High completion of COVID-19 vaccination among healthcare workers despite initial self-reported vaccine reluctance

Vivek Jain,† Sarah B. Doernberg,‡ Marisa Holubar,§ Beatrice Huang,¶ Jenna Bollyky,¶ Hannah Sample,† Yingjie Weng,† Di Lu,‡ Manisha Desai,§ Yvonne Maldonado,†† George Rutherford,††† and the CHART Study Consortium**

†Division of HIV, Infectious Diseases & Global Medicine, San Francisco General Hospital, University of California, San Francisco (UCSF), CA, USA; ‡Division of Infectious Diseases, UCSF, CA, USA; §Division of Infectious Diseases and Geographic Medicine, Stanford University School of Medicine, Stanford, CA, USA; ¶Department of Family and Community Medicine, San Francisco General Hospital, University of California, San Francisco (UCSF), CA, USA; ‡Department of Biochemistry and Biophysics, University of California, San Francisco (UCSF), CA, USA; ††Quantitative Sciences Unit, Stanford University School of Medicine, Stanford, CA, USA; †††Division of Pediatric Infectious Diseases, Stanford University School of Medicine, Stanford, CA, USA; **Division of Infectious Disease and Global Epidemiology, Department of Epidemiology and Biostatistics, UCSF, CA, USA

†† Authors contributed equally to this report
** Consortium co-authors listed in supplementary appendix

© The Author(s) 2021. Published by Oxford University Press on behalf of Infectious Diseases Society of America.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs licence (http://creativecommons.org/licenses/by-nc-nd/4.0/), which permits non-commercial reproduction and distribution of the work, in any medium, provided the original work is not altered or transformed in any way, and that the work is properly cited. For commercial re-use, please contact journals.permissions@oup.com
Keywords:
COVID-19, healthcare providers, vaccine completion, vaccine reluctance, vaccine hesitancy

Corresponding Author:
Vivek Jain, MD, MAS
Division of HIV, Infectious Diseases & Global Medicine
Zuckerberg San Francisco General Hospital
University of California, San Francisco (UCSF)
UCSF Box 0874
San Francisco, CA 94143-0874, USA
Email: vivek.jain@ucsf.edu

Alternate Corresponding Author:
Sarah Doernberg, MD, MAS, FIDSA
Division of Infectious Diseases
University of California, San Francisco (UCSF)
UCSF Box 0654
San Francisco, CA 94143-0654, USA
Email: sarah.doernberg@ucsf.edu
Dear Editor,

Surveys of US healthcare workers (HCW) have demonstrated variable reluctance to receiving COVID-19 vaccination.[1] [2] The degree to which pre-vaccination opinions correlate with actual vaccination completion is unclear. We also describe emergent reasons for vaccine delay and non-completion among HCW.

We conducted 2 cross-sectional surveys (11/16/20-12/8/20 and 4/7/21-4/30/21; Supplementary Appendices) nested in the CHART (COVID-19 Healthcare Worker Antibody and RT-PCR) Study, a longitudinal cohort study of HCW open to all employees at the University of California, San Francisco (UCSF), Zuckerberg San Francisco General Hospital, and Stanford Health Care.[3] On-site vaccinations were offered in staged fashion starting in December 2020; all HCW were invited before the second survey; HCW were also given materials about multiple community-based locations where they could receive vaccination. Both surveys were web/email-based and used REDCap electronic data capture tools hosted at Stanford University [4] (surveys included as Supplemental Appendices 1/2). We defined vaccine reluctance in the first survey as a 5-point Likert scale response of “definitely no” or “unlikely” to the question “If a vaccine received emergency use authorization but not formal FDA approval, would you get it?” We ascertained HCW vaccine completion via survey, and defined delay in receipt of vaccine as an individual receiving vaccination ≥2 weeks after their invitation for vaccination. The UCSF Committee on Human Subjects Research and the Stanford University School of Medicine Panel on Human Subjects in Medical Research approved this study, and patients provided individual written consent to participate.

Overall, 2069/2238 (92.5%) participants responded to survey #1, 1747 (78.1%) to survey #2, and 1671 (74.7%) to both. Table 1 describes participant characteristics. Overall, nearly all respondents to survey #2 [1725/1747 (98.7%)] self-reported receipt of ≥1 vaccine dose: 1614 (92.4%) received vaccination immediately, and 111 (6.4%) delayed initiation
but eventually received vaccination (Table 1). Among respondents to both surveys, 502/1671 (30.0%) expressed initial vaccine reluctance on survey #1. Reluctant HCW had higher frequency of vaccine delay compared to non-reluctant HCW (11.4% vs. 3.4%, Table 1). Despite this, 487/502 (97.0%) reluctant HCW eventually received ≥1 vaccine dose (430 [85.7%] immediately and 57 [11.4%] delayed).

Of the 111 HCW who delayed vaccination by ≥2 weeks after initial offer, top reasons included concerns about side effects (29, 26.1%), pregnancy/breastfeeding (21, 18.9%), and personal logistic barriers to accessing available vaccine appointments (20, 18.0%).

Overall, 22/1747 (1.3%) HCW remained unvaccinated by April 2021. Top reasons for not receiving vaccine included concerns about side effects, regulatory approval processes, vaccine efficacy, allergy to vaccine components or other agents, and pregnancy/breastfeeding. However, when asked if they would eventually receive COVID-19 vaccination, only 4/22 (18.2%) responded “definitely not” or “unlikely”, while 11/22 (50%) responded “likely” or “definitely.”

In a cohort of over 2000 California HCW, over 98% of HCWs self-reported completing COVID-19 vaccination despite 30% initially reporting reluctance. A small fraction of HCW delayed vaccination at the time they first became eligible but eventually sought vaccination. Among HCWs who remained unvaccinated in April 2021, months after initial eligibility, diverse reasons included concerns about side effects, vaccine efficacy, and a perception that there was insufficient data for women who were pregnant. Half of unvaccinated HCWs indicated a high likelihood of future vaccine completion.
Our data add to an emerging picture of HCW vaccination. Our vaccination rates are higher than in other regions but align with California’s overall high general population vaccine uptake,[5] and are very similar to a 96% vaccine completion recently reported among Los Angeles HCW.[6] Limitations of our study included voluntary participation in a research cohort and a high fraction of physicians and nurses, both of which could reduce generalizability to all HCW, and a lower second survey response rate. Vaccine hesitancy among nonrespondents to the second survey was only modestly higher than among respondents to both surveys (153/398 [38.4%] vs. 502/1671 [30.0%]), indicating that estimates of vaccine completion were reasonably representative of the cohort.

HCW vaccination is critical for ensuring the safety and stability of the workforce, and for promoting public confidence in the vaccines. Despite widespread availability for HCW vaccination rates are still below targets. Our data underscore the critical need for healthcare systems to (1) continue to maintain low-barrier access to vaccination at work sites and other venues (2) continue to inform HCW about the vaccine approval process and existing safety data. Emerging COVID-19 vaccine safety data among pregnant/lactating individuals[7] should also be integrated into outreach campaigns. Given the high willingness of unvaccinated HCW to be vaccinated eventually, health systems should not view these HCW as having fixed opinions; rather they should be continually engaged in the process of vaccination offerings.
Patient Consent Statement

The UCSF Committee on Human Subjects Research and the Stanford University School of Medicine Panel on Human Subjects in Medical Research approved this study, and patients provided individual written consent to participate.

Funding Statement

This work was supported by a research grant from the Chan Zuckerberg Initiative.

Acknowledgements

We gratefully acknowledge the participation of healthcare worker participants in the CHART Study at UCSF Health and Zuckerberg San Francisco General Hospital, University of California, San Francisco, CA, and at Stanford Health Care, Palo Alto, CA. We also acknowledge the support of medical center leadership at the three CHART study sites, and all members of the CHART Study team.

Potential conflicts of Interest:

S.D. has served as a consultant to Genentech and Basilea Pharmaceutica for work unrelated to this study, and has received funding from the NIH (UM1AI104681) for work unrelated to this study. All authors have received research grant funding from the Chan Zuckerberg Initiative for this work.
Table 1. Demographic characteristics and COVID-19 vaccine completion among survey respondents (n=2069)

| Demographic Characteristic                      | Vaccine Survey #1 Respondents | Vaccine Survey #2 Respondents | Respondents only to Survey #1 | Respondents to both Surveys |
|------------------------------------------------|------------------------------|-------------------------------|------------------------------|----------------------------|
| n                                              | 2069                         | 1747                          | 398                          | 1671                       |
| Age at baseline, years (mean [SD])             | 40.9 (10.2)                  | 41.6 (10.4)                   | 37.1 (8.4)                   | 41.8 (10.4)                |
| Gender (%)                                      |                              |                               |                              |                            |
| Male                                           | 417 (20.2)                   | 347 (19.9)                    | 85 (21.4)                    | 332 (19.9)                 |
| Female                                         | 1642 (79.4)                  | 1392 (79.7)                   | 311 (78.1)                   | 1331 (79.7)                |
| Trans/genderqueer/gender nonbinary/no answer   | 10 (0.5)                     | 8 (0.5)                       | 2 (0.5)                      | 8 (0.5)                    |
| Latinx Ethnicity (%)                           |                              |                               |                              |                            |
| Yes                                            | 219 (11.1)                   | 174 (10.4)                    | 58 (15.7)                    | 161 (10.0)                 |
| No                                             | 1742 (88.2)                  | 1497 (89.2)                   | 306 (82.7)                   | 1436 (89.5)                |
| Decline to answer                              | 13 (0.7)                     | 7 (0.4)                       | 6 (1.6)                      | 7 (0.4)                    |
| Race (%)                                       |                              |                               |                              |                            |
| White                                          | 1235 (62.6)                  | 1073 (64.0)                   | 203 (55.0)                   | 1032 (64.4)                |
| Black                                          | 30 (1.5)                     | 18 (1.1)                      | 12 (3.3)                     | 18 (1.1)                   |
| Asian                                          | 434 (22.0)                   | 368 (21.9)                    | 88 (23.8)                    | 346 (21.6)                 |
| Multiple races                                 | 116 (5.9)                    | 98 (5.8)                      | 22 (6.0)                     | 94 (5.9)                   |
| Other                                          | 115 (5.8)                    | 87 (5.2)                      | 32 (8.7)                     | 83 (5.2)                   |
| Decline to answer                              | 42 (2.1)                     | 33 (2.0)                      | 12 (3.3)                     | 30 (1.9)                   |
| Education (%)                                  |                              |                               |                              |                            |
| Less than college                              | 21 (1.1)                     | 16 (1.0)                      | 8 (2.2)                      | 13 (0.8)                   |
| College                                        | 820 (41.5)                   | 669 (39.9)                    | 188 (50.8)                   | 632 (39.4)                 |
| Higher than college                            | 1120 (56.7)                  | 984 (58.6)                    | 169 (45.7)                   | 951 (59.3)                 |
| Other                                          | 13 (0.7)                     | 9 (0.5)                       | 5 (1.4)                      | 8 (0.5)                    |
| Work Category (%)                              |                              |                               |                              |                            |
| Direct patient care involved in intubating/suctioning patient airways | 578 (29.3)                   | 467 (27.8)                    | 137 (36.9)                   | 441 (27.5)                 |
| Direct patient care but NOT performing any airway procedures | 1050 (53.2)                  | 916 (54.6)                    | 169 (45.6)                   | 881 (54.9)                 |
| Staff with indirect patient contact (e.g. reception, environmental services) | 105 (5.3)                    | 89 (5.3)                      | 24 (6.5)                     | 81 (5.0)                   |
| Laboratory                                     | 49 (2.5)                     | 41 (2.4)                      | 11 (3.0)                     | 38 (2.4)                   |
| Work in healthcare but not with patients or biological samples | 75 (3.8)                     | 67 (4.0)                      | 8 (2.2)                      | 67 (4.2)                   |
| Other                                          | 118 (6.0)                    | 98 (5.8)                      | 22 (5.9)                     | 96 (6.0)                   |
| Healthcare Role (%)                            |                              |                               |                              |                            |
| Position/Role                                                                 | N     | Mean | SD   | N     | Mean | SD   |
|------------------------------------------------------------------------------|-------|------|------|-------|------|------|
| Registered nurse and nurse manager                                          | 887   | (42.9)|      | 735   | (42.1)|      |
| Physician (attending, staff, fellow, resident, or intern), student, advanced practitioner (physician asst., nurse practitioner, CRNA) | 715   | (34.6)|      | 620   | (35.5)|      |
| Respiratory or speech therapist                                              | 27    | (1.3 )|      | 22    | (1.3 )|      |
| Medical or Nurse Assistant or Technologist, Phlebotomy                       | 64    | (3.1 )|      | 53    | (3.0 )|      |
| Registration/ward clerk, Clinic manager/Coordinator                          | 35    | (1.7 )|      | 24    | (1.4 )|      |
| Social worker, child life specialist, spiritual care, counselor, case manager, behavioral health specialist, interpreter | 63    | (3.0 )|      | 53    | (3.0 )|      |
| Radiology technician, physical or occupational therapy/training, patient transport | 97    | (4.7 )|      | 82    | (4.7 )|      |
| Environmental services, food services, or nutrition                          | 14    | (0.7 )|      | 14    | (0.8 )|      |
| Microbiology or other laboratory staff                                       | 30    | (1.4 )|      | 25    | (1.4 )|      |
| Pharmacist or pharmacy technologist                                         | 36    | (1.7 )|      | 33    | (1.9 )|      |
| Research, administration, facilities, information technology                 | 101   | (4.9 )|      | 86    | (4.9 )|      |

| Vaccine completion | Vaccine Survey #2 Respondents (N=1747) | Respondents to Both Surveys (N=1671) |
|--------------------|----------------------------------------|--------------------------------------|
| Have not received any vaccination                                           | 22 (1.3)                              | 15 (3.0)                             |
| Delayed initiation of vaccination                                           | 111 (6.4)                             | 57 (11.4)                            |
| Received vaccination right away                                             | 1614 (92.4)                           | 430 (85.7)                           |

SD, standard deviation
References

1. Shaw J, Stewart T, Anderson KB, et al. Assessment of U.S. health care personnel (HCP) attitudes towards COVID-19 vaccination in a large university health care system. Clin Infect Dis 2021.

2. Meyer MN, Gjorgjieva T, Rosica D. Trends in Health Care Worker Intentions to Receive a COVID-19 Vaccine and Reasons for Hesitancy. JAMA Netw Open 2021; 4(3): e215344.

3. Jain V, Doernberg, S.B., Holubar, M., Huang, B., Marquez, C., Brown, L.B., Rubio, L., Sample, H.A., Bollyky, J., Padda, G., Valdivieso, D., Kempema, A., Leung, C., Sklar, M., Julien, A., Paoletti, M., Jaladanki, S., Wan, E., Ghahremani, J., Chao, J., Weng, Y., Lu, D., Glidden, D., Grumbach, K., Maldonado, Y., Rutherford, G. Healthcare personnel knowledge, motivations, concerns and intentions regarding COVID-19 vaccines: a cross-sectional survey. medRxiv 2021: 2021.02.23.21251993.

4. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009; 42(2): 377-81.

5. COVID19.CA.GOV. Vaccination progress data. Accessed May 7, 2021.
6. Halbrook M, Gadoth A, Martin-Blais R, et al. Longitudinal assessment of COVID-19 vaccine acceptance and uptake among frontline medical workers in Los Angeles, California. Clin Infect Dis 2021.

7. Shimabukuro TT, Kim SY, Myers TR, et al. Preliminary Findings of mRNA Covid-19 Vaccine Safety in Pregnant Persons. N Engl J Med 2021.