable bias. Therefore, the sample may not be generalizable to all practicing nurses. The survey was developed by the research team and reviewed by experts. However, the survey did not undergo testing beyond content validity. Our survey was open for nearly 3 months in spring 2022, which may not reflect subsequent changes in nurses’ health beliefs related to the risk for COVID-19 and COVID-19 vaccines. Vaccine hesitancy is complex, and this survey incorporated questions regarding influencing factors and may not reflect all aspects that contribute to vaccination decisions.

**Conclusion**

The introduction of a COVID-19 vaccine was not without challenges. Multiple factors influence vaccination, such as age, vaccine mandate, and media messaging on HCWs when a prescribed health behavior is not required for employment. Although nursing staff rated the influence of the mandate lower than other factors, researchers cannot ignore the effect of the mandate on vaccine decisions. The implications in clinical practice are profound in that nurses provide education and care across the health care continuum and are in a position to likely influence others in their vaccination decision. Nurses are the most trusted profession. Therefore, it is vital that more research is performed on nurse attitudes about future vaccines.

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**Patient Consent**

This was a survey of nursing staff practicing in health care who consented to participate in the study. Patients were not involved in this study.

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