

COVID-19 Vaccination Concerns and Reasons for Acceptance Among US Health Care Personnel

Public Health Reports
2022, Vol. 137(6) 1227–1234
© 2022, Association of Schools and
Programs of Public Health
All rights reserved.
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/00333549221120590
journals.sagepub.com/home/phr



Lindsay M.S. Oberleitner, PhD¹ ; Victoria C. Lucia, PhD¹;
Mark C. Navin, PhD^{1,2,3}; Melissa Ozdych, BA³;
Nelia M. Afonso, MD¹; Richard H. Kennedy, PhD^{1,3};
Hans Keil, MA, MBA³; Lawrence Wu, MBA³;
and Trini A. Mathew, MD, MPH^{1,3,4}

Abstract

Objectives: Because health care personnel (HCP) are potentially at increased risk of contracting COVID-19, high vaccination rates in this population are essential. The objective of this study was to assess vaccination status, barriers to vaccination, reasons for vaccine acceptance, and concerns about COVID-19 vaccination among HCP.

Methods: We conducted an anonymous online survey at a large US health care system from April 9 through May 4, 2021, to assess COVID-19 vaccination status and endorsement of reasons for acceptance and concerns related to vaccination (based on selections from a provided list).

Results: A total of 4603 HCP (12.2% response rate) completed the survey, 3947 (85.7%) had received at least 1 dose of a COVID-19 vaccine at the time of the survey, and 550 (11.9%) reported no plans to receive the vaccine. Unvaccinated HCP were 30 times more likely than vaccinated HCP to endorse religious or personal beliefs as a vaccine concern (odds ratio = 30.95; 95% CI, 21.06-45.48) and 15 times more likely to believe that personal vaccination is not needed if enough others are vaccinated (odds ratio = 14.99; 95% CI, 10.84-20.72). The more reasons endorsed for vaccination ($\beta = 0.60$; $P < .001$), the higher the likelihood of having received the vaccine. However, the number of concerns about COVID-19 vaccine was not related to vaccination status ($\beta = 1.01$; $P = .64$).

Conclusions: Our findings suggest that reasons for vaccination acceptance and concerns about vaccination need to be considered to better understand behavioral choices related to COVID-19 vaccination among HCP, because these beliefs may affect vaccination advocacy, responses to vaccine mandates, and promotion of COVID-19 vaccine boosters.

Keywords

COVID-19, vaccination, health behavior, attitudes

The fight to end the COVID-19 pandemic in the United States accelerated with Emergency Use Authorization of a COVID-19 vaccine in December 2020. However, despite the effectiveness of the 3 COVID-19 vaccines now widely available in the United States, the rate of vaccine uptake decreased after the initial implementation in December 2020 through early spring 2021.¹⁻³ In the United States, health care personnel (HCP) were included in phase 1a^{4,5} of the vaccine rollout, to preserve health care system capacity and to protect workers. However, vaccination behavior (ie, choosing to receive the vaccine) is not synonymous with vaccine acceptance (ie, beliefs and attitudes held toward vaccination), and understanding HCP's concerns even after the behavioral choice of

vaccination is essential. HCP are highly trusted sources of vaccine information,⁶ and understanding HCP's beliefs related to COVID-19 vaccination is an important step in

¹ William Beaumont School of Medicine, Oakland University, Rochester, MI, USA

² Department of Philosophy, Oakland University, Rochester, MI, USA

³ Beaumont Health, Royal Oak, MI, USA

⁴ HealthTAMCycle3 PLLC, Troy, MI, USA

Corresponding Author:

Lindsay M.S. Oberleitner, PhD, Oakland University, William Beaumont School of Medicine, 586 Pioneer Dr, 446 O'Dowd Hall, Rochester, MI 48309, USA.

Email: loberleitner@oakland.edu

addressing potential concerns. Given the rise in COVID-19 cases because of the Delta (B.1.617.2) and Omicron (B.1.1.529) variants in the United States, especially in unvaccinated communities, it is imperative to increase vaccination uptake among HCP and broader communities.⁷ Understanding vaccine hesitancy and acceptance among HCP can inform efforts to increase COVID-19 vaccination rates in the United States, because HCP have direct contact with patients at high risk of COVID-19 complications and because they have an essential role in health promotion behaviors such as vaccination. Furthermore, many health systems are weighing the cost and benefits of COVID-19 vaccination as a condition of employment, considering the balance of safety and staffing concerns.⁸ Therefore, understanding reasons for acceptance and concerns about vaccines, specifically COVID-19 vaccines, among HCP will be crucial for implementing these changes.

We conducted a survey of HCP at a large US health care system in Michigan to assess COVID-19 vaccination status among HCP and to determine their concerns about and reasons for acceptance of COVID-19 vaccination. Previous studies addressed HCP's attitudes toward COVID-19 vaccination prior to or during the initial rollout with limited vaccine supply.^{9,10} To our knowledge, this is the first study to focus on HCP's attitudes and behaviors toward COVID-19 vaccination months after vaccines were available and offered to all HCP.

Methods

We surveyed HCP at a large 8-hospital health system. Vaccination was available to all staff at the time of data collection. We developed an anonymous survey based on prior research¹¹⁻¹³ and the clinical expertise of research team members involving attitudes and behaviors about vaccination. We assessed the following: (1) interactions with COVID-19 patients and COVID-19 history (past and current interactions with COVID-19 patients, personal history of COVID-19 diagnosis, fear of COVID-19 infection¹¹); (2) attitudes toward the vaccine,^{12,13} assessed using the 5C scale,¹² a standard and widely used assessment for vaccine hesitancy (including items on standard, general vaccination attitudes and items modified to directly assess COVID-19 vaccination attitudes); (3) reasons for vaccine acceptance and concerns about COVID-19 vaccination; and (4) demographic characteristics (ie, age, sex, race, and ethnicity) and job category (ie, clinical or nonclinical care). Clinical care included direct patient care positions, such as nursing, doctor of medicine/doctor of osteopathy, and allied health positions. Nonclinical care included positions that do not provide direct patient care, such as administration, clinical records, and environmental services.

We distributed a unique survey link to all HCP within the system via email that was available from April 9 through May 4, 2021, a period coinciding with the third COVID-19

surge in Michigan. We automated email invitations and survey completion reminders to maintain confidentiality of participants. A maximum of 2 reminders were sent to individuals who had not completed the survey. The Beaumont health system's institutional review board approved this study.

Data Analysis

We checked data for errors and to ensure that assumptions for key analyses were met. COVID-19 risk of workplace exposure, concerns about COVID-19 infection, and vaccine attitudes¹² were calculated as means and SDs. We used multivariate analyses of variance to identify significant differences between vaccinated and unvaccinated participants, with $P < .05$ considered significant. Reasons for acceptance and concerns about vaccination were calculated as numbers and percentages. We used the Pearson χ^2 test to identify significant differences between vaccinated and unvaccinated participants, and we calculated odds ratios to determine the magnitude of difference between vaccinated and unvaccinated HCP. We used logistic regression for predictive models, and we conducted all analyses using SPSS version 26 (IBM Corp).

Results

Participants

Of 37 695 invited HCP, 5274 (14.0%) completed at least part of the survey; 4603 (12.2%) HCP responded to key items and were included in the final analyses. Of HCP included in the analyses, 49.5% were clinical HCP, 17.0% were male, and the average age was 46.2 years (SD = 13.0).

Of the 4603 respondents, 3947 (85.8%) were vaccinated (Table 1) and 656 (14.2%) were unvaccinated. A total of 106 (2.3%) unvaccinated HCP reported planning to get vaccinated, and these HCP were excluded from analyses related to vaccination status, leaving 550 (11.9%) unvaccinated HCP in the analysis.

COVID-19–Related Work Exposure

Unvaccinated HCP were more likely than vaccinated HCP to report direct work with COVID-19 patients (59.3% vs 49.5%) and ever having a personal history of COVID-19 infection (27.4% vs 12.4%). Unvaccinated HCP had a lower rated fear of COVID-19 infection than vaccinated HCP (29.0 to 48.4 on a scale of 0 to 100; Table 1).

Vaccine Attitudes

Compared with vaccinated HCP, unvaccinated HCP gave a significantly higher rating to the belief that personal vaccination is less important if others are vaccinated (Table 1). Direct work with COVID-19 patients did not predict

Table 1. Demographic characteristics, COVID-19–related work exposure, and vaccine attitudes among health care personnel (N = 4497) at a large health care system in Michigan, April 9–May 4, 2021^a

Characteristic	Overall (n = 4497) ^b	Vaccination status ^b		Partial η^2 or OR (95% CI) ^c
		Unvaccinated (n = 550)	Vaccinated (n = 3947)	
Sex				
Male	757 (17.0)	64 (12.7)	693 (17.7)	1.47 (1.12-1.94) ^d
Female	3696 (83.0)	440 (87.3)	3222 (82.3)	1 [Reference]
Age, y	46.2 (13.0)	40.3 (12.1)	47.0 (12.9)	0.03 ^d
Job category ^e				
Clinician	2197 (49.5)	291 (55.6)	1906 (48.7)	1.32 (1.10-1.59) ^d
Nonclinician	2244 (50.5)	232 (44.4)	2004 (51.3)	1 [Reference]
Race and ethnicity				
White	3848 (85.8)	451 (82.0)	3397 (86.5)	1 [Reference]
Black	228 (5.1)	48 (8.7)	179 (4.6)	0.49 (0.40-0.60) ^{d,f}
Asian	193 (4.3)	7 (1.3)	186 (4.7)	
Middle Eastern	110 (2.5)	20 (3.6)	90 (2.3)	
Other	103 (2.3)	24 (4.4)	77 (2.0)	
Hispanic/Latino	118 (2.6)	17 (3.1)	101 (2.6)	0.73 (0.43-1.22)
COVID-19 history ^g				
Yes	638 (14.2)	148 (27.4)	490 (12.4)	0.38 (0.30-0.47) ^d
No	3859 (85.8)	392 (72.6)	3457 (87.6)	1 [Reference]
Direct work with COVID-19 patients				
Yes	2253 (50.7)	318 (59.3)	1935 (49.5)	0.67 (0.56-0.81) ^d
No	2191 (49.3)	218 (40.7)	1974 (50.5)	1 [Reference]
Direct work with COVID-19 patients in past 3 mo ^h				
Yes	879 (19.6)	164 (29.8)	715 (18.1)	1.92 (1.57-2.34) ^d
No	3606 (80.4)	386 (70.2)	3235 (81.9)	1 [Reference]
Perceptions of COVID-19 infection, 0-100 scale				
Perceived likelihood of infection ⁱ	38.4 (28.6)	49.9 (28.9)	36.9 (28.2)	0.02 ^d
Perceived likelihood of severity if infected	33.8 (25.2)	34.8 (23.4)	33.7 (25.4)	0
Scared of being infected	46.3 (34.1)	29.0 (29.3)	48.4 (34.0)	0.03 ^d
Vaccine attitudes ^j				
COVID-19 vaccines are safe	5.5 (1.8)	2.1 (1.3)	6.0 (1.2)	0.51 ^d
COVID-19 vaccination is unnecessary	1.3 (0.9)	2.6 (1.4)	1.1 (0.6)	0.27 ^d
COVID-19 vaccination is a hassle	2.4 (1.8)	3.8 (1.8)	2.2 (1.7)	0.07 ^d
Weigh pros and cons of COVID-19 vaccination	6.5 (1.1)	6.5 (1.1)	6.6 (1.1)	0
No need to vaccinate if enough others vaccinate for COVID-19	1.6 (1.2)	3.5 (1.8)	1.3 (0.8)	0.36 ^d

Abbreviation: OR, odds ratio.

^aData source: survey of health care personnel at a large health care system in Michigan.

^bCategorical values are presented as number (percentage); continuous values are presented as mean (SD). The total number of participants responding to each item varied because of missing responses.

^cValues indicate likelihood of nonvaccination. Pearson χ^2 analyses were used to determine significant differences for categorical values, and ORs (95% CIs) are presented. Multiple analysis of variance was used to determine significant differences for continuous variables, and partial η^2 is presented.

^dIndicates a significant difference between vaccinated and unvaccinated health care personnel.

^eJob categories of physician, resident/fellow, nursing, and allied health (eg, respiratory therapists, physical therapists, radiology) were defined as clinical; all others (eg, administrative, clerical, maintenance) were defined as nonclinical.

^f χ^2 analyses for race were conducted as White vs non-White (Black, Asian, and Middle Eastern combined).

^gCOVID-19–positive history is based on self-report of confirmed diagnosis.

^hDirect work with COVID-19 patients was rated by frequency and changed to a categorical yes/no if participant reported at least 50% of the time in the past 3 months.

ⁱEach item on a scale from 0 (not at all likely) to 100 (extremely likely) was based on items described in Caserotti et al.¹¹

^jVaccine attitudes were assessed with the 5C scale, rated 1 (strongly disagree) to 7 (strongly agree).¹² Vaccine attitude items were modified to reflect COVID-19–specific vaccination attitudes.

Table 2. Concerns about COVID-19 vaccine among health care personnel (N = 4497) at a large health care system in Michigan, by vaccination status, April 9–May 4, 2021^a

Concern ^b	Overall, no. (%) (n = 4497)	Vaccination status, no. (%)		OR (95% CI) ^c
		Unvaccinated (n = 550)	Vaccinated (n = 3947)	
Unknown long-term effects	2662 (59.2)	461 (83.8)	2201 (55.8)	4.10 (3.24-5.19)
Ineffective for variants	1709 (38.0)	246 (44.7)	1463 (37.1)	1.37 (1.15-1.64)
Unsure of effectiveness	1668 (37.1)	341 (62.0)	1327 (33.6)	3.22 (2.68-3.87)
Developed too quickly	1631 (36.3)	367 (66.7)	1264 (32.0)	4.25 (3.52-5.14)
Fear of serious side effects	1154 (25.7)	262 (47.6)	892 (22.6)	3.11 (2.59-3.74)
Fear of minor side effects	918 (20.4)	92 (16.7)	826 (20.9)	0.76 (0.60-0.96)
mRNA platform	846 (18.8)	261 (47.5)	585 (14.8)	5.19 (4.29-6.27)
Concern about ingredients	841 (18.7)	275 (50.0)	566 (14.3)	5.97 (4.94-7.22)
Know people with a bad reaction	600 (13.3)	223 (40.5)	377 (9.6)	6.45 (5.28-7.89)
Pregnancy/nursing	409 (9.1)	109 (19.8)	300 (7.6)	3.00 (2.36-3.82)
Immune system strong	346 (7.7)	157 (28.5)	189 (4.8)	7.94 (6.27-10.05)
Lack of guidance from doctor	231 (5.1)	53 (9.6)	178 (4.5)	2.26 (1.64-3.11)
Not needed if enough others vaccinate	173 (3.8)	109 (19.8)	64 (1.6)	14.99 (10.84-20.72)
Religious or personal beliefs	158 (3.5)	122 (22.2)	36 (0.9)	30.95 (21.06-45.48)
Judgment from colleagues	89 (2.0)	23 (4.2)	66 (0.2)	2.57 (1.58-4.16)

Abbreviation: OR, odds ratio.

^aData source: survey of health care personnel at a large health care system in Michigan.

^bPartial $\eta^2 = 0.13$ for difference between vaccinated and unvaccinated health care personnel, determined by multiple analysis of variance. Concerns about vaccination that were endorsed by <10% of participants and with ORs <1 are not presented.

^cDifference between vaccinated and unvaccinated health care personnel was significant at $P < .05$ for all concerns, determined with Pearson χ^2 analyses. Unvaccinated participants were the reference group; ORs represent the likelihood of being unvaccinated if endorsing the concern.

vaccination ($\beta = 1.35$, $P = .07$) after controlling for fear of COVID-19 infection ($\beta = 0.98$, $P < .001$), confidence in vaccine safety ($\beta = 0.34$, $P < .001$), and belief that there is no need to vaccinate if others are vaccinated ($\beta = 1.79$, $P < .001$; χ^2 [$df = 4$, $N = 4459$] = 1786.0, $P < .001$; 94.9% correctly classified).

Concerns About and Reasons for Accepting COVID-19 Vaccination

Of 4497 respondents, the most prevalent concerns about vaccination were unknown long-term effects (59.2%, $n = 2662$), vaccine ineffective for variants (38.0%, $n = 1709$), unsure of effectiveness (37.1%, $n = 1668$), and vaccine developed too quickly (36.3%, $n = 1631$; Table 2). The most prevalent reasons for endorsing acceptance of vaccination were health and safety of loved ones (78.4%, $n = 3524$), personal health and safety (77.1%, $n = 3467$), and health and safety of the community (72.1%, $n = 3244$; Table 3).

Vaccinated HCP endorsed an average of 2.8 concerns and 6.0 reasons for acceptance, whereas unvaccinated HCP endorsed an average of 5.6 concerns and 1.6 reasons for acceptance. Most HCP endorsed at least 1 concern related to COVID-19 vaccination (80.7% of vaccinated HCP, 94.4% of unvaccinated HCP). Fewer than half (46.2%) of unvaccinated HCP endorsed any reasons for acceptance of vaccination,

compared with 98.4% of vaccinated HCP. For vaccinated and unvaccinated HCP, fear of long-term effects of vaccination was endorsed most frequently (55.8% of vaccinated HCP and 83.8% of unvaccinated HCP). Concerns that most differentiated the groups were religious or personal beliefs (nearly 31 times more likely to be unvaccinated) and belief that personal vaccination is not necessary if enough others are vaccinated (nearly 15 times more likely; Table 2). Health and safety of loved ones was the most frequently endorsed reason for vaccination among vaccinated and unvaccinated HCP (86.4% vs 20.9%, respectively; Table 3). For acceptance of vaccination, HCP endorsing the reasons of health and safety of loved ones, personal health and safety, or ability to interact with loved ones were >20 times more likely to be vaccinated than HCP who did not endorse each of those reasons.

Logistic regression showed that the number of reasons for acceptance endorsed ($\beta = .60$, $P < .001$), not the number of concerns endorsed ($\beta = 1.01$, $P = .64$), predicted vaccination, even after controlling for HCP's rating of COVID-19 vaccine safety ($\beta = 0.36$, $P < .001$; χ^2 [$df = 3$, $N = 4459$] = 2197.0, $P < .001$; 95.2% correctly classified).

Differences Among HCP

The number of concerns about and reasons for acceptance of the COVID-19 vaccine differed between clinical and non-clinical HCP. Concerns that significantly differentiated

Table 3. Reasons for acceptance of COVID-19 vaccine among health care personnel (N = 4497) at a large health care system in Michigan, by vaccination status, April 9–May 4, 2021^a

Reason for acceptance ^b	Overall, no. (%) (n = 4497)	Vaccination status, no. (%)		OR (95% CI) ^c
		Unvaccinated (n = 550)	Vaccinated (n = 3947)	
Health and safety of loved ones	3524 (78.4)	115 (20.9)	3409 (86.4)	24.06 (19.21-30.12)
Personal health and safety	3467 (77.1)	111 (20.2)	3356 (85.0)	22.54 (17.98-28.25)
Health and safety of community	3244 (72.1)	97 (17.6)	3147 (79.7)	18.42 (14.60-23.24)
Ability to interact with loved ones	3003 (66.8)	62 (11.3)	2941 (74.5)	23.06 (17.53-30.32)
Health and safety of patients	2543 (56.5)	81 (14.7)	2462 (62.4)	9.61 (7.53-12.28)
To serve as a role model	2344 (52.1)	16 (2.9)	2328 (59.0)	48.05 (29.11-79.33)
Vaccine is safe and effective	2327 (51.7)	23 (4.2)	2304 (58.4)	32.17 (21.09-49.07)
Improve social/recreational activities	2198 (48.9)	64 (11.6)	2134 (54.1)	8.95 (6.84-11.70)
Future requirement	874 (19.4)	73 (13.3)	801 (20.3)	1.67 (1.29-2.16)
More people getting vaccine	754 (16.8)	25 (4.5)	729 (18.5)	4.76 (3.16-7.17)

Abbreviation: OR, odds ratio.

^aData source: survey of health care personnel at a large health care system in Michigan.

^bPartial $\eta^2 = 0.30$ for difference between vaccinated and unvaccinated health care personnel, determined by multiple analysis of variance. Reasons for vaccination that were endorsed by <10% of participants and with ORs <1 are not presented.

^cDifference between vaccinated and unvaccinated health care personnel was significant at $P < .05$ for all reasons, determined by Pearson χ^2 analyses. Unvaccinated participants were the reference group; ORs represent the likelihood of being unvaccinated if endorsing the reason.

Table 4. Concerns about COVID-19 vaccine between clinical and nonclinical health care personnel (N = 4542) at a large health care system in Michigan, April 9–May 4, 2021^a

Concern	Overall, no. (%) (n = 4542)	Type of health care personnel, no. (%) ^b		OR (95% CI) ^c
		Clinical (n = 2249)	Nonclinical (n = 2293)	
Unknown long-term effects	2714 (59.8)	1365 (60.7)	1349 (58.8)	1.08 (0.96-1.22)
Ineffective for variants	1725 (38.0)	879 (39.1)	846 (36.9)	1.10 (0.97-1.24)
Unsure of effectiveness	1686 (37.1)	838 (37.3)	848 (37.0)	1.01 (0.90-1.14)
Developed too quickly	1662 (36.6)	802 (35.7)	860 (37.5)	0.92 (0.82-1.04)
Fear of serious side effects	1180 (26.0)	548 (24.4)	632 (27.6)	0.85 (0.74-0.97) ^d
Fear of minor side effects	935 (20.6)	421 (18.7)	514 (22.4)	0.80 (0.69-0.92) ^d
mRNA platform	863 (19.0)	477 (21.2)	386 (16.8)	1.33 (1.15-1.54) ^d
Concern about ingredients	850 (18.7)	414 (18.4)	436 (19.0)	0.96 (0.83-1.11)
Know people who had a bad reaction	617 (13.6)	310 (13.8)	307 (13.4)	1.03 (0.87-1.23)
Pregnancy/nursing	428 (9.4)	296 (13.2)	132 (5.8)	2.48 (2.00-3.07) ^d
Immune system strong	346 (7.6)	176 (7.8)	170 (7.4)	1.06 (0.85-1.32)
Lack of guidance from doctor	241 (5.3)	120 (5.3)	121 (5.3)	1.01 (0.78-1.31)
Not necessary	170 (3.7)	82 (3.6)	88 (3.8)	0.95 (0.70-1.29)
Religious or personal beliefs	155 (3.4)	86 (3.8)	69 (3.0)	1.28 (0.93-1.77)
Judgment from colleagues	89 (2.0)	52 (2.3)	37 (1.6)	1.44 (0.94-2.21)

Abbreviation: OR, odds ratio.

^aData source: survey of health care personnel at a large health care system in Michigan.

^bClinical health care personnel included direct patient care positions, such as nursing, doctor of medicine/doctor of osteopathy, and allied health positions. Nonclinical health care personnel included positions that do not provide direct patient care, such as administration, clinical records, and environmental services.

^cClinical health care personnel were the reference group; ORs represent the likelihood of being clinical health care personnel if endorsing the concern.

^dDifference between clinical and nonclinical health care personnel was significant at $P < .05$, as determined by Pearson χ^2 analyses.

Table 5. Reasons for acceptance of COVID-19 vaccination between clinical and nonclinical health care personnel (N = 4542) at a large health care system in Michigan, April 9–May 4, 2021^a

Reason for acceptance	Overall, no. (%) (n = 4542)	Type of health care personnel, no. (%) ^b		OR (95% CI) ^c
		Clinical (n = 2249)	Nonclinical (n = 2293)	
Health and safety of loved ones	3575 (78.7)	1775 (78.9)	1800 (78.5)	1.03 (0.89-1.18)
Personal health and safety	3521 (77.5)	1745 (77.6)	1776 (77.4)	1.01 (0.88-1.16)
Health and safety of community	3287 (72.4)	1626 (72.3)	1661 (72.4)	0.99 (0.87-1.13)
Ability to interact with loved ones	3029 (66.7)	1477 (65.7)	1552 (67.7)	0.91 (0.81-1.03)
Health and safety of patients	2585 (56.9)	1489 (66.2)	1096 (47.8)	2.14 (1.90-2.41) ^d
To serve as a role model	2359 (51.9)	1257 (55.9)	1102 (48.0)	1.37 (1.22-1.54) ^d
Vaccine is safe and effective	2337 (51.5)	1186 (52.7)	1151 (50.2)	1.11 (0.99-1.24) ^d
Improve social/recreational activities	2233 (49.2)	1127 (50.1)	1106 (48.2)	1.08 (0.96-1.21)
Future requirement	900 (19.8)	443 (19.7)	457 (19.9)	0.99 (0.85-1.14)
More people getting vaccine	773 (17.0)	383 (17.0)	390 (17.0)	1.00 (0.86-1.17)

Abbreviation: OR, odds ratio.

^aData source: survey of health care personnel at a large health care system in Michigan.

^bClinical health care personnel included direct patient care positions, such as nursing, doctor of medicine/doctor of osteopathy, and allied health positions. Nonclinical health care personnel included positions that do not provide direct patient care, such as administration, clinical records, and environmental services.

^cClinical health care personnel were the reference group; ORs represent the likelihood of being clinical health care personnel if endorsing the reason for acceptance.

^dDifference between clinical and nonclinical health care personnel was significant at $P < .05$, determined by Pearson χ^2 analyses.

clinical HCP from nonclinical HCP were fear of serious side effects, fear of minor side effects, mRNA platform, and pregnancy/nursing (Table 4). Reasons for vaccination that significantly differentiated clinical HCP and nonclinical HCP were health and safety of patients, serving as a role model, and safety and effectiveness of the vaccine (Table 5). The order of frequency across concerns about and reasons for vaccination was similar among clinical HCP and nonclinical HCP. Further examination of the clinical HCP group found a significant difference in vaccination rate between nursing and physicians/advanced practice providers: 81.1% (n = 1026) of nursing staff and 96.1% (n = 448) of physicians and advanced practice providers (ie, doctor of medicine, doctor of osteopathic medicine, advanced practice registered nurse, physician assistant) were vaccinated ($\chi^2 = 60.9$, $P < .001$).

Discussion

HCP may influence others in their communities to optimize COVID-19 vaccine uptake.⁶ Therefore, it is crucial to understand the COVID-19 vaccine behaviors and attitudes of HCP who are vaccinated or unvaccinated. HCP play an important role in the promotion of vaccine acceptance in settings both professional (patients and their families) and community (family/friends). Vaccination concerns and hesitancy may negatively impact the messaging HCP provide to others. Despite the availability of free vaccines through the health care facility and the COVID-19 surge in the community during the study period, 12.4% of HCP reported that they were not planning to or would never seek COVID-19 vaccination.

Even vaccinated HCP reported many concerns about vaccination, with 80.7% endorsing at least 1 concern.

Vaccinated and Unvaccinated HCP Remain Concerned

Understanding the most frequently endorsed concerns about vaccination can help to guide large-scale messaging and interventions that may benefit vaccinated and unvaccinated HCP. Overall, vaccinated and unvaccinated HCP endorsed concerns about long-term consequences of COVID-19 vaccine (55.8% of vaccinated HCP, 83.8% of unvaccinated HCP). More than half of those who were vaccinated had concerns about the long-term impact of their choice to receive a COVID-19 vaccine. This finding highlights a need to develop interventions to mitigate these concerns among HCP¹⁴ (eg, public health messaging, interventions). The second-most highly endorsed concern in the overall sample was that the vaccine may be ineffective against variants (38% of HCP). Given preliminary data suggesting decreased vaccine effectiveness against the Delta variant and the Omicron variant,¹⁵ it is important to consider how this may impact future vaccination decision making (eg, potential boosters) among vaccinated and unvaccinated HCP.

Examining Behaviorally Relevant Beliefs About COVID-19 Vaccination

Understanding the concerns about and reasons for acceptance of vaccination that highly differentiated vaccinated

and unvaccinated HCP may assist in guiding tailored interventions for these groups. As we see growth in mandates for COVID-19 vaccination across hospital systems in the United States, we need to be aware that the behavioral mandate will not eradicate the concerns of individual HCP. Our study showed that even vaccinated HCP maintain substantial concerns. Addressing the unique concerns of unvaccinated HCP may aid in reducing workforce impacts and decreasing distress. Our study found that concerns that most differentiated unvaccinated HCP from vaccinated HCP were religious or personal beliefs and the belief that the vaccine is not necessary if enough others are vaccinated. Although religious or personal beliefs may be difficult to intervene upon, the necessity of vaccine may be an appropriate target for messaging. Unvaccinated HCP were nearly 15 times more likely than vaccinated HCP to endorse that vaccines are not necessary; this assumption—in combination with the finding that unvaccinated HCP were significantly more likely than vaccinated HCP to have been diagnosed with COVID-19, were less fearful overall of COVID-19 exposure, and were more likely to have continued direct work with COVID-19 patients—should be further explored in the development of targeted messaging to this group.

This study revealed that reasons for vaccine acceptance were most predictive of vaccination receipt, and this finding may guide messaging that could be reinforced for vaccine-hesitant and unvaccinated HCP. Specifically, compared with unvaccinated HCP, vaccinated HCP were significantly more confident in COVID-19 vaccination, and they highly endorsed collective responsibility as a reason for vaccine acceptance, despite concerns about the long-term consequences of vaccination. The reason for acceptance that most differentiated vaccinated and unvaccinated HCP was the desire to be a role model for others through seeking vaccination. Capitalizing on the collective responsibility and being a good model for health behavior may be valuable for hesitant vaccinated HCP and unvaccinated HCP.

Limitations

This study had several limitations. First, despite the large number of respondents, there may be differences between HCP who chose to respond to the survey and those who did not. Second, our sample was similar to the overall health care system in identified sex, race, and age; however, our sample had a higher vaccination rate than the overall health care system at the time of data collection, which may suggest that our sample is not directly representative of broader health care systems. However, similar to our sample, HCP across the health care system had an average age of 43.4 years, 25.5% identified as male, 73.0% identified as White, and 1.8% identified as Hispanic, with 53.2% of HCP in primarily clinical roles. Third, because this study was conducted at a large Midwest health system with many respondents of diverse

race and ethnicity, the results may not be generalizable to other US health care systems.

Conclusions

Many vaccinated HCP expressed multiple concerns about COVID-19 vaccines. Addressing these concerns is important as health systems are implementing COVID-19 vaccination as a condition of employment and for sustaining resilient HCP. If concerns about and reasons for vaccination among unvaccinated and vaccinated HCP are not addressed, the potential COVID-19 vaccination mandates may exacerbate HCP shortages. Understanding concerns of HCP is also critical for promoting the health and safety of HCP, because HCP are often able to influence vaccination attitudes and behaviors of other members of the community. These concerns may also present a barrier should COVID-19 vaccine boosters become necessary, as it is unclear if these concerns will influence future vaccination behavior when the attitude of a collective responsibility for vaccination is less pressing.

Another critical finding is that despite the endorsement of many concerns about vaccination, the reasons for vaccine acceptance were a more important driver of actual vaccination behavior of HCP than concerns about vaccination. These findings suggest that approaches that amplify the benefits of vaccination are crucial to increase vaccine uptake.¹⁶ Consistent with the concept of gain-framed messaging in improving health behavior interventions,^{17,18} our findings suggest that interventions to increase reasons for acceptance, rather than to reduce concerns, may be beneficial in scaling up COVID-19 vaccinations in the United States.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Lindsay M.S. Oberleitner, PhD  <https://orcid.org/0000-0002-1390-4821>

References

1. Centers for Disease Control and Prevention. COVID data tracker. Accessed December 20, 2021. <https://covid.cdc.gov/covid-data-tracker/#vaccination-trends>
2. Roy B, Kumar V, Venkatesh A. Health care workers' reluctance to take the COVID-19 vaccine: a consumer-marketing approach to identifying and overcoming hesitancy. *NEJM Catalyst Innovations in Care Delivery*. 2020;1(6).
3. Steel-Fisher GK, Blendon RJ, Caporello H. An uncertain public—encouraging acceptance of COVID-19 vaccines. *N Engl J Med*. 2021;384:1483-1487. doi:10.1056/NEJMp2100351

4. Dooling K, Marin M, Wallace M, et al. The Advisory Committee on Immunization Practices' updated interim recommendation for allocation of COVID-19 vaccine—United States, December 2020. *MMWR Morb Mortal Wkly Rep.* 2021;69(5152):1657-1660. doi:10.15585/mmwr.mm695152e2
5. Dooling K, McClung N, Chamberland M, et al. The Advisory Committee on Immunization Practices' interim recommendation for allocating initial supplies of COVID-19 vaccine—United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69(49):1857-1859. doi:10.15585/mmwr.mm6949e1
6. Centers for Disease Control and Prevention. Talking with patients about COVID-19 vaccination. Updated November 3, 2021. Accessed December 20, 2021. <https://www.cdc.gov/vaccines/covid-19/hcp/engaging-patients.html>
7. Centers for Disease Control and Prevention. COVID data tracker weekly review. Accessed August 5, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/covidview/index.html>
8. Weber DJ, Al-Tawfiq JA, Babcock HM, et al. Multisociety statement on coronavirus disease 2019 (COVID-19) vaccination as a condition of employment for healthcare personnel. *Infect Control Hosp Epidemiol.* 2021;43(1):3-11. doi:10.1017/ice.2021.322
9. Grech V, Gauci C, Agius S. Vaccine hesitancy among Maltese healthcare workers toward influenza and novel COVID-19 vaccination. *Early Hum Dev.* Published online October 1, 2020. doi:10.1016/j.earlhumdev.2020.105213
10. Kabamba Nzaji M, Kabamba Ngombe L, Ngoie Mwamba G, et al. Acceptability of vaccination against COVID-19 among healthcare workers in the Democratic Republic of the Congo. *Pragmat Obs Res.* 2020;11:103-109. doi:10.2147/POR.S271096
11. Caserotti M, Girardi P, Rubaltelli E, Tasso A, Lotto L, Gavaruzzi T. Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents. *Soc Sci Med.* 2021;272:113688. doi:10.1016/j.soescimed.2021.113688
12. Betsch C, Wicker S. E-health use, vaccination knowledge and perception of own risk: drivers of vaccination uptake in medical students. *Vaccine.* 2012;30(6):1143-1148. doi:10.1016/j.vaccine.2011.12.021
13. Cuschieri S, Grech V. A comparative assessment of attitudes and hesitancy for influenza vis-à-vis COVID-19 vaccination among healthcare students and professionals in Malta. *Z Gesundh Wiss.* Published online May 25, 2021. doi:10.1007/s10389-021-01585-z
14. Centers for Disease Control and Prevention. COVID-19 vaccination coverage and intent among adults aged 18-39 years—United States, March–May 2021. Published June 25, 2021. Accessed June 26, 2021. <https://www.cdc.gov/mmwr/volumes/70/wr/mm7025e2.htm>
15. Bernal JL, Andrews N, Gower C, et al. Effectiveness of COVID-19 vaccines against the B.1.617.2 (Delta) variant. *N Engl J Med.* 2021;385(7):585-594. doi:10.1056/NEJMoa2108891
16. Laine C, Cotton D, Moyer DV. COVID-19 vaccine: promoting vaccine acceptance. *Ann Intern Med.* 2021;174(2):252-253.
17. Lawes-Wickwar S, Ghio D, Tang MY, et al. A rapid systematic review of public responses to health messages encouraging vaccination against infectious diseases in a pandemic or epidemic. *Vaccines (Basel).* 2021;9(2):72. doi:10.3390/vaccines9020072
18. O'Keefe DJ, Jensen JD. The relative persuasiveness of gain-framed loss-framed messages for encouraging disease prevention behaviors: a meta-analytic review. *J Health Commun.* 2007;12(7):623-644. doi:10.1080/10810730701615198