Factors Influencing COVID-19 Vaccine Acceptance in the Workplace: Results From a Rapid Survey at 2 Corporations in Los Angeles County, California, 2021

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Abstract

Objectives: Achieving widespread vaccine acceptance across various employment sectors is key to a successful public health response to COVID-19, but little is known about factors influencing vaccine acceptance among essential non–health care workers. We examined factors influencing vaccine acceptance among a sample of essential non–health care workers in California.

Methods: We conducted a survey in early spring 2021 at 2 corporations in Los Angeles County, California, to identify and describe factors influencing vaccine acceptance and the ability of incentives to increase this acceptance. We used modified Poisson regression analysis to estimate adjusted prevalence ratios and a best-subset selection algorithm to identify the strongest factors influencing vaccine acceptance.

Results: Of 678 workers who completed the survey, 450 were unvaccinated. Among unvaccinated participants, having trust in information about the vaccine from public health experts, having ≥1 chronic health condition related to COVID-19 severity, being Asian, and perceiving risk for COVID-19 were factors that most influenced vaccine acceptance. Most (271 of 296, 91.6%) participants who had trust in information from public health experts and 30.6% (30 of 98) of participants who did not have trust in information from public health experts said that they would accept the vaccine. Seventeen of 24 (70.8%) vaccine-hesitant workers who had trust in information from public health experts and 12 of 72 (16.7%) vaccine-hesitant workers who did not have trust in this information said that they would be more likely to accept the vaccine if an incentive were offered.

Conclusions: Efforts to increase vaccine coverage at workplaces should focus on improving trust in the vaccine and increasing public awareness that the vaccine is free.

Keywords
vaccine acceptance, vaccine hesitancy, COVID-19, non–health care workers
A cross-sectional study showed that older age and exposure to patients with COVID-19 at work were determinants of vaccine acceptance among Canadian health care workers.\textsuperscript{11} A 2020 online survey of US dental students reported that factors such as distrust of vaccine information from public health experts, concerns about side effects, vaccine effectiveness, and needing more information about the vaccine strongly influenced vaccine hesitancy.\textsuperscript{12}

Evidence from influenza vaccine distribution suggests that workplaces may be ideal locations to pursue increases in vaccinations.\textsuperscript{13} However, little is known about factors that can influence COVID-19 vaccine acceptance among non–health care workers. Understanding which factors influence non–health care workers overall and within subgroups may help local health departments design more effective campaigns to achieve higher vaccination coverage in workplaces. We sought to inform this gap in public health practice by describing factors that influence vaccine acceptance at 2 non–health care worksites in Los Angeles County, California.

**Methods**

**Study Design**

Los Angeles County is the largest county in the United States and is home to >10 million people.\textsuperscript{14} The Los Angeles County Department of Public Health (LACDPH) COVID-19 Outbreak Management Branch conducted a rapid self-administered survey at 2 corporate worksites in Los Angeles County that aimed to identify and examine factors that affect vaccine acceptance among essential non–health care workers. We defined vaccine acceptance as being vaccinated or willing to be vaccinated. The survey was self-administered by participants in English or Spanish and written at a Flesch-Kincaid seventh-grade level.\textsuperscript{15} Bilingual, culturally sensitive LACDPH staff helped translate the questionnaire into Spanish. The survey included closed-ended questions on the following demographic characteristics: age (grouped into 18-29, 30-49, 50-64, and ≥65 years), gender (male, female, transgender male, transgender female, gender nonbinary), race or ethnicity (White, African American/Black, Asian, Hispanic/Latino, Other [Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native]), highest education level completed (some high school, high school/General Educational Development [GED], some college/community college/trade school, ≥bachelor’s degree), and job classification (production/assembly, quality/testing, machine shop, administrative support, contracts/finance, engineering, unspecified nonproduction, other).

We also collected data on health-related information (previous COVID-19 diagnosis for the participants; knowing a family member, friend, or coworker who has been diagnosed with COVID-19; whether the participant has a chronic health condition [eg, diabetes, hypertension, heart failure, chronic obstructive pulmonary disease, heart disease, obesity, chronic kidney disease]) and vaccination status (whether participant has been vaccinated against COVID-19 or is likely to get vaccinated). Among those who were unvaccinated, we also collected data on (1) whether they would be willing to get vaccinated, (2) their perceptions about the vaccine, (3) factors that could impact their likelihood of getting vaccinated (eg, trust in vaccine information from public health experts, access to the vaccine at work, getting paid time off, or receiving a gift card as an incentive), and (4) concerns that they may have about the vaccine (safety, effectiveness, cost, and newness). We refer to participants who report not having received ≥1 dose of the vaccine and stating that they are not likely to receive the vaccine as vaccine-hesitant.

The LACDPH Institutional Review Board considered the study exempt. To keep the names of the corporations confidential, we call them site A and site B in this study. Both worksites are nonresidential essential manufacturing facilities that had previously worked with LACDPH during a COVID-19 outbreak investigation at their sites.

**Eligibility Criteria**

The study inclusion criteria were that the participant must be (1) an employee of the worksite, (2) aged ≥18 years, and (3) able and willing to complete the survey in English or Spanish. To keep the surveys anonymous, LACDPH did not have access to the workers’ names or contact information. Therefore, employers at site A and site B were asked to distribute the survey to all eligible employees during the last week of March 2021 through the first week of April 2021, approximately 1 month after essential workers were eligible to receive the vaccine in California. The survey could be completed on paper or via a SurveyMonkey link; neither format recorded the workers’ names.
Data Analysis

We performed analyses including frequencies, prevalence ratios (PRs), and 95% CIs. We used modified Poisson regression models to estimate adjusted PRs (aPRs) for the association between the following factors and vaccine acceptance: demographic characteristics, health-related information, and knowledge and perceptions about the vaccine. We used maximum likelihood estimators to estimate 95% CIs. We did not estimate odds ratios because the prevalence of vaccine acceptance was not rare in this population and, therefore, would overestimate the PRs. We did not use binomial regression to estimate PRs to avoid convergence problems. We identified potential confounders based on a priori knowledge and use of directed acyclic graphs by using dags.

We used a best-subset selection algorithm to identify the strongest factors in the self-reported likelihood to receive a COVID-19 vaccine among unvaccinated workers. The best-subset selection algorithm fits all possible combinations of variables and chooses models with the best fit based on the branch-and-bound algorithm. We forced demographic and health-related variables into the model if the analyses described previously suggested that they were strongly associated with vaccine acceptance in the group of unvaccinated workers. We performed these variable selection algorithms for the unvaccinated population overall and for age-, gender-, and race- and ethnicity-specific strata. We did not have adequate sample sizes to maintain confidential information for employees who were aged ≥65 years, were in the “other” gender identities category (other than male or female), and had only some high school education to include them as separate strata. We analyzed the data by grouping employees aged 50-64 and ≥65 years together. Lastly, we performed these analyses to identify factors that most influenced an increase in vaccine acceptance among vaccine-hesitant workers if an incentive were offered (vaccine being offered at work, time off work, or a gift card incentive).

Ancillary Vaccination Clinic and Postvaccination Survey

LACDPH offers on-site COVID-19 vaccination events using mobile vaccination teams at worksites that have had a COVID-19 outbreak. Site B participated in such an event on May 20, 2021, and a short survey was offered after workers were vaccinated. The survey collected data on demographic characteristics, why participants received the vaccine, and their satisfaction with the vaccination process.

Results

Of 902 workers (250 at site A and 652 at site B) employed at the time of the survey, 678 (75.2%) completed the survey (150 at site A and 528 at site B). Most participants reported working in production or assembly jobs (72.7%), self-identified as male (47.5%) or female (45.1%), and self-reported their age as 30-49 (42.2%) or ≥50 (34.5%) years. Of 611 participants who self-reported their race and ethnicity, 36.7% identified as Hispanic, 44.8% as Asian, 16.2% as White, and 3.4% as African American/Black. Approximately one-third (36.4%) had ≥bachelor’s degree.

Of the 678 participants, 450 were unvaccinated at the time of the survey. However, most participants (80.8%) reported that they had already received ≥1 dose of a COVID-19 vaccine (33.6%) or were likely to receive the vaccine (47.2%) (Table 1). Most workers aged ≥50 years had already received the vaccine or reported that they were likely to receive the vaccine at some point (89.4%). Other subgroups with the highest proportion of participants reporting vaccine acceptance were Asian (93.1%), those with ≥1 chronic health condition (93.2%), and those with ≥bachelor’s degree (89.0%). Ninety-six (14.2%) workers were vaccine-hesitant, and 34 (5.0%) did not answer the question about vaccine acceptance. Workers who were aged 18-29 years (21.8%) and Hispanic (22.8%) had the highest proportion of vaccine hesitancy.

Workers with ≥1 chronic health condition were 15% more likely than workers without a chronic health condition to report vaccine acceptance (aPR = 1.15; 95% CI, 1.07-1.24) after controlling for potential confounders (Table 2). Workers aged ≥50 years were 16% more likely than workers aged 18-29 years to be likely to accept the vaccine (aPR = 1.16; 95% CI, 1.05-1.29). Asian workers were 28% more likely than Hispanic workers to report receiving or being likely to receive a vaccine (aPR = 1.28; 95% CI, 1.14-1.44). Workers who had completed at most some college, community college, or trade school were 8% less likely than workers with ≥bachelor’s degree to accept the vaccine (aPR = 0.92; 95% CI, 0.85-1.00).

Unvaccinated workers who had trust in COVID-19 vaccine information from public health experts and those who believed that they were at risk for COVID-19 were more likely to say that they would be willing to receive the vaccine when compared with unvaccinated workers who did not have trust in COVID-19 vaccine information and did not believe that they were at risk for COVID-19 (Table 3). Of 394 respondents, 98 (24.9%) reported that they did not have trust in the information that they were given about the vaccine from public health experts. Among unvaccinated workers, 91.6% (271 of 296) who had trust in this information and 30.6% (30 of 98) who did not have trust in this information reported being likely to receive the vaccine (aPR = 2.65; 95% CI, 1.94-3.62). Unvaccinated workers who reported wanting educational materials about the vaccine to inform their decision were 38% more likely to accept the vaccine than unvaccinated workers who did not report wanting educational materials about the vaccine (aPR = 1.38; 95% CI, 1.03-1.85). Of 399 unvaccinated workers, 118 (29.6%) were concerned about the cost of the vaccine. Of 392 unvaccinated workers, 89 (22.7%) believed that the side effects from the vaccine would be worse than the disease itself. Unvaccinated workers who believed
Table 1. Demographic and health characteristics of essential non–health care workers (N = 678) at 2 corporations in Los Angeles County who reported receipt of a COVID-19 vaccine or likelihood of receiving a COVID-19 vaccine, a March–April 2021

| Characteristic                                      | No. of respondents | Received the vaccine | Likely to receive the vaccine | Either received or are likely to receive the vaccine | Had not received and are not likely to receive the vaccine | Preferred not to answer/no response |
|-----------------------------------------------------|--------------------|----------------------|-------------------------------|-----------------------------------------------------|--------------------------------------------------------------|-----------------------------------|
| Overall                                             | 678                | 228 (33.6)           | 320 (47.2)                    | 548 (80.8)                                          | 96 (14.2)                                                     | 34 (5.0)                          |
| Survey language                                     |                    |                      |                               |                                                     |                                                              |                                   |
| English                                             | 675                | 228 (33.8)           | 320 (47.4)                    | 548 (81.2)                                          | 93 (13.8)                                                     | 34 (5.0)                          |
| Spanish                                             | 3                  | 0                    | 0                             | 0                                                   | 3 (100.0)                                                     | 0                                 |
| Gender                                              |                    |                      |                               |                                                     |                                                              |                                   |
| Male                                                | 322                | 110 (34.2)           | 157 (48.8)                    | 267 (82.9)                                          | 49 (15.2)                                                     | 6 (1.9)                           |
| Female                                              | 306                | 110 (35.9)           | 152 (49.7)                    | 262 (85.6)                                          | 33 (10.8)                                                     | 11 (3.6)                          |
| Race and ethnicity                                   |                    |                      |                               |                                                     |                                                              |                                   |
| White                                               | 99                 | 37 (37.4)            | 46 (46.5)                     | 83 (83.8)                                           | 13 (13.1)                                                     | 3 (3.0)                           |
| Hispanic/Latino                                     | 224                | 49 (21.9)            | 121 (54.0)                    | 170 (75.9)                                          | 51 (22.8)                                                     | 3 (1.3)                           |
| African American/Black                              | 21                 | 5 (23.8)             | 13 (61.9)                     | 18 (85.7)                                           | 3 (14.3)                                                     | 0                                 |
| Asian                                               | 274                | 121 (44.2)           | 134 (48.9)                    | 255 (93.1)                                          | 10 (3.6)                                                      | 9 (3.3)                           |
| Other race or ethnicity                             | 12                 | 5 (41.7)             | 5 (41.7)                      | 10 (83.3)                                           | 2 (16.7)                                                      | 4 (32.3)                          |
| Highest education level completed                   |                    |                      |                               |                                                     |                                                              |                                   |
| Some high school                                    | 20                 | 10 (50.0)            | 10 (50.0)                     | 20 (100.0)                                          | 0                                                             | 0                                 |
| High school or GED                                  | 172                | 44 (25.6)            | 94 (54.7)                     | 138 (80.2)                                          | 30 (17.4)                                                     | 4 (2.3)                           |
| Some college, community college, or trade school    | 204                | 61 (29.9)            | 100 (49.0)                    | 161 (78.9)                                          | 34 (16.7)                                                     | 9 (4.4)                           |
| Bachelor’s degree                                   | 227                | 101 (44.5)           | 101 (44.5)                    | 202 (89.0)                                          | 19 (8.4)                                                      | 6 (2.6)                           |
| No response                                         | 55                 | 12 (21.8)            | 15 (22.4)                     | 30 (44.8)                                           | 18 (26.9)                                                     | 19 (32.8)                         |
| Job classification                                  |                    |                      |                               |                                                     |                                                              |                                   |
| Production or assembly                              | 493                | 162 (32.9)           | 241 (48.9)                    | 403 (81.7)                                          | 73 (14.8)                                                     | 17 (3.4)                          |
| Quality or testing                                  | 24                 | 9 (37.5)             | 14 (58.3)                     | 23 (95.8)                                           | 1 (42)                                                        | 0                                 |
| Machine shop                                        | 7                  | 3 (42.9)             | 4 (57.1)                      | 7 (100.0)                                           | 0                                                             | 0                                 |
| Administrative support                              | 7                  | 2 (28.6)             | 4 (57.1)                      | 6 (85.7)                                            | 0                                                             | 1 (14.3)                          |
| Contracts or finance                                | 10                 | 8 (80.0)             | 2 (20.0)                      | 10 (100.0)                                          | 0                                                             | 0                                 |
| Engineering                                         | 37                 | 18 (48.6)            | 12 (32.4)                     | 30 (81.1)                                           | 7 (18.9)                                                      | 0                                 |
| Unspecified nonproduction                           | 47                 | 13 (27.7)            | 28 (59.6)                     | 41 (87.2)                                           | 4 (8.5)                                                       | 7 (4.3)                           |
| Other                                               | 18                 | 5 (27.8)             | 8 (44.4)                      | 13 (72.2)                                           | 5 (27.8)                                                      | 0                                 |
| No response                                         | 35                 | 8 (22.9)             | 7 (20.0)                      | 15 (42.9)                                           | 6 (17.1)                                                      | 14 (40.0)                         |
| Have you ever previously been diagnosed with COVID-19|                    |                      |                               |                                                     |                                                              |                                   |
| Yes                                                 | 89                 | 27 (30.3)            | 41 (46.1)                     | 68 (76.4)                                           | 21 (23.6)                                                     | 0                                 |
| No                                                  | 538                | 191 (35.5)           | 266 (49.4)                    | 457 (84.9)                                          | 66 (12.3)                                                     | 15 (2.8)                          |
| Unsure                                              | 10                 | 1 (10.0)             | 5 (50.0)                      | 6 (60.0)                                            | 4 (40.0)                                                      | 0                                 |
| No response                                         | 141                | 0                   | 4 (9.8)                       | 4 (9.8)                                             | 4 (9.8)                                                       | 33 (80.5)                         |
| Do you know a family member, friend, or coworker    |                    |                      |                               |                                                     |                                                              |                                   |
| who has been diagnosed with COVID-19                |                    |                      |                               |                                                     |                                                              |                                   |
| Yes                                                 | 378                | 127 (33.6)           | 180 (47.6)                    | 307 (81.2)                                          | 69 (18.3)                                                     | 2 (0.5)                           |
| No                                                  | 211                | 84 (38.0)            | 112 (50.7)                    | 196 (88.7)                                          | 15 (6.8)                                                      | 10 (4.5)                          |
| Unsure                                              | 21                 | 4 (19.0)             | 10 (47.6)                     | 14 (66.7)                                           | 6 (28.6)                                                      | 1 (4.8)                           |
| No response                                         | 58                 | 4 (6.9)              | 16 (26.7)                     | 20 (34.5)                                           | 5 (8.6)                                                       | 33 (56.9)                         |
| Do you have >1 chronic health condition             |                    |                      |                               |                                                     |                                                              |                                   |
| Yes                                                 | 103                | 53 (51.5)            | 43 (41.7)                     | 96 (93.2)                                           | 7 (6.8)                                                       | 0                                 |
| No                                                  | 490                | 156 (31.8)           | 245 (50.0)                    | 401 (81.8)                                          | 76 (15.5)                                                     | 13 (2.7)                          |
| Unsure                                              | 25                 | 4 (16.0)             | 19 (76.0)                     | 23 (92.0)                                           | 2 (8.0)                                                       | 0                                 |
| No response                                         | 60                 | 7 (11.7)             | 11 (18.3)                     | 18 (30.0)                                           | 10 (16.7)                                                     | 32 (53.3)                         |
| Company                                             |                    |                      |                               |                                                     |                                                              |                                   |
| Site A                                              | 150                | 61 (40.7)            | 57 (38.0)                     | 118 (78.7)                                          | 20 (13.3)                                                     | 12 (8.0)                          |
| Site B                                              | 528                | 167 (31.6)           | 263 (49.8)                    | 430 (81.4)                                          | 76 (14.4)                                                     | 22 (4.2)                          |

Abbreviation: GED, General Educational Development.

*aAll values are number (percentage), unless otherwise indicated. Percentages may not sum to 100% because of rounding.
*bThe number of participants in other categories was <5; 47 participants did not respond to the question on gender identity.
*cOther race includes American Indian/Alaska Native and Native Hawaiian/Other Pacific Islander.
*dSome participants responded as pertaining to >1 racial or ethnic group category. As such, the total is >678.
*eChronic health conditions included diabetes, hypertension, heart failure, chronic obstructive pulmonary disease, obesity, heart disease, and chronic kidney disease.
Table 2. Association between demographic and health-related characteristics and COVID-19 vaccine acceptance in a survey of essential non–health care workers (N = 678) at 2 corporations in Los Angeles County, California, a March–April 2021

| Characteristic                        | aPR (95% CI) for unvaccinated workers | Factors controlled for in the modelb |
|---------------------------------------|---------------------------------------|--------------------------------------|
| Age, y                                |                                       |                                      |
| 18-29                                 | 1 [Reference]                         | 1 [Reference]                       |
| 30-49                                 | 1.07 (0.97-1.19)                      | 1.05 (0.91-1.21)                    |
| ≥50                                   | 1.16 (1.05-1.29)                      | 1.14 (0.98-1.32)                    |
| Gender                                |                                       |                                      |
| Male                                  | 1 [Reference]                         | 1 [Reference]                       |
| Female                                | 1.03 (0.97-1.11)                      | 1.05 (0.94-1.17)                    |
| Race and ethnicityc                   |                                       |                                      |
| Hispanic                              | 1 [Reference]                         | 1 [Reference]                       |
| White                                 | 1.07 (0.90-1.27)                      | 1.09 (0.92-1.30)                    |
| Black                                 | 1.19 (0.92-1.54)                      | 2.06 (1.38-3.10)                    |
| Asian                                 | 1.28 (1.14-1.44)                      | 1.31 (1.16-1.47)                    |
| Highest education level completed     |                                       |                                      |
| College/postgraduate                  | 1 [Reference]                         | 1 [Reference]                       |
| Some college or trade school          | 0.92 (0.85-1.00)                      | 0.87 (0.76-1.00)                    |
| High school/GED                       | 0.96 (0.88-1.04)                      | 0.92 (0.80-1.05)                    |
| ≥1 Chronic health conditiond          |                                       |                                      |
| No                                    | 1 [Reference]                         | 1 [Reference]                       |
| Yes                                   | 1.15 (1.07-1.24)                      | 1.17 (1.03-1.35)                    |
| Previous COVID-19 diagnosis           |                                       |                                      |
| No                                    | 1 [Reference]                         | 1 [Reference]                       |
| Yes                                   | 0.95 (0.80-1.13)                      | 0.97 (0.82-1.17)                    |
| Family/friend/coworker with previous  |                                       |                                      |
| COVID-19 diagnosis                    |                                       |                                      |
| No                                    | 1 [Reference]                         | 1 [Reference]                       |
| Yes                                   | 1.01 (0.89-1.15)                      | 1.05 (0.93-1.20)                    |

Abbreviations: aPR, adjusted prevalence ratio; GED, General Educational Development. a COVID-19 vaccine acceptance is defined as stating either that they have received or are likely to receive the vaccine. b Modified Poisson regression adjusting for factors based on directed acyclic graphs. c The race categories including American Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, unsure, and no response are not shown in the table but were included in the model as dummy variables so that the indicated reference group would be properly classified. d Chronic health conditions included diabetes, hypertension, heart failure, chronic obstructive pulmonary disease, obesity, heart disease, and chronic kidney disease.

that they were not at risk of getting COVID-19 were less likely to report being likely to receive the vaccine than unvaccinated workers who believed that they were at risk of getting COVID-19 (aPR = 0.58; 95% CI, 0.37-0.92).

We included Asian race, college education, age ≥ 50 years, and having ≥ 1 chronic health condition in all models because they were strongly associated with vaccine acceptance among unvaccinated workers (Table 4). Having trust in COVID-19 vaccine information from public health experts, believing that they were not at risk for the disease, having ≥ 1 chronic health condition, and self-identifying as Asian were the strongest factors influencing vaccine acceptance. For example, for each age group, respondents who stated that they had trust in COVID-19 vaccine information from public health experts reported being more likely to receive the vaccine than respondents who did not have trust in COVID-19 vaccine information from public health experts. The strata-specific estimates for PRs for adults aged 18-29, 30-49, and ≥ 50 years were 1.60 (95% CI, 1.09-2.36), 2.06 (95% CI, 1.51-2.80), and 2.72 (95% CI, 1.61-4.62), respectively.

The belief that they were not at risk for COVID-19 and having ≥ 1 chronic health condition were strong determinants of vaccine acceptance among participants who were aged 30-49 years, male, female, or Hispanic (Table 4). For example, among participants aged 30-49 years, those who believed that they were not at risk for COVID-19 were less
Table 3. Effect of perceptions and concerns about the COVID-19 vaccine on vaccine acceptance among unvaccinated essential non–health care workers at 2 corporations in Los Angeles County, California, March–April 2021

| Perception or concern                                                                 | No. of respondents\textsuperscript{c,d} | Likely would receive vaccine | Not likely to receive vaccine | Preferred not to answer/no response | Adjusted prevalence ratio (95% CI) |
|--------------------------------------------------------------------------------------|------------------------------------------|-----------------------------|-----------------------------|-------------------------------------|----------------------------------|
| I do not believe I am at risk of getting COVID-19, so I do not need the vaccine.\textsuperscript{a} | Agree 56                                  | 20 (35.7)                   | 36 (62.5)                   | 1 (1.8)                             | 0.58 (0.37-0.92)                 |
|                                                                                     | Disagree 340                             | 283 (83.2)                  | 56 (16.5)                   | 1 (0.3)                             | 1 [Reference]                    |
| Not everyone who is eligible to get the COVID-19 vaccine needs to receive it because herd immunity will protect everyone.\textsuperscript{a,b} | Agree 121                                | 84 (69.4)                   | 36 (29.8)                   | 1 (0.8)                             | 0.94 (0.72-1.23)                 |
|                                                                                     | Disagree 276                             | 220 (79.7)                  | 55 (19.9)                   | 1 (0.4)                             | 1 [Reference]                    |
| Side effects of the vaccine are likely to be worse than COVID-19 itself.\textsuperscript{a,b} | Agree 89                                 | 46 (51.7)                   | 42 (47.2)                   | 1 (1.1)                             | 0.87 (0.63-1.21)                 |
|                                                                                     | Disagree 303                             | 256 (84.5)                  | 47 (15.5)                   | 0                                   | 1 [Reference]                    |
| I trust the information I am receiving about the COVID-19 vaccine from the public health experts.\textsuperscript{a} | Agree 296                                | 271 (91.6)                  | 24 (8.1)                    | 1 (0.3)                             | 2.65 (1.94-3.62)                 |
|                                                                                     | Disagree 98                              | 30 (30.6)                   | 68 (69.4)                   | 0                                   | 1 [Reference]                    |
| Would receiving educational information about the vaccine help you decide whether to get the COVID-19 vaccine?\textsuperscript{a,b} | Yes 289                                  | 252 (87.2)                  | 37 (12.8)                   | 0                                   | 1.38 (1.03-1.85)                 |
|                                                                                     | No 110                                   | 50 (45.5)                   | 59 (53.6)                   | 1 (0.9)                             | 1 [Reference]                    |
| Are you concerned about the safety of the COVID-19 vaccine (ie, side effects)?\textsuperscript{a,b} | Yes 281                                  | 200 (71.2)                  | 79 (28.1)                   | 1 (0.7)                             | 1.02 (0.81-1.28)                 |
|                                                                                     | No 125                                   | 108 (86.4)                  | 17 (13.6)                   | 0                                   | 1 [Reference]                    |
| Are you concerned about how well the vaccine protects against symptomatic disease?\textsuperscript{a} | Yes 258                                  | 203 (78.7)                  | 54 (21.3)                   | 1 (0.4)                             | 1.25 (0.99-1.57)                 |
|                                                                                     | No 143                                   | 101 (70.6)                  | 42 (29.4)                   | 0                                   | 1 [Reference]                    |
| Are you concerned about the cost of the vaccine?\textsuperscript{a} | Yes 118                                  | 104 (88.1)                  | 14 (11.9)                   | 0                                   | 1.18 (0.93-1.50)                 |
|                                                                                     | No 281                                   | 199 (70.8)                  | 81 (29.2)                   | 1 (0.4)                             | 1 [Reference]                    |
| Are you concerned about the newness of the vaccine?\textsuperscript{a} | Yes 261                                  | 190 (72.8)                  | 70 (27.2)                   | 1 (0.4)                             | 1.06 (0.85-1.32)                 |
|                                                                                     | No 133                                   | 109 (82.0)                  | 24 (18.0)                   | 0                                   | 1 [Reference]                    |

\textsuperscript{a}Controlling for age $\geq$50 years, Asian race, having $\geq$1 chronic health condition, and having $\geq$ bachelor’s degree.

\textsuperscript{b}All values are number (percentage), unless otherwise indicated. Percentages may not sum to 100% because of rounding.

\textsuperscript{c}The total number of participants who reported being unvaccinated was 450. Not all respondents answered all of the questions; therefore, the total number of respondents varies by question.

\textsuperscript{d}The total number of respondents was 678, of whom 450 were unvaccinated and included in this analysis. Not all respondents answered all questions; therefore, the total number of respondents varies by characteristic.

\textsuperscript{e}Additionally controlled for trusting information that they are receiving about the COVID-19 vaccine from public health experts.

\textsuperscript{f}Additionally controlled for not believing that they were at risk for COVID-19, so they did not need the vaccine.

likely than those who believed that they were at risk for COVID-19 to report being likely to receive the vaccine (PR = 0.55; 95% CI, 0.35-0.88). Self-identifying as Asian was a factor influencing vaccine acceptance in every nonracial stratum. A higher percentage of Asian respondents (93.1%) than respondents in other racial categories (70.1%) reported being likely to receive the vaccine (PR = 1.25; 95% CI, 1.14-1.37). Among workers who were aged <50 years, female, Hispanic, or Asian, wanting educational materials on the COVID-19 vaccine before deciding to get vaccinated influenced vaccine acceptance. Among Hispanic participants, 84.0% who reported having at least a bachelor’s degree versus 66.7% of those who had less than a bachelor’s degree reported being likely to receive the vaccine (PR = 1.20; 95% CI, 1.01-1.44).

The best-subset selection algorithm revealed that trust in COVID-19 information from public health experts and concern about the cost of the vaccine had the strongest impact on whether an incentive would increase the likelihood that a vaccine would be accepted by vaccine-hesitant workers (Table 5). Of 96 vaccine-hesitant workers, 29 (30.2%) stated that an incentive would increase the likelihood that they would receive the vaccine. Seventeen of 24 (70.8%) vaccine-hesitant workers who had trust in COVID-19 vaccine information from public health experts and 12 of 72 (16.7%) vaccine-hesitant workers who did not have trust in vaccine information from public health experts said that they would be more likely to receive the vaccine if an incentive were offered. Ten of 14 vaccine-hesitant workers who were concerned about the cost of the vaccine, as compared with 19 of 82 vaccine-hesitant
Table 4. Factors that influenced self-reported likelihood to receive a COVID-19 vaccine among unvaccinated essential non–health care workers (n = 450) at 2 corporations in Los Angeles County, California, March–April 2021, using the best-subset selection algorithm

| Characteristic | Strongest factors influencing self-reported likelihood to receive the vaccine | Respondents who reported that they are likely to receive the vaccine, % | All strata-specific factors in the model, prevalence ratio (95% CI) |
|---------------|--------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------|
|               | With characteristic | Without characteristic | Overall\(^a\) |
|               | Trusts COVID-19 information from public health experts | 91.6 | 30.6 | 2.65 (2.11-3.33) |
|               | Does not believe they are at risk for COVID-19 | 35.7 | 83.2 | 0.58 (0.42-0.80) |
|               | Has \(\geq\) 1 chronic health condition\(^b\) | 84.3 | 76.3 | 1.19 (1.07-1.33) |
|               | Asian (vs other race) | 93.1 | 70.1 | 1.25 (1.14-1.37) |
| Age, y\(^c\) | 18-29 |
|               | Trusts COVID-19 information from public health experts | 86.1 | 37.8 | 1.60 (1.09-2.36) |
|               | Believes that COVID-19 side effects are likely to be worse than COVID-19 | 43.8 | 81.0 | 0.58 (0.42-0.81) |
|               | Educational materials\(^e\) | 84.5 | 34.4 | 2.00 (1.29-3.09) |
|               | Asian (vs other race) | 89.5 | 67.1 | 1.48 (1.13-1.81) |
|               | 30-49 |
|               | Trusts COVID-19 information from public health experts | 92.4 | 38.7 | 2.06 (1.51-2.80) |
|               | Educational materials\(^e\) | 87.8 | 50.0 | 1.28 (1.03-1.58) |
|               | Asian (vs other race) | 90.9 | 71.7 | 1.34 (1.12-1.59) |
|               | \(\geq\) 50 |
|               | Trusts COVID-19 information from public health experts | 94.3 | 33.3 | 2.72 (1.61-4.62) |
|               | Asian (vs other race) | 92.2 | 71.6 | 1.20 (1.05-1.37) |
| Gender\(^d\) | Male |
|               | Trusts COVID-19 information from public health experts | 90.2 | 32.2 | 2.57 (1.77-3.72) |
|               | Does not believe they are at risk for COVID-19 | 36.7 | 80.2 | 0.71 (0.49-1.03) |
|               | Has \(\geq\) 1 chronic health condition\(^b\) | 87.5 | 72.3 | 1.12 (1.00-1.25) |
|               | Asian (vs other race) | 89.6 | 66.9 | 1.19 (1.05-1.34) |
|               | Female |
|               | Trusts COVID-19 information from public health experts | 92.7 | 43.3 | 1.83 (1.35-2.47) |
|               | Does not believe they are at risk for COVID-19 | 40.0 | 81.8 | 0.66 (0.42-0.85) |
|               | Educational materials\(^e\) | 92.1 | 51.4 | 1.38 (1.10-1.73) |
|               | Asian (vs other race) | 84.6 | 76.5 | 1.22 (1.04-1.44) |
|               | \(\geq\) 50 |
|               | Trusts COVID-19 information from public health experts | 85.5 | 71.7 | 1.17 (1.03-1.34) |
| Race and ethnicity\(^f\) | Hispanic |
|               | Trusts COVID-19 information from public health experts | 85.3 | 32.1 | 1.97 (1.33-2.91) |
|               | Does not believe they are at risk for COVID-19 | 20.8 | 76.8 | 0.37 (0.18-0.77) |
|               | Educational materials\(^e\) | 81.8 | 36.7 | 1.51 (1.10-2.10) |
|               | \(\geq\) Bachelor’s degree | 84.0 | 66.7 | 1.20 (1.01-1.44) |
|               | Asian (vs other race) | 87.0 | 66.5 | 1.34 (1.11-1.62) |
|               | White |
|               | Trusts COVID-19 information from public health experts | 92.9 | 35.0 | 2.73 (1.51-4.94) |
|               | Asian |
|               | Trusts COVID-19 information from public health experts | 97.4 | 56.8 | 1.52 (1.16-2.00) |
|               | Educational materials\(^e\) | 97.3 | 62.8 | 1.31 (1.06-1.60) |
|               | Other\(^g\) |
|               | Trusts COVID-19 information from public health experts | 95.5 | 13.0 | 7.93 (3.83-16.42) |

\(^a\)Asian race, college education, age \(\geq 50\) years, and \(\geq 1\) chronic health condition were forced in the model to control for these variables; these are listed only if they were also strong determinants.

\(^b\)Chronic health conditions included diabetes, hypertension, heart failure, chronic obstructive pulmonary disease, obesity, heart disease, and chronic kidney disease.

\(^c\)Only 3 unvaccinated workers were aged \(\geq 65\) years, so this category was not included.

\(^d\)The sample size was too small to stratify on respondents aged \(\geq 65\) years and on gender categories other than male and female.

\(^e\)Would like to read educational materials on COVID-19 before deciding whether to get the vaccine.

\(^f\)Some participants in the White, Asian, and Other race categories also responded that they were Hispanic.

\(^g\)Other race includes Black, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, or preferred not to provide their race.
workers who were not concerned about the cost of the vaccine, reported that they would be more likely to receive the vaccine if offered an incentive.

Of 73 workers from site B who received the COVID-19 vaccine at their worksite, 63 (86.3%) completed a short survey after receiving the vaccine. Twenty-eight (44.4%) said that they would probably or definitely have gotten vaccinated if the vaccine had not been offered at their workplace, and 42 (66.7%) said that getting the vaccine for free was the best part of the vaccine experience. Workers who received the vaccine at their worksite were primarily aged <30 years (n = 42, 44.4%) or 30-49 years (n = 19, 30.2%), followed by ≥50 years (n = 16, 25.4%). The racial distribution was 63.0% Hispanic, 23.6% Asian, 6.4% White, 4.8% Black, and 4.8% other races.

Discussion

Our findings add to knowledge about COVID-19 by affirming that factors that influence COVID-19 vaccine acceptance in various groups also affect acceptance among essential non-health care workers. Having trust in COVID-19 vaccine information from public health experts, having ≥1 chronic health condition, and self-identifying as Asian were among the strongest factors that positively influenced vaccine acceptance among unvaccinated workers; believing that they were not at risk for COVID-19 negatively influenced vaccine acceptance. This information can be used to inform public health workplace strategies to increase vaccine acceptance.

Trust was also identified as a factor that influenced vaccine acceptance in other studies. In a recent online national survey, trust in public health officials was associated with COVID-19 vaccine acceptance. Eighty percent of respondents who had trust in public health officials, as compared with 21.3% of those who did not have trust in public health officials, reported being likely to receive the vaccine. An online survey of dental students found that trust in COVID-19 vaccine information from public health experts was associated with vaccine acceptance. Hardt et al suggest that effective culturally appropriate provaccine messaging be tailored to the local vaccine community to improve trust and uptake among vaccine-hesitant populations.

In our study, vaccine-hesitant workers who had trust in COVID-19 vaccine information from public health experts were more likely than vaccine-hesitant workers who did not have trust in COVID-19 vaccine information from public health experts to report that they would get vaccinated if an incentive were offered. Previous studies showed that mistrust of vaccine information from public health experts is affected by misinformation from various sources, including mainstream media and social media. Misinformation about the vaccine was common among unvaccinated workers at the 2 worksites. Provaccine messaging with accurate information on social media and local news should be included in campaigns to increase trust and vaccine uptake.

Limitations

Our study had several limitations. First, our rapid survey included workers at manufacturing corporations that have had COVID-19 outbreaks. Additionally, this sampled population primarily consisted of Hispanic and Asian workers; the proportion of workers who were Black or White was small. Thus, the results may not be generalizable to workers in other geographic areas, among other racial and ethnic groups, or at worksites without a previous COVID-19 outbreak. Second, not all workers participated in the survey; therefore, self-selection bias may have occurred. The participation rates differed between the worksites (60% vs 81%). This variation in participation may reflect differences in attitudes and cultures at each site. Workers who did not participate may also have had different attitudes about the vaccine than those who did participate. If vaccine-hesitant workers who did not have trust in vaccine information from public health experts were less likely to participate than vaccine-hesitant workers who did have trust in vaccine information, then the influence of trusting vaccine information...
Conclusions

Young and Hispanic workers were more likely to be vaccine-hesitant than other workers in spring 2021. Offering incentives such as administering vaccines at the workplace, paid time off, and gift cards may be an efficient approach to increasing vaccine uptake among essential non–health care workers. Trust in public health experts about COVID-19 vaccines was a key factor that consistently influenced vaccine acceptance. Future public health efforts to increase COVID-19 vaccine acceptance among non–health care workers should focus on improving public trust and confidence in the vaccine, debunking misinformation about its side effects and cost, and raising public awareness that the vaccine is free to all people in the United States.

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