COVID-19 Vaccine Acceptance or Refusal Among US Nurses: A Descriptive Cross-Sectional Study

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ABSTRACT

Introduction: Nurse turnover has accelerated during the COVID-19 pandemic. Nurse refusal of mandated vaccines contributes to understaffing and affects patient health outcomes. The purposes of this study were to describe (1) nurse reasons for COVID-19 vaccine decisions and (2) the relationship between vaccine status and nurse characteristics.

Methods: This cross-sectional descriptive study employed a survey of US nurses who worked in nursing during the COVID-19 pandemic. The survey included a free-text question about COVID-19 vaccine uptake rationale, self-reported vaccine acceptance/refusal, and demographic data.

Results: Of the 1682 participants, 11.2% refused the COVID-19 vaccine. Higher education level was correlated with greater vaccine acceptance rates ($P < 0.001$). Themes for vaccine rationale included safeguarding well-being, trust in the science, coercion to vaccinate, perceived immunity, and concern about preexisting health conditions.

Conclusions: The risks of COVID-19 vaccine mandates may be greater than the potential benefits given the potential for compounding workforce attrition during a nursing staffing crisis. Further research is needed to outline the relationships between vaccine education, advocacy, and vaccine uptake among nurses.

INTRODUCTION

Nurses play a critical role in health care delivery across the acute, primary, and community settings that is essential to global universal health outcomes.[1] The present global shortage of nurses—exacerbated by shortfalls in the number of educators and nurses voluntarily leaving the profession before retirement—is concerning given the impact that nurses make on global health.[2] Prior to the pandemic, there was projected to be a shortage of 151 500 licensed practical nurse and 918 232 registered nurses jobs in the United States by 2030.[3,4] The COVID-19 pandemic has accelerated nurse attrition through numerous mechanisms, such as burnout, lack of personal protective equipment, and COVID-19 vaccine refusal in the setting of vaccine mandates.[5,6] In 2021, COVID-19 vaccine refusal for nurses was estimated to be 18.3% globally[7] and approximately 12% in the United States.[8] Potential losses to the nursing workforce secondary to vaccine refusal-related attrition would exacerbate the existing nursing shortage. Therefore, understanding reasons for vaccine refusal is crucial to prevent future losses that would ultimately negatively affect patient health outcomes.

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Vaccine Refusal Among Health Care Workers

Vaccine refusal historically has been an issue among global health care workers, with wide geographic variances in childhood vaccine completion rates for children of health care workers under 5 years old.[9] Vaccine uptake rates also can vary in the same region from year to year. Influenza vaccine uptake among Italian health care workers was 60% in 2019 but only 22% in 2020.[10] There are several predictors for health care worker vaccine uptake. Education level and self-perceived vaccination knowledge are associated with both personal uptake of vaccines and recommendation for patient vaccine uptake.[10] Health care workers are less receptive to receiving vaccines for diseases that they perceive to have low severity.[8,10] Natural immunity from prior infection is sometimes cited as a rationale for vaccine refusal.[8,11,12]

Vaccine Mandates for Health Care Workers

Vaccine mandates for health care workers can effectively increase vaccine uptake rates;[13] however, it is unclear if mandates alone are responsible for improved vaccine uptake. One implementation of a hospital-wide mandatory influenza vaccine policy coupled with a vaccination campaign found that vaccine uptake increased from 54% to 97.6%; however, unionized staff who were exempt from the mandate also achieved 95.8% vaccination.[14]

The impact of vaccine mandates on patient safety outcomes is unknown.[15,16] The COVID-19 vaccine has poor relative efficacy in reducing disease transmission.[17] Proponents of vaccine mandates argue that mandates are a codification of the health care worker's duty to protect the well-being of their patients. Vaccine refusal is perceived as a willingness to spread contagious disease to the vulnerable and, therefore, a refusal to meet the duty of care burden that health care workers inherently shoulder.[18] Breach of the health care worker's duty to their patients' well-being is rationalized as justification for excluding them from patient care duties.[19]

Vaccine mandates also can be seen as a violation of the health care worker's right to personal medical autonomy.[19] Alternatives, such as mandatory personal protective equipment (PPE) use for unvaccinated staff, are often overlooked in the discourse supporting vaccine mandates and were not supported by the Centers for Medicare and Medicaid Services (CMS) COVID-19 vaccine mandate.[20] Health care workers are patients when they undergo medical treatment; however, their autonomy is perceived to be unvalued when a treatment is mandated and without alternatives.[21]

While proponents of vaccine mandates would argue the intrusion into personal autonomy is justified, a consequence of a vaccine mandate may be premature attrition from the profession by vaccine-hesitant health care workers, further exacerbating staffing shortages and compromising the ability to provide patient care.[22] Preexisting workplace stressors, such as demanding working conditions with inadequate resources and perceived poor support from health care institutions, may further diminish a vaccine-hesitant nurse's motivation to remain in the profession.[23,24] There is a dearth of research examining nurse rationale for their decision to accept or refuse the COVID-19 vaccine—particularly in the setting of a new mandate for a vaccine that had emergency use authorization at the implementation of the mandate.[20,25] The purpose of this study is to describe nurses' reasons for accepting or refusing the COVID-19 vaccine and to understand relationships between nurse characteristics and COVID-19 vaccination acceptance status.

METHODS

This cross-sectional study employed an online survey of US registered nurses and licensed practical nurses. Inclusion criteria included nurses currently licensed in any state and working in nursing at any time since the beginning of the COVID-19 pandemic in the United States, defined in this survey as March of 2020. Nurses were recruited via social media, an advertisement through the Wisconsin Nurses Association, and mass email to all actively licensed nurses in Wisconsin. Consent was implied by participating in the voluntary survey. Participants were surveyed via Qualtrics about their perceived reasons for accepting or refusing the COVID-19 vaccine and their vaccine status. This study was reviewed and approved by the Marquette University institutional review board for human research. The survey was open between November 2021 and January 2022. The CMS COVID-19 vaccine mandate took effect at the beginning of this study period and remained in effect throughout the study duration.[20]

Measures

The survey consisted of 2 vaccine questions: (1) "Did you receive the COVID-19 vaccine?" (yes/no) and (2) "Why did you choose to receive or not receive the COVID-19 vaccine?" (free-text answer). Demographic data included age, gender, highest completed nursing education level, years in practice, working with COVID-19 patients, and practice type (eg, direct patient care, manager).

Analysis

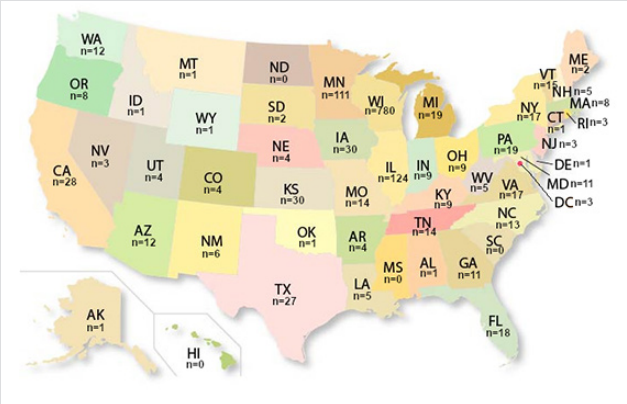
Quantitative data were analyzed with chi-square tests to examine the association between participant characteristics and vaccination status. This analysis was performed using SPSS Statistics version 28.0.0.0.[26] Qualitative data were analyzed using content analysis, a process in which data are coded and analyzed for meaning and abstracted into broader themes.[27] Three investigators (JC, BSO, and MM) independently read the content to identify meaningful themes. A predefined theoretical framework was not utilized for this analysis to preserve the integrity of the messages as they were written by participants. The three investigators met as a team to validate themes and examples within the data. A consensus was reached that the themes and exemplar quotes were accurate representations of the data set (internal validity and credibility). Transferability was enhanced by sample description via demographic data.

RESULTS

Participants

A total of 1682 participants answered the survey; of those, 1445 (85.9%) answered the binary vaccine acceptance/refusal question, 1316 (78.2%) answered the free-text vaccine rationale question, and 1301 (77.3%) answered both questions. Of the participants who answered both questions, 1155 (88.8%) received the vaccine and 146 (11.2%) did not. To create an equal sample of both vaccinated and unvaccinated participants for comparison, a random sample of 146 vaccinated participants were selected for analysis via a random number generator. All three investigators agreed that data saturation was met for both the selected vaccinated participant group and the unvaccinated group. Over 90% of participants (91.7%) were female, and the majority held a baccalaureate degree (54%) (missing data excluded from percentage tabulations).

Figure. Participant Location by State



N = 1428 participants with available location data.

Almost half had been in nursing for less than 10 years (44.9%), 52.7% were ages 25 to 44, and 78.3% were primarily involved in direct patient care (Table 1). A state-by-state participant breakdown is presented in Figure 1.

Vaccination Status and Sample Characteristics, Intention to Leave

A chi-square test was performed to assess the relationships between nurse characteristics, including gender, age, education level, years in nursing, practice type, and whether they worked with COVID-19 patients. This analysis was performed on the total sample (N = 1682). There was a significant correlation between education level and vaccine acceptance; nurses with higher education levels were more likely to accept the COVID-19 vaccine ($P < 0.001$, Table 1).

Table 1. Education Level and Vaccination Status

Characteristic	No Vaccine (%)	Yes Vaccine (%)	*P* value
Gender	155 (10.9)	1273 (89.1)	0.197
Female	147 (11.2)	1162 (88.8)	
Male	1 (0.9)	107 (99.1)	
Nonbinary/other	1 (20)	4 (80.0)	
Age	156 (10.9)	1276 (89.1)	0.215
18 – 24	8 (7.5)	99 (92.5)	
25 – 34	50 (13.2)	330 (86.8)	
35 – 44	45 (12.0)	330 (88.0)	
45 – 54	30 (10.2)	264 (89.8)	
55 – 64	18 (8.4)	197 (91.6)	
65+	5 (8.2)	56 (91.8)	
Education level	154 (10.8)	1272 (89.2)	< 0.001
LPN	17 (21.3)	63 (78.8)	
ADN	44 (15.3)	243 (84.7)	
BSN	70 (9.1)	703 (90.9)	
Graduate[a]	23 (8.0)	263 (92.0)	
Years in nursing	156 (10.9)	1277 (89.1)	0.057
< 10	75 (11.6)	569 (88.4)	
10 – 20	52 (13.1)	344 (86.9)	
21+	29 (7.4)	364 (92.6)	
Practice type	155 (10.8)	1275 (89.2)	0.969
Direct patient care	123 (11.0)	996 (89.0)	
Manager/supervisor	9 (8.0)	104 (92.0)	
Educator	7 (12.5)	49 (87.5)	
Other	16 (11.3)	126 (88.7)	
Worked with COVID patients	156 (10.9)	1276 (89.1)	0.831
Yes	128 (11.0)	1038 (89.0)	
No	28 (10.5)	238 (89.5)	

Abbreviations: LPN, licensed practical nurse; ADN, associate degree nurse; BSN, baccalaureate of science in nursing.

[a]Graduate education level includes master's and doctorate degrees. Within the education level subcategories, the percentage denoted is the percentage within the education level.

Vaccination Rationale

Five themes emerged from the free-text question about rationale for vaccine acceptance or refusal: (1) safeguarding well-being, (2) trust in the science, (3) coercion to vaccinate, (4) perceived immunity, and (5) concern regarding preexisting health conditions. Exemplar quotations for each theme are presented in Table 2.

Safeguarding Well-Being: Among vaccinated participants, the desire to protect oneself, one's family, and one's patients was the most prevalent theme. The desire to end the pandemic was also a prevalent concern expressed. Some participants reported fears about catching COVID-19 or personal experiences of COVID-related loss. On the other hand, some of the unvaccinated participants expressed concerns for their personal safety with regard to the vaccine. Unvaccinated nurses expressed concerns about personal side-effects.

Trust in the Science: Trust in the science around vaccine development was a prevalent theme for all respondents. Vaccinated participants reported trust in the science behind vaccinations. Some cited their education, profession, and perceived duty to comply with evidence-based practice guidelines as a rationale for trust in the science. Many expressed desire to utilize science to end the pandemic, and some recalled the impact of vaccination on past epidemics.

Unvaccinated respondents, on the other hand, discussed their skepticism around vaccine development and deployment, with most giving multiple reasons for their mistrust. Mistrust in health care authorities and concern for misinformation from authorities or pharmaceutical manufacturers was prevalent. Several participants expressed concerns about experimentation specifically, and others discussed concerns about the veracity of vaccine side-effect reporting systems.

Coercion to Vaccinate: Perceived coercion and breach of personal autonomy was a theme among unvaccinated nurses. Some unvaccinated nurses reported frustration due to perceived coercion because of the COVID-19 vaccine mandate. Many reported threatened or actual firing from their jobs if they remained unvaccinated.

Table 2. Exemplar Quotes From Themes

Vaccinated Participants	Unvaccinated Participants
Safeguarding Well-Being	
"I received this [vaccine] before it was mandatory. To first and foremost prevent me from getting sick, second my family, third my patients."	"Chose not to receive due to fear of adverse effects."
"I chose to receive the COVID-19 vaccine because I trust and believe in science and think it is part of a collective effort to end the global pandemic."	"Lack of documentation of long-term side effects."
"Not one of my patients lived for the first three months. That whole time I was terrified I would be the next to die. I would have taken the vaccine as a shot in my eyeball just to decrease the stress of going to work and not bring home COVID to my family."	"It's not a vaccine. It is gene therapy and I do not consent."
Trust in Science	
"I believe in science and it's my duty as a nurse to educate the public on that science."	"Something feels wrong about all of it. Don't feel I need a questionable vaccine for something with a high survival rate."
"I believe in science and the protective power of vaccines. I am an older nurse and lived through polio, etc."	"I have every vaccination known to man, except the COVID vaccine. It is too highly politicized, you are not allowed to question the side effects, it was rushed to the market."
"This is an evidence-based profession; we have a duty to follow the evidence and the evidence is clear – the vaccine has saved lives."	"I chose not to receive the vaccine because I still have major doubts about the amount of time and research put into this vaccine. I do not feel as though I'm ready to be an experiment just because I'm a nurse."
	"I also saw horrible side effects of the vaccine that people received in the ER. And it was even more disgraceful that not one doctor would relate the vaccine to these effects. Therefore, all of the side effects I saw from this vaccine never got reported to VAERS [vaccine associated event reporting system] at the facility I worked at."
Coercion to Vaccinate	
"I do feel like it was pushed on us, and I'm not sure that there will not be long-term side effects."	"I'm not allowing anyone to make my medical decisions for me."
"I felt forced to in order to keep my job."	"[I] did not get [the] vaccine and will lose my job due to this."
"I had to [get the COVID-19 vaccine] as a requirement, otherwise I would not have. I wanted to know more about it (long term studies), and I feel it is not working as they said it would. Way too many politics involved, and I don't trust Fauci or big pharma."	"Nurses were heroes at the start of the pandemic and are now being fired for not taking a vaccine. What happened to living in a free country."
"Nobody cared last year when we didn't have PPE or a vaccine… it is more safe to have more staff than having unvaccinated coworkers."	"Too much media hype and pressure."
Perceived Immunity	
There were no responses from vaccinated participants in this category.	"There is not enough research or evidence to prove efficacy stronger than my own natural immunity to make me want to risk the adverse effects."
	"Epidemiology 101 taught us vaccines are good, but natural immunity infection is better toward herd immunity."
Concern Regarding Preexisting Health Conditions	
"I was in the first group to have the shot. But I had a severe allergic reaction to the shot and cannot get the vaccine. I am frustrated and worried about my own personal health."	"There was not enough clinical studies/research for me to feel comfortable receiving the vaccine while pregnant. I am absolutely disgusted that when I make a decision about my body and the little body I have growing inside of me that I continued to be called out, lectured, and told I was wrong. I will now get the vaccine because I have to in order to return to work from maternity leave."
	"I was pregnant and very nervous to harm my pregnancy. I chose to not get it while pregnant and am hopeful for an exemption to not get it while breastfeeding."
	"I have had health issues and am concerned about my immunity."

Some vaccinated nurses also indicated they felt that they were not presented with a genuine choice regarding their vaccination status. While many expressed frustrations at unvaccinated colleagues for their refusal, some reported they got the vaccine even though they did not want to solely because it was required to continue work. Several voiced disagreement with vaccine mandates due to the effect it had on their unit staffing.

Perceived Immunity: Numerous unvaccinated respondents rationalized that their natural immunity from prior COVID-19 infections was sufficient to protect them. One cited perceived superiority of natural immunity.

Concern Regarding Preexisting Health Conditions: Some unvaccinated respondents reported personal health conditions that made them situationally unable or unwilling to accept the COVID-19 vaccine. Numerous participants expressed possible safety concerns due to their pregnancies. (At the time of this study, the American College of Obstetrics and Gynecology had released a statement recommending COVID-19 vaccination for all eligible persons, including pregnant and lactating individuals.[28]) Two respondents reported anaphylactic or severe adverse reactions to the first vaccination in a 2-dose series and self-identified as unvaccinated despite receiving 1 vaccine dose. Other unvaccinated participants reported concerns for their health following vaccination given preexisting health concerns, such as a family history of adverse vaccine reactions (1 nurse) or witnessing patient side-effects (9 nurses).

DISCUSSION

The purposes of this study were to describe nurses' reasons for accepting or refusing the COVID-19 vaccine and to better understand the relationships between nurse characteristics and COVID-19 vaccination acceptance. While this analysis supports prior findings that vaccination mandates increase vaccination acceptance, 11.2% of our sample declined the vaccine despite mandates, including some who accepted personal consequences due to their refusal.

Prior research has associated vaccination refusal with inadequate staffing due to job attrition, which risks further exacerbating the nursing shortage.[13,23] While COVID-related escalations in attrition from the nursing profession are multifactorial, vaccine refusal is a particularly concerning potential contributor to attrition because it is preventable—particularly if alternatives to vaccination like continuous PPE use for unvaccinated staff were implemented.[21] Research on influenza vaccine mandates have shown that job attrition secondary to vaccine mandates is as low as 0.15%.[14] However, this number may have limited comparison to attrition secondary to COVID-19 vaccination refusal.

Exemption criteria for the COVID-19 vaccine mandate was broadly outlined by CMS; however, implementation of exemption policies were left to the discretion of health care facilities.[20] Participants in this study reported variance in how their facilities treated their exemption requests, which may indicate variance in exemption implementations. Prior recommendations regarding influenza immunization mandates have advised against severe actions, such as termination, due to vaccine refusal; however, several participants in this study reported threatened or actual termination due to COVID-19 vaccine refusal. While it is outside the scope of this study to determine the proportion of nurse attrition attributable to vaccine mandates, further research on this topic may be warranted.

The COVID-19 vaccine was perceived as new and of questionable trustworthiness by unvaccinated participants in this study. Mistrust in COVID-19 vaccine development may have been fueled over evolving knowledge around side-effects, such as coagulopathies associated with adenovirus vaccine vectors (eg, Johnson and Johnson/Janssen vaccine).[29] While the CMS mandate cited concerns for PPE compliance as rationale for a vaccine mandate in lieu of stricter PPE use guidelines, the evidence for N95 mask use to prevent COVID-19 transmission among health care workers was graded as high.[20,30] Policy decisions that may further exacerbate the nurse shortage should be carefully examined for their necessity prior to implementation—particularly considering pandemic-related escalations in nurse burnout and attrition.[23,24,31]

Vaccination and Science Literacy

Education level and attitudes toward the efficacy of government and scientific institutions have been correlated with COVID-19 vaccine acceptability.[10] Participants in this study were divided with regard to trust or mistrust in scientific processes and government health care authorities. Vaccinated participants expressed trust in those institutions as a rationale for vaccine acceptance, whereas unvaccinated participants expressed skepticism in the same authorities. Nonetheless, education efforts have been shown to be effective in past vaccine advocacy campaigns.[7,10] Participants who have high confidence in their vaccine knowledge are more likely to accept vaccines.[10] One vaccinated participant in our study expressed initial hesitancy that improved with education: "Initially highly encouraged and [I] felt obligated, now I stand behind the vaccines with further education."

While experts agree that education programs are effective in increasing vaccine acceptance among health care workers, policy experts disagree on the adequacy of voluntary vaccination programs and education to reach desired health care worker vaccination compliance.[15,19,21] While there was an association between education level and vaccine uptake, it is outside the scope of this study to determine if COVID-19 vaccine education—or education on vaccines in general—is correlated with increased vaccine uptake in nurses.

Limitations

The CMS vaccination mandate went into effect on November 5, 2021, as this study commenced.[20] While some vaccinated nurses

reported they would not have received the vaccine were it not for the mandate, nurse preference for COVID-19 vaccination was not addressed in this study. There may be an unacknowledged discrepancy between desire to become vaccinated and actual vaccination status, and nurses may have had preferences for which vaccine they would rather receive. Additionally, this study did not collect data regarding when nurses made their decision regarding COVID-19 vaccination.

This study took place approximately 1 year after the first COVID-19 vaccine was available for health care workers. Vaccine refusal constitutes an ongoing decision; an unvaccinated nurse can choose to become vaccinated at any time. While some nurses were skeptical about the science of the vaccine and its emergency use authorization, additional evidence has become available and 2 COVID-19 vaccines have been fully approved for use by the US Food and Drug Administration.[25] It is possible that nurses who declined the COVID-19 vaccine at the time of our study have since reconsidered. Vaccinated and unvaccinated nurses were categorized by how they self-identified. However, several nurses self-selected their status as unvaccinated despite writing in free-text that they received a dose (eg, nurses who received 1 dose but did not complete a 2-dose series due to adverse reactions).

There were markedly more vaccinated than unvaccinated nurses; our chosen method of randomly sampling vaccinated participants to include in the analysis may have missed themes despite achieving data saturation. Participants in this convenience sampling may have unique perspectives that prompted them to self-select to participate in this study. This sample was also disproportionately representative of the states of Wisconsin and Minnesota.

CONCLUSIONS

An extensive analysis of the COVID-19 pandemic response is important to improve our response and prevent avoidable missteps during future pandemics. This study highlights the need to consider the ethical and practical implications of vaccine mandates for health care workers. While some vaccinated nurses opted to obtain a vaccine they otherwise would have declined, there is also potential that vaccine mandate-related nurse attrition could exacerbate the pre-existing nursing shortage. Vaccination mandates should be carefully considered in relation to the practical benefits and costs with regard to patient care prior to implementation. Many nurses who declined the vaccine cited skepticism about safety and efficacy; alternatives to mandates such as strict PPE requirements should be considered prior to or in combination with vaccination advocacy to reduce the potential for further disruption of the nursing workforce. Further research is needed to evaluate the effects of vaccine mandates and their impact on both nosocomial disease transmission and workforce attrition. Changes to global health needs during a pandemic may warrant reconsideration of whether vaccine mandates are necessary and pragmatic for all health care workers.

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REFERENCES

1. State of the world's nursing 2020: investing in education, jobs and leadership. World Health Organization. Published April 6, 2020. Accessed August 8, 2022. https://www.who.int/publications/i/item/9789240003279

2. Gan I. A scoping review of the nursing workforce's changing demography: supporting Baby-Boomer nurses. *J Nurs Manag*. 2020;28(7):1473-1480. doi:10.1111/jonm.13132

3. Juraschek SP, Zhang X, Ranganathan V, Lin VW. United States registered nurse workforce report card and shortage forecast. *Am J Med Qual.* 2019;34(5):473-481. doi:10.1177/1062860619873217

4. Supply and Demand Projections of the Nursing Workforce: 2014-2030. US Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis; 2017. Accessed July 25, 2022. https://bhw.hrsa.gov/sites/default/files/bureau-health-workforce/data-research/nchwa-hrsa-nursing-report.pdf

5. Christianson J, Guttormson J, McAndrew NS, Calkins K. Impact of COVID-19 on intensive care unit nurse duty of care and professional roles: a qualitative content analysis. *SAGE Open Nurs.* 2022;8:23779608221113539. doi:10.1177/23779608221113539

6. Sinsky CA, Brown RL, Stillman MJ, Linzer M. COVID-related stress and work intentions in a sample of US health care workers. *Mayo Clin Proc Innov Qual Outcomes.* 2021;5(6):1165-1173. doi:10.1016/j.mayocpiqo.2021.08.007

7. Khubchandani J, Bustos E, Chowdhury S, Biswas N, Keller T. COVID-19 vaccine refusal among nurses worldwide: review of trends and predictors. *Vaccines (Basel).* 2022;10(2):230. doi:10.3390/vaccines10020230

8. Pulse on the Nation's Nurses Survey Series: COVID-19 Two-Year Impact Assessment Survey. American Nurses Foundation; 2022. Accessed July 25, 2022. https://www.nursingworld.org/~4a2260/contentassets/872ebb13c63f44f6b11a1bd0c74907c9/covid-19-two-year-impact-assessment-written-report-final.pdf

9. Omoleke SA, Ajibola O, Omisakin OA, Umeh GC. Vaccine hesitancy among medical practitioners. *Sahel Med J.* 2020;23(2):126-131. doi:10.4103/smj.smj_32_18

10. Lin C, Mullen J, Smith D, Kotarba M, Kaplan SJ, Tu P. Healthcare providers' vaccine perceptions, hesitancy, and recommendation to patients: a systematic review. *Vaccines (Basel).* 2021;9(7):713. doi:10.3390/vaccines9070713

11. Pacella-LaBarbara ML, Park YL, Patterson PD, et al. COVID-19 vaccine uptake and intent among emergency healthcare workers: a cross-sectional survey. *J Occup Environ Med.* 2021;63(10):852-856. doi:10.1097/JOM.0000000000002298

12. Unroe KT, Evans R, Weaver L, Rusyniak D, Blackburn J. Willingness of long-term care staff to receive a COVID-19 vaccine: a single state survey. *J Am Geriatr Soc.* 2021;69(3):593-599. doi:10.1111/jgs.17022

13. McGarry BE, Gandhi AD, Syme M, Berry SD, White EM, Grabowski DC. Association of state COVID-19 vaccine mandates with staff vaccination coverage and staffing shortages in US nursing homes. *JAMA Health Forum*. 2022;3(7):e222363. doi:10.1001/jamahealthforum.2022.2363

14. Rakita RM, Hagar BA, Crome P, Lammert JK. Mandatory influenza vaccination of healthcare workers: a 5-year study. *Infect Control Hosp Epidemiol.* 2010;31(9):881-888. doi:10.1086/656210

15. Cheng AC, Worth LJ. Mandatory influenza vaccination of healthcare workers: is it necessary or sufficient to protect patients? *Healthc Infect*. 2014;19(3):114-115. doi:10.1071/HI14018

16. Pitts SI, Maruthur NM, Millar KR, Perl TM, Segal J. A systematic review of mandatory influenza vaccination in healthcare personnel. *Am J Prev Med.* 2014;47(3):330-340. doi:10.1016/j.amepre.2014.05.035

17. Shah ASV, Gribben C, Bishop J, et al. Effect of vaccination on transmission of SARS-CoV-2. *N Engl J Med*. 2021;385(18):1718-1720. doi:10.1056/NEJMc2106757

18. Kates OS, Stock PG, Ison MG, et al. Ethical review of COVID-19 vaccination requirements for transplant center staff and patients. *Am J Transplant.* 2022;22(2):371-380. doi:10.1111/ajt.16878

19. Van Hooste WLC, Bekaert M. To be or not to be vaccinated? The ethical aspects of influenza vaccination among healthcare workers. *Int J Environ Res Public Health.* 2019;16(20):3981. doi:10.3390/ijerph16203981

20. Medicare and Medicaid programs; Omnibus COVID-19 health care staff vaccination. Fed Regist. 2021;86(212):61555-61627. CMS–3415–IFC. Accessed August 18, 2022. https://www.federalregister.gov/d/2021-23831

21. Flood CM, Thomas B, Wilson K. Mandatory vaccination for health care workers: an analysis of law and policy. *CMAJ*. 2021;193(6):E217-E220. doi:10.1503/cmaj.202755.

22. Rodger D, Blackshaw BP. COVID-19 vaccination should not be mandatory for health and social care workers. *New Bioeth*. 2022;28(1):27-39. doi:10.1080/20502877.2022.2025651

23. Christianson J, Johnson N, Nelson A, Singh M. Work-related burnout, compassion fatigue, and nurse intention to leave the profession during COVID-19. *Nurse Lead.* 2023;21(2):244-251. doi:10.1016/j.mnl.2022.06.007

24. Laws L. The great RNesignation: shifting the paradigm from burnout to integrative nurse wellness and retention. *Int J Nurs Health Care Sci.* 2022;2(4):2022-113.

25. COVID-19 vaccines. US Food and Drug Administration. Published 2022. Accessed August 18, 2022. https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines

26. IBM SPSS Statistics for Windows. Version 28.0.0.0. IBM Corp; 2021.

27. Ravitch S, Carl N. *Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological.* 2nd ed. Sage Publications; 2021.

28. COVID-19 vaccination considerations for obstetric-gynecologic care. American College of Obstetrics and Gynecology. Updated October 1, 2021. Accessed August 3, 2022. https://web.archive.org/web/20211008161632/https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2020/12/covid-19-vaccination-considerations-for-obstetric-gynecologic-care

29. Kircheis R. Coagulopathies after vaccination against SARS-CoV-2 may be derived from a combined effect of SARS-CoV-2 spike protein and adenovirus vector-triggered signaling pathways. *Int J Mol Sci.* 2021;22(19):10791. doi:10.3390/ijms221910791

30. Schoberer D, Osmancevic S, Reiter L, Thonhofer N, Hoedl M. Rapid review and meta-analysis of the effectiveness of personal protective equipment for healthcare workers during the COVID-19 pandemic. *Public Health Pract (Oxf).* 2022;4:100280. doi:10.1016/j.puhip.2022.100280

31. Guttormson JL, Calkins K, McAndrew N, Fitzgerald J, Losurdo H, Loonsfoot D. Critical care nurse burnout, moral distress, and mental health during the COVID-19 pandemic: a United States survey. *Heart Lung.* 2022;55:127-133. doi:10.1016/j.hrtlng.2022.04.015

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