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

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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 (β = 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 (β = 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 In the United States, health care personnel (HCP) were included in phase 1a of the vaccine rollout, to preserve health care system capacity and support 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

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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. 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. 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. 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 research 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 infection); (2) attitudes toward the vaccine, assessed using the 5C scale, 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 attitudes 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 χ² 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.

| Characteristic                          | Overall (n = 4497) | Unvaccinated (n = 550) | Vaccinated (n = 3947) | Partial $\eta^2$ or OR (95% CI) |
|----------------------------------------|--------------------|------------------------|-----------------------|--------------------------------|
| Vaccination statusb                    |                    |                        |                       |                                |
|                                        | Overall            | Unvaccinated           | Vaccinated            |                                |
|                                        | (n = 4497)         | (n = 550)              | (n = 3947)            |                                |
| Sex                                    | 757 (17.0)         | 64 (12.7)              | 693 (17.7)            | 1.47 (1.12-1.94)               |
| Male                                   | 267 (6.0)          | 23 (4.2)               | 244 (6.2)             | 1 [Reference]                 |
| Female                                 | 3696 (83.0)        | 440 (87.3)             | 3256 (83.8)           |                                |
| Age, y                                 | 46.2 (13.0)        | 40.3 (12.1)            | 47.0 (12.9)           | 0.03                           |
| Job categorya                          | 2197 (49.5)        | 291 (55.6)             | 1906 (48.7)           | 1.32 (1.10-1.59)               |
| Clinician                              | 2244 (50.5)        | 232 (44.4)             | 2012 (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)               | 180 (4.6)             | 0.49 (0.40-0.60)               |
| 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)               | 79 (2.0)              |                                |
| Hispanic/Latino                        | 118 (2.6)          | 17 (3.1)               | 101 (2.6)             | 0.73 (0.43-1.22)               |
| COVID-19 historyb                      | 638 (14.2)         | 148 (27.4)             | 490 (12.4)            | 0.38 (0.30-0.47)               |
| Yes                                    | 3859 (85.8)        | 392 (72.6)             | 3457 (87.6)           | 1 [Reference]                 |
| No                                     |                    |                        |                       |                                |
| Direct work with COVID-19 patients     |                    |                        |                       |                                |
| Yes                                    | 2253 (50.7)        | 318 (59.3)             | 1935 (49.5)           | 0.67 (0.56-0.81)               |
| No                                     | 2191 (49.3)        | 218 (40.7)             | 1974 (50.5)           | 1 [Reference]                 |
| Direct work with COVID-19 patients in past 3 moh |                    |                        |                       |                                |
| Yes                                    | 879 (19.6)         | 164 (29.8)             | 715 (18.1)            | 1.92 (1.57-2.34)               |
| No                                     | 3606 (80.4)        | 386 (70.2)             | 3235 (81.9)           | 1 [Reference]                 |
| Perceptions of COVID-19 infection, 0-100 scale |                    |                        |                       |                                |
| Perceived likelihood of infectioni     | 38.4 (28.6)        | 49.9 (28.9)            | 36.9 (28.2)           | 0.02                           |
| 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                           |
| Vaccine attitudesj                     | COVID-19 vaccines are safe | 5.5 (1.8)             | 2.1 (1.3)             | 6.0 (1.2)                      |
| COVID-19 vaccination is unnecessary    | 1.3 (0.9)          | 2.6 (1.4)              | 1.1 (0.6)             | 0.51                           |
| COVID-19 vaccination is a hassle       | 2.4 (1.8)          | 3.8 (1.8)              | 2.2 (1.7)             | 0.27                           |
| 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                           |

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 $\chi^2$ 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 $\eta^2$ 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$\chi^2$ 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.
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 ($\beta = 1.79, P < .001; \chi^2 [df = 4, N = 4459] = 1786.0, P < .001; 94.9\%$ 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 of loved ones (78.4\%, $n = 3667$), 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 ($\beta = 0.36, P < .001; \chi^2 [df = 3, N = 4459] = 2197.0, P < .001; 95.2\%$ 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 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^

| Concernb | Overall, no. (%) (n = 4497) | Unvaccinated (n = 550) | Vaccinated (n = 3947) | OR (95% CI)c |
|----------|-----------------------------|------------------------|-----------------------|--------------|
| 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) | 5.97 (4.94-7.22) |
| 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.
^a^Data source: survey of health care personnel at a large health care system in Michigan.
^b^Partial η² = 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.
^c^Difference between vaccinated and unvaccinated health care personnel was significant at P < .05 for all concerns, determined with Pearson χ² analyses.

Unvaccinated participants were the reference group; ORs represent the likelihood of being unvaccinated if endorsing the concern.
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, 2021a

| Reason for acceptanceb | Overall, no. (%) (n = 4497) | Unvaccinated (n = 550) | Vaccinated (n = 3947) | OR (95% CI)c |
|-----------------------|-------------------------------|------------------------|-----------------------|--------------|
| 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 η² = 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 χ² 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, 2021a

| Concern | Overall, no. (%) (n = 4542) | Clinical (n = 2249) | Nonclinical (n = 2293) | OR (95% CI)c |
|---------|-------------------------------|---------------------|-----------------------|--------------|
| 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 χ² 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

| Reason for acceptance                                  | Overall, no. (%) (n = 4542) | Clinical (n = 2249) | Nonclinical (n = 2293) | OR (95% CI)
|-------------------------------------------------------|-----------------------------|---------------------|------------------------|--------------------------------------------------|
| 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)                                 |
| To serve as a role model                               | 2359 (51.9)                 | 1257 (55.9)         | 1102 (48.0)            | 1.37 (1.22-1.54)                                 |
| Vaccine is safe and effective                          | 2337 (51.5)                 | 1186 (52.7)         | 1151 (50.2)            | 1.11 (0.99-1.24)                                 |
| 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 χ² 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 (χ² = 60.9, P < .001).

Discussion

HCP may influence others in their communities to optimize COVID-19 vaccine uptake. 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 HCP (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, 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. Consistent with the concept of gain-framed messaging in improving health behavior interventions, 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.

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