


Prevalence of Previous COVID-19 Infection, COVID-19 Vaccination Receipt, and Intent to Vaccinate Among the US Workforce

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Abstract

Objective: As COVID-19 vaccines become more accessible to all people in the United States, more employees are returning to the workforce or switching to in-person work. However, limited information is available on vaccination coverage and intent among the US workforce.

Methods: We used data from the US Census Bureau's Household Pulse Survey, fielded during April 14–May 24, 2021 (N = 218 787), to examine the prevalence of previous COVID-19 infection, vaccination receipt, and intent to vaccinate by essential worker status and employment type. In addition, we analyzed factors associated with vaccination receipt and reasons for not getting vaccinated.

Results: More than 15% of the US workforce had a previous diagnosis of COVID-19, and 73.6% received ≥ 1 dose of COVID-19 vaccine; however, 12.4% reported that they probably will not or definitely will not get vaccinated. Vaccination coverage (range, 63.8%–78.3%) was lowest and non-intent to get vaccinated (12.9%–21.7%) was highest among self-employed adults across all essential and nonessential worker groups. Factors associated with receipt of vaccination were age, race, Hispanic ethnicity, educational attainment, annual household income, health insurance status, and previous COVID-19 diagnosis. The main reasons for not getting vaccinated were concerns about possible side effects and waiting and seeing if the vaccine is safe.

Conclusion: Identifying and addressing disparities in COVID-19 vaccination coverage in the US workforce can protect groups with low vaccine coverage and increase understanding of reasons for vaccine hesitancy. Educating employees about the vaccine and its potential side effects, promoting a culture of health and safety in the workplace, and building social norms around vaccination can help create a safe work environment for all employees and their families.

Keywords

COVID-19 vaccine, vaccine hesitancy, vaccine confidence, employment, essential workers

As COVID-19 vaccines become more readily available to all people in the United States,¹ more businesses have begun to reopen and more people are returning to the workplace or switching to in-person work (as opposed to working from home).^{2,3} The Centers for Disease Control and Prevention (CDC) has provided guidance for safely reopening businesses, such as actively encouraging sick employees to stay home, developing flexible policies for scheduling and telework (if feasible), promoting frequent handwashing, performing routine environmental cleaning, and providing education and training materials in easy-to-understand formats.⁴ According to CDC, COVID-19 vaccination is the number-one preventive strategy to protect all individuals,

including employees and the people with whom they interact, from developing severe health outcomes.^{5,6}

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As of February 1, 2022, more than 72 million COVID-19 cases in the United States have occurred, with the rise in cases in winter 2021 due to highly transmissible COVID-19 variants. However, 12% of US adults had not received any COVID-19 vaccinations and 26% were not fully vaccinated as of February 2022.¹ Little is known about COVID-19 prevalence, vaccination status, and intent to vaccinate among the US workforce. Previous studies⁷⁻¹¹ have mainly focused on essential workers—those who conduct a range of operations and services to ensure the continuity and viability of critical infrastructure functions^{12,13}—who received prioritization for early COVID-19 vaccination.¹⁴ Essential workers are more likely than nonessential workers to be exposed to COVID-19 and face a greater risk of severe illness and death from COVID-19 because their jobs require frequent or close contact with coworkers and/or the public and involve tasks that cannot be performed from home.^{7,8} Prior to the first Emergency Use Authorization of COVID-19 vaccines in the United States,¹⁵ studies found that less than half of essential workers (eg, health care workers) planned to get vaccinated.^{9,10} Despite the vaccine being available now to all adults,¹⁶ little is known about vaccination status and intent among workers overall, or by essential worker status and employment type, nor has this topic been thoroughly investigated through the use of a large, nationally representative survey of US adults.

As more businesses are reopening and more employees are returning to the workforce or switching to in-person work, understanding disparities and gaps in vaccination coverage and intent to get vaccinated among the US workforce will be instrumental in the design of strategies to safely reopen workplaces, the planning of interventions among groups with low rates of vaccine coverage or intent, and the development of relevant messages to increase vaccine confidence and uptake in this population. To our knowledge, our study is among the first studies to use a large, nationally representative household survey of US adults to examine COVID-19 vaccination coverage and intent to be vaccinated by essential worker status and employment type.

Methods

Survey Design

We used data from the Household Pulse Survey (HPS), a large, nationally representative household survey conducted by the US Census Bureau since April 2020 to help understand household experiences during the COVID-19 pandemic.¹⁷ The study design has been described previously.¹⁸ We combined data from 3 data collection cycles (April 14-26, April 28–May 10, and May 12-24, 2021) for this study (N = 218 787), with response rates from 6.6% to 7.4%.¹⁹ Our study was reviewed by the Tufts University Health Sciences Institutional Review Board and was not considered to be human subjects research.

COVID-19 Questions

The HPS asks questions about COVID-19 diagnosis, receipt of ≥ 1 dose of COVID-19 vaccine, intent to be vaccinated in the future, and reasons for not intending to be vaccinated. COVID-19 diagnosis was assessed by the following question: “Has a doctor or other health care provider ever told you that you have COVID-19?” Response options were yes, no, and not sure. Receipt of COVID-19 vaccine (≥ 1 dose) was assessed with the following yes/no question: “Have you received a COVID-19 vaccine?” Among unvaccinated adults, intent to be vaccinated was assessed with the following question: “Once a vaccine to prevent COVID-19 is available to you, would you . . . definitely, probably, be unsure about, probably not, or definitely not get(ting) a vaccine.” Because the vaccination intent questions were asked only of people who were not vaccinated or did not plan to be fully vaccinated, measuring intent over time would show bias as more people get vaccinated (reducing the sample size of people who are asked about intent). To reduce this potential for bias, vaccination intent was assessed among everyone in the sample, including those who were vaccinated.²⁰ Responses were categorized as follows: definitely and probably will get vaccinated, unsure about getting vaccinated, and probably and definitely will not get vaccinated.

Unvaccinated respondents who did not definitely intend to get vaccinated were asked reasons for not getting vaccinated: “Which of the following, if any, are reasons that you [probably will/are unsure about/probably won’t/definitely won’t] get a COVID-19 vaccine?” Response options were (1) I am concerned about possible side effects of a COVID-19 vaccine, (2) I don’t know if a COVID-19 vaccine will work, (3) I don’t believe I need a COVID-19 vaccine, (4) I don’t like vaccines, (5) My doctor has not recommended it, (6) I plan to wait and see if it is safe and may get it later, (7) I think other people need it more than I do right now, (8) I am concerned about the cost of a COVID-19 vaccine, (9) I don’t trust COVID-19 vaccines, (10) I don’t trust the government, and (11) other. Respondents could select all options that applied. These questions underwent expert review at the US Census Bureau and federal partner agencies, as well as cognitive testing in laboratories at CDC’s National Center for Health Statistics.

Employment

Employment status was assessed by the following yes/no question: “In the last 7 days, did you do any work for either pay or profit?” Employment type was assessed by the following question: “Are you employed by the government, by a private company, a nonprofit organization, or are you self-employed or working in a family business?” Response options were (1) government; (2) private company; (3) nonprofit organization, including tax-exempt and charitable organizations; (4) self-employed; or (5) working in a family business. Because of small sample sizes, data for respondents who

worked in a family business were combined with data for respondents who were self-employed.

Essential Worker Groups

Essential worker status was assessed by the following yes/no question: “In the last 7 days, have you worked or volunteered outside your home?” If respondents answered yes, they were asked the following question: “Since January 1, 2021, which best describes the primary location/setting where you worked or volunteered outside your home?” Based on definitions established by the US Department of Homeland Security’s Cybersecurity and Infrastructure Security Agency and CDC,^{12,13} respondents were categorized as health care personnel if they reported 1 of the following 3 primary locations/work settings: (1) health care (eg, hospital, doctor, dentist or mental health specialist office, outpatient facility, long-term care, home health care, pharmacy, medical laboratory); (2) social service (eg, child, youth, family, elderly, disability services); or (3) death care (eg, funeral home, crematory, cemetery). Respondents were categorized as non-health care frontline essential workers if they reported 1 of the following 10 work settings: (1) education (prekindergarten, kindergarten–12th grade) or childcare; (2) other education (eg, business or technical school, college, university); (3) first responder (eg, police or fire protection, emergency relief services); (4) correctional facility (eg, jail, prison, detention center, reformatory); (5) food and beverage store (eg, grocery store, warehouse club, supercenter, convenience store, specialty food store, bakery, liquor store); (6) agriculture, forestry, fishing, or hunting; (7) food manufacturing facility (eg, meat processing, produce packing, food or beverage manufacturing); (8) non-food manufacturing facility (eg, metals, equipment and machinery, electronics); (9) public transit (eg, bus, commuter rail, subway, school bus); or (10) US Postal Service. Respondents were categorized as “other essential workers” if they reported that they were employed in another work setting classified as essential during the COVID-19 pandemic. Although not specified in the survey, these categories may include workers in transportation and logistics, food service, energy, water and wastewater, shelter and housing, public safety, information technology and communication, news media, public safety, public health, finance, legal, and others.¹² Respondents who were health care personnel, frontline, or other essential workers were categorized as essential workers. All other respondents were categorized as nonessential workers if they reported other work settings not classified as essential or if they reported that they currently work for either pay or profit but did not work or volunteer outside the home.

Sociodemographic Variables

We assessed the following sociodemographic variables: age group, sex, race, Hispanic ethnicity, educational attainment,

annual household income, health insurance status, and previous COVID-19 diagnosis. Age was categorized as 18–49, 50–64, and ≥ 65 years. Race and Hispanic ethnicity were categorized as non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic Asian; those who reported more than 1 race were categorized as non-Hispanic “other”/multiple races. The “other” category included American Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, and Other. Educational attainment was categorized as \leq high school, some college or college graduate, and $>$ college graduate. Annual household income was categorized as $<$ \$35 000, \$35 000–\$49 999, \$50 000–\$74 999, \geq \$75 000, or not reported. Health insurance status was defined as having or not having health insurance.

Analysis

We analyzed COVID-19 diagnosis, vaccination receipt, and intent to be vaccinated by essential worker status, with stratification by employment type. In addition, we examined factors associated with vaccination coverage from multivariable regression models and reasons for not vaccinating by essential worker status and stratified by employment type. We conducted Wald χ^2 tests to assess differences between essential worker groups and employment type, with a .004 significance level to adjust for multiple comparisons (12 groups). Analyses accounted for the survey design in SAS version 9.4 (SAS Institute, Inc) and Stata version 16.1 (StataCorp LLC). Missing data accounted for 0.1% to 1.5% of all variables in the study and were removed from analyses. Unless otherwise noted, all reported findings in the text were significant.

Results

Among respondents who were employed, 15.2% had a previous diagnosis of COVID-19, compared with 12.0% among those who were not employed (Table 1). Approximately 74% of employed adults received ≥ 1 dose of COVID-19 vaccine; however, 12.4% reported that they probably will not or definitely will not get vaccinated (Table 1 and Figure). Among essential workers, vaccination coverage was highest among health care personnel (80.7%) and lowest among other (non-health care personnel and non-frontline essential) workers (65.2%). Among essential and nonessential workers, vaccination coverage was highest among nonprofit organizations (80.0%–82.9%), followed by government (78.5%–78.8%) and private companies (69.7%–75.6%), and lowest among self-employed individuals (66.7%–69.4%). Similarly, reluctance to get vaccinated (adults who were probably or definitely not likely to be vaccinated) was highest among the self-employed among essential (19.3%) and nonessential (14.1%) workers.

Among all essential workers, adults aged 50–64 years (adjusted prevalence ratio [aPR] = 1.17; 95% CI, 1.15–1.20) and adults aged ≥ 65 years (aPR = 1.27; 95% CI, 1.23–1.30)

Table 1. Prevalence of prior COVID-19 infection, vaccination coverage, and intention to vaccinate, by employment type and essential worker categories, United States, April 14–May 24, 2021^a

Category	Unweighted no. (%)	Ever had COVID-19	COVID-19 vaccination (≥1 dose)	% (95%CI)		
				Definitely/probably	Unsure	Probably not/definitely not
Employment status^b						
Employed	131 027 (58.5)	15.2 (14.8-15.6)	73.6 (73.1-74.1) ^c	7.9 (7.6-8.3) ^c	6.0 (5.7-6.3) ^c	12.4 (12.0-12.8) ^c
Not employed	87 760 (41.5)	12.0 (11.4-12.5)	74.3 (73.8-74.8) ^c	9.2 (8.9-9.7) ^c	6.4 (6.1-6.7) ^c	10.0 (9.5-10.5) ^c
Essential workers^d						
Nonprofit organization	9 679 (15.7)	16.1 (14.2-18.1)	82.9 (80.5-85.0) ^c	4.1 (3.2-5.3) ^c	3.8 (3.1-4.7) ^c	9.2 (7.5-11.2) ^c
Government	12 429 (20.1)	16.7 (15.4-18.2)	78.8 (77.1-80.4) ^c	4.4 (3.8-5.2) ^c	4.8 (4.0-5.7) ^c	12.0 (10.7-13.4) ^c
Private company	32 942 (53.4)	17.4 (16.6-18.2)	69.7 (68.7-70.7) ^c	7.9 (7.2-8.5) ^c	7.0 (6.3-7.8) ^c	15.5 (14.7-16.2) ^c
Self-employed	6 651 (10.8)	14.5 (12.8-16.4)	66.7 (64.3-69.0) ^c	7.4 (6.3-8.8) ^c	6.5 (5.2-8.1) ^c	19.3 (17.3-21.5) ^c
Health care personnel^f						
Nonprofit organization	5 304 (24.8)	16.1 (14.4-17.8)	86.3 (84.1-88.5) ^c	2.6 (1.8-3.6) ^c	3.4 (2.6-4.4) ^c	7.8 (5.8-9.8) ^c
Government	2 071 (10.0)	17.6 (14.3-20.9)	80.6 (76.7-84.5) ^c	3.3 (2.1-5.1) ^c	4.6 (3.2-6.5) ^c	11.5 (8.3-14.8) ^c
Private company	9 673 (56.5)	19.4 (17.7-21.1)	80.1 (78.8-81.3) ^c	4.3 (3.5-5.1) ^c	5.3 (4.5-6.4) ^c	10.3 (9.2-11.4) ^c
Self-employed	1 961 (8.6)	17.5 (13.6-21.4)	78.3 (74.2-82.5) ^c	4.3 (3.1-5.9) ^c	4.1 (2.6-6.4) ^c	12.9 (8.9-17.0) ^c
Frontline essential workers^g						
Nonprofit organization	23 953 (30.4)	16.7 (15.8-17.7)	70.7 (69.5-71.8) ^e	8.2 (7.5-9.0) ^e	6.5 (5.9-7.2)	14.6 (13.7-15.5)
Government	35 111 (9.9)	16.1 (11.9-20.3)	80.0 (75.4-84.6) ^c	5.3 (3.6-8.0) ^c	3.8 (2.6-5.6)	10.8 (6.6-15.0)
Private company	7 705 (24.3)	16.8 (15.0-18.5)	79.6 (77.9-81.3) ^c	4.6 (3.6-5.8) ^c	4.5 (3.6-5.7)	11.2 (9.9-12.6)
Self-employed	10 624 (55.8)	16.3 (13.1-17.5)	68.6 (66.7-70.5) ^c	8.2 (7.2-9.3) ^c	7.1 (6.0-8.4)	16.1 (14.7-17.5)
Other essential workers ^h	21 113 (10.0)	12.9 (10.5-15.4)	64.1 (59.6-68.5) ^c	7.4 (5.1-10.6) ^c	7.7 (5.5-10.6)	21.7 (17.4-26.1)
Other essential workers^h						
Nonprofit organization	18 739 (24.8)	16.9 (15.8-18.0)	65.2 (64.0-66.4) ^e	9.6 (8.7-10.6)	7.7 (7.0-8.6)	17.5 (16.3-18.6)
Government	864 (3.6)	15.4 (11.5-19.3)	74.7 (67.2-82.3) ^c	7.9 (4.9-12.5)	6.2 (3.7-10.4)	11.1 (6.3-16.0)
Private company	2 653 (11.0)	16.1 (12.7-19.5)	75.5 (72.0-79.0) ^c	4.8 (3.4-6.7)	5.6 (4.0-7.7)	14.1 (10.4-17.8)
Self-employed	12 645 (71.3)	17.2 (15.9-18.5)	64.8 (63.1-66.6) ^c	9.6 (8.5-10.7)	7.9 (6.9-8.9)	17.8 (16.4-19.1)
Nonessential workersⁱ						
Nonprofit organization	2 577 (14.1)	14.5 (11.9-17.1)	63.8 (60.4-67.1) ^c	7.1 (5.4-9.2)	7.1 (4.7-10.6)	20.1 (17.4-22.9)
Government	68 387 (50.4)	13.7 (13.1-14.3)	74.9 (74.2-75.6) ^e	8.9 (8.4-9.5) ^e	5.8 (5.5-6.2) ^e	10.3 (9.7-10.8) ^e
Private company	6 740 (10.0)	12.2 (10.5-14.1)	80.2 (78.1-82.3) ^c	6.4 (5.2-7.9) ^c	5.0 (4.0-6.2) ^c	8.2 (6.6-10.3) ^c
Self-employed	8 846 (13.1)	13.1 (11.8-14.5)	78.5 (76.7-80.2) ^c	6.0 (4.9-7.3) ^c	6.1 (5.2-7.3) ^c	9.3 (8.0-10.8) ^c
Private company	39 452 (58.6)	13.8 (13.1-14.4)	75.6 (74.6-76.5) ^c	9.4 (8.7-10.1) ^c	5.5 (5.1-6.0) ^c	9.5 (8.8-10.3) ^c
Self-employed	12 260 (18.2)	13.9 (12.5-15.3)	69.4 (67.5-71.3) ^c	9.8 (8.4-11.4) ^c	6.7 (5.6-7.8) ^c	14.1 (12.9-15.4) ^c

^aData source: US Census Bureau's Household Pulse Survey, fielded during April 14–May 24, 2021 (N = 218 787).¹⁷ All percentages were weighted. Sum of unweighted N of employment type within each essential worker group may not be equal to the total because of missing responses to the question on type of work.

^bEmployment or volunteer status as of January 1, 2021.

^cP < .001 for difference among employment types; determined by Wald χ^2 test; P < .004 considered significant.

^dRespondents who were health care personnel, frontline, or other essential worker groups were categorized as essential workers.

^eP < .001 for difference among essential worker groups; determined by Wald χ^2 test; P < .004 considered significant.

^fRespondents were categorized as health care personnel if their response was in 1 of the following 3 primary locations/work settings: (1) health care (eg, hospital, doctor, dentist or mental health specialist office, outpatient facility, long-term care, home health care, pharmacy, medical laboratory); (2) social service (eg, child, youth, family, elderly, disability services); or (3) death care (eg, funeral home, crematory, cemetery).

^gRespondents were categorized as non-health care frontline essential workers if they replied with 1 of the following 10 settings: (1) education (pre-kindergarten, kindergarten–12th grade school) or childcare; (2) other education (eg, business or technical school, college, university); (3) first response (eg, police or fire protection, emergency relief services); (4) correctional facility (eg, jail, prison, detention center, reformatory); (5) food and beverage store (eg, grocery store, warehouse club, supercenter, convenience store, specialty food store, bakery, liquor store); (6) agriculture, forestry, fishing, or hunting; (7) food manufacturing facility (eg, meat processing, produce packing, food or beverage manufacturing); (8) non-food manufacturing facility (eg, metals, equipment and machinery, electronics); (9) public transit (eg, bus, commuter rail, subway, school bus); or (10) US Postal Service.

^hRespondents were categorized as other essential workers if they reported they were employed in another work setting classified as essential during the COVID-19 pandemic. Although not specified in the survey, these categories may include workers in transportation and logistics, food service, energy, water and wastewater, shelter and housing, public safety, information technology and communication, news media, public safety, public health, finance, legal, and others.

ⁱRespondents were categorized as nonessential workers if they reported other work settings not classified as essential or if they reported that they currently work for either pay or profit but did not work or volunteer outside the home.

were more likely to be vaccinated than adults aged 18-49 years. Adults who were Hispanic (aPR = 1.14; 95% CI, 1.01-1.18) or non-Hispanic Asian (aPR = 1.20; 95% CI, 1.17-1.22) were more likely to be vaccinated than non-Hispanic White adults, while adults who were non-Hispanic other

races or multiple races (aPR = 0.92; 95% CI, 0.86-0.98) were less likely to be vaccinated than non-Hispanic White adults. Adults with at least some college (vs ≤high school), higher annual household incomes (\$35 000-\$49 999, \$50 000-\$74 999, and ≥\$75 000 vs <\$35 000), and no previous COVID-19

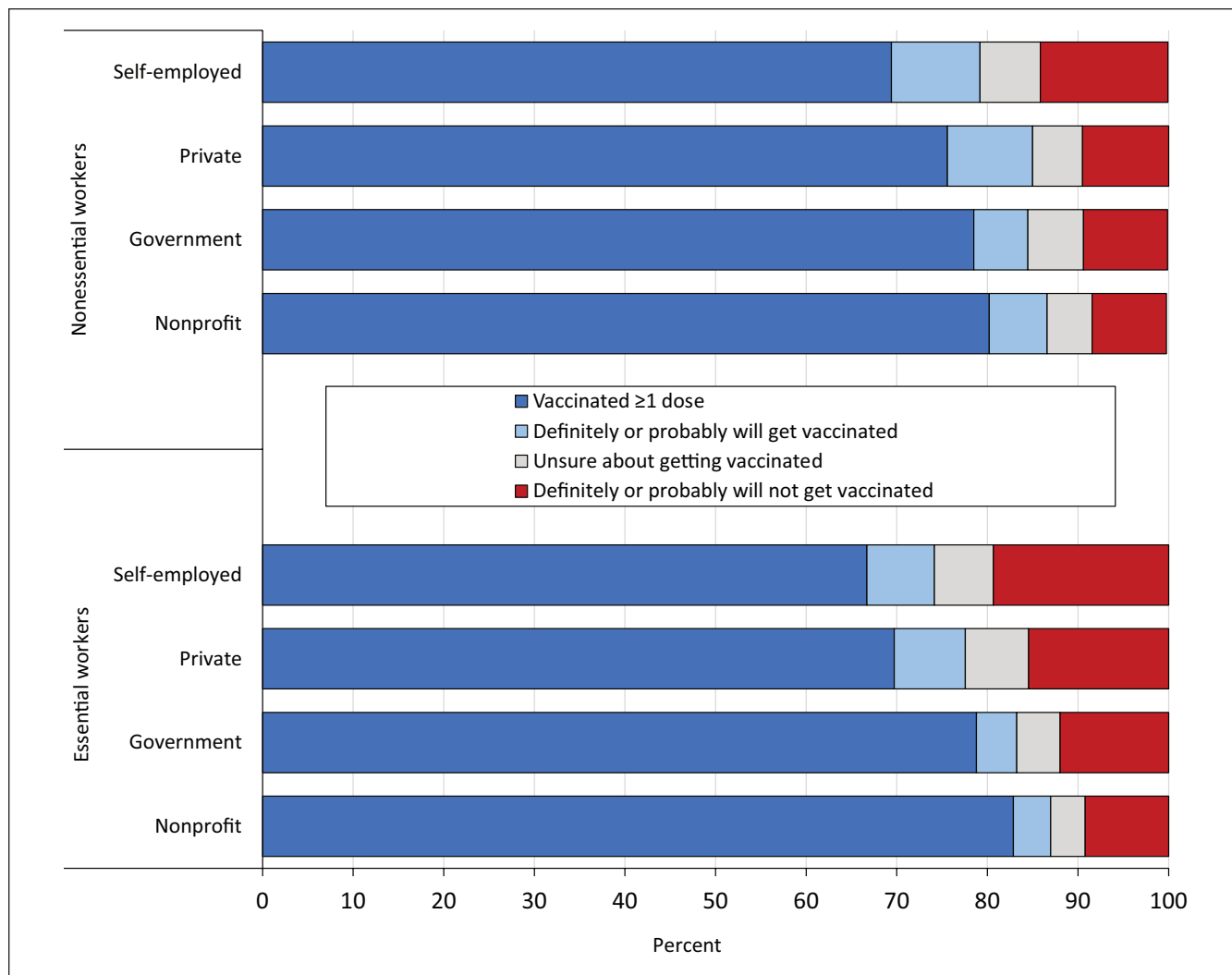


Figure. COVID-19 vaccination coverage (≥ 1 dose), by essential worker status and employment type, United States. Data source: US Census Bureau’s Household Pulse Survey, fielded during April 14–May 24, 2021 (N = 218 787).¹⁷

diagnosis (vs a previous COVID-19 diagnosis) were more likely to be vaccinated, and adults without health insurance (aPR = 0.75; 95% CI, 0.71-0.80) were less likely than adults with health insurance to be vaccinated. Findings were similar among nonessential workers and by employment type (Table 2).

Across all employment types and essential worker status, the main reasons for not getting vaccinated were concerns about possible side effects (48.2%-60.4%), the desire to wait and see if the vaccine is safe (34.7%-50.7%), lack of trust in COVID-19 vaccines (29.9%-37.5%), lack of trust in the government (22.8%-33.4%), and the belief that a COVID-19 vaccine is not needed (17.8%-31.0%) (Table 3). The percentage of those who reported that they did not trust the government and did not believe a vaccine was needed as a reason for not being vaccinated was higher among self-employed adults than among adults with other types of employment.

Discussion

Despite the higher prevalence of previous COVID-19 infection among employed adults than among unemployed adults, approximately 1 in 4 adults had not received any doses of the COVID-19 vaccine and 1 in 8 adults were reluctant to get vaccinated (probably will not or definitely will not get vaccinated). Furthermore, despite being prioritized for early vaccination and their increased risk of exposure, only 65.2% of other (non-health care personnel) essential workers had received ≥ 1 dose of the COVID-19 vaccine, which is even lower than vaccination coverage among nonessential workers (74.9%), and reluctance toward vaccination was higher among essential workers (14.6%) than among nonessential workers (10.3%). Across all essential and nonessential groups, adults who were self-employed had the lowest vaccination coverage and were more likely to be reluctant toward

Table 2. Characteristics associated with vaccination coverage, by essential worker status, and stratified by employment type, United States, April 14–May 24, 2021^a

Characteristic	Essential workers ^b					Nonessential workers ^d				
	All essential	Nonprofit organization	Government	Private	Self-employed	All nonessential	Nonprofit organization	Government	Private	Self-employed
Age group, y										
18-49	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
50-64	1.17 (1.15-1.20)	1.10 (1.07-1.13)	1.10 (1.06-1.15)	1.19 (1.16-1.23)	1.28 (1.20-1.37)	1.17 (1.15-1.19)	1.10 (1.05-1.15)	1.12 (1.07-1.18)	1.15 (1.13-1.18)	1.39 (1.29-1.50)
≥65	1.27 (1.23-1.30)	1.13 (1.09-1.18)	1.11 (0.97-1.05)	1.35 (1.29-1.41)	1.35 (1.24-1.04)	1.27 (1.25-1.30)	1.14 (1.08-1.20)	1.20 (1.13-1.28)	1.26 (1.23-1.30)	1.56 (1.44-1.68)
Sex										
Male	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Female	1.03 (1.01-1.05)	0.98 (0.94-1.01)	1.01 (0.97-1.05)	1.04 (1.01-1.07)	0.96 (0.89-1.04)	0.98 (0.96-1.00)	1.02 (0.98-1.07)	0.98 (0.94-1.21)	0.97 (0.95-1.00)	1.00 (0.95-1.07)
Race and ethnicity										
Non-Hispanic White	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Non-Hispanic Black	0.97 (0.92-1.01)	0.87 (0.79-0.96)	0.94 (0.87-1.01)	0.99 (0.93-1.05)	1.05 (0.90-1.41)	0.95 (0.91-0.99)	0.84 (0.76-0.93)	0.96 (0.90-1.03)	0.95 (0.89-1.01)	0.96 (0.85-1.09)
Hispanic	1.14 (1.01-1.18)	1.03 (0.96-1.10)	1.05 (0.98-1.12)	1.18 (1.12-1.23)	1.20 (1.07-1.36)	1.06 (1.02-1.10)	0.97 (0.89-1.05)	1.03 (0.96-1.11)	1.08 (1.03-1.13)	1.08 (0.95-1.21)
Non-Hispanic Asian	1.20 (1.17-1.22)	1.04 (0.96-1.11)	1.12 (1.06-1.19)	1.25 (1.22-1.29)	1.29 (1.14-1.45)	1.12 (1.10-1.14)	1.07 (1.00-1.14)	1.08 (1.02-1.14)	1.11 (1.08-1.13)	1.30 (1.21-1.39)
Non-Hispanic "other"/multiple races ^c	0.92 (0.86-0.98)	0.88 (0.76-1.03)	0.95 (0.85-1.06)	0.93 (0.86-1.01)	0.86 (0.72-1.03)	0.96 (0.90-1.01)	1.04 (0.93-1.16)	0.99 (0.88-1.12)	0.92 (0.86-0.98)	1.01 (0.84-1.22)
Educational attainment										
≤High school	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Some college or college graduate	1.20 (1.15-1.24)	1.08 (0.99-1.18)	1.14 (1.06-1.23)	1.19 (1.14-1.24)	1.24 (1.09-1.22)	1.16 (1.12-1.20)	1.23 (1.08-1.40)	1.12 (1.01-1.25)	1.13 (1.09-1.19)	1.18 (1.10-1.26)
>College graduate	1.35 (1.31-1.40)	1.16 (1.05-1.28)	1.28 (1.19-1.37)	1.35 (1.30-1.41)	1.38 (1.24-1.54)	1.27 (1.22-1.31)	1.30 (1.15-1.47)	1.24 (1.12-1.38)	1.23 (1.18-1.28)	1.29 (1.21-1.40)
Annual household income, \$										
<35 000	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
35 000-49 999	1.04 (0.99-1.09)	1.06 (0.95-1.18)	0.96 (0.84-1.10)	1.04 (0.98-1.11)	1.02 (0.86-1.21)	1.03 (0.97-1.09)	1.17 (1.03-1.33)	1.00 (0.83-1.21)	1.02 (0.94-1.10)	1.01 (0.88-1.16)
50 000-74 999	1.05 (1.00-1.11)	1.09 (0.99-1.21)	1.05 (0.94-1.10)	1.04 (0.98-1.11)	1.02 (0.88-1.19)	1.10 (1.05-1.15)	1.14 (1.03-1.26)	1.16 (1.04-1.30)	1.08 (1.02-1.15)	1.11 (1.01-1.21)
≥75 000	1.13 (1.09-1.18)	1.10 (1.00-1.22)	1.12 (1.02-1.23)	1.14 (1.09-1.19)	1.11 (0.99-1.25)	1.15 (1.11-1.20)	1.21 (1.10-1.32)	1.23 (1.10-1.38)	1.14 (1.02-1.15)	1.09 (1.01-1.18)
Did not report	1.04 (0.99-1.09)	1.08 (0.96-1.21)	1.04 (0.92-1.18)	1.03 (0.96-1.10)	1.00 (0.86-1.16)	1.06 (1.00-1.13)	0.99 (0.84-1.16)	1.18 (1.03-1.35)	1.08 (1.02-1.15)	0.97 (0.84-1.12)
Health insurance status										
Insured	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
Not insured	0.75 (0.71-0.80)	0.79 (0.62-1.01)	0.89 (0.70-1.15)	0.77 (0.71-0.85)	0.70 (0.60-1.31)	0.80 (0.74-0.86)	0.69 (0.47-1.01)	0.63 (0.46-0.87)	0.81 (0.74-0.90)	0.87 (0.76-0.99)
Previous COVID-19 diagnosis										
Yes	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]	1 [Ref]
No	1.17 (1.13-1.21)	1.12 (1.04-1.20)	1.23 (1.13-1.34)	1.17 (1.12-1.25)	1.17 (1.04-1.31)	1.16 (1.11-1.20)	1.18 (1.06-1.31)	1.14 (1.05-1.24)	1.19 (1.13-1.25)	1.09 (0.99-1.21)
Not sure	0.82 (0.67-1.01)	0.68 (0.36-1.29)	0.98 (0.56-1.70)	0.77 (0.57-1.06)	0.98 (0.68-1.41)	0.65 (0.47-0.91)	0.93 (0.49-1.78)	0.14 (0.06-0.34)	0.77 (0.57-1.05)	0.69 (0.39-1.22)

Abbreviation: Ref, reference.

^aData source: US Census Bureau's Household Pulse Survey, fielded during April 14–May 24, 2021 (N = 218 787).¹⁷ All values are adjusted prevalence ratio (95% CI).^bRespondents who were health care personnel, frontline, or other essential worker groups were categorized as essential workers.^c"Other" category included American Indian/Alaska Native, Native Hawaiian/Other Pacific Islander, and Other.^dRespondents were categorized as nonessential workers if they reported other work settings not classified as essential or if they reported that they currently work for either pay or profit but did not work or volunteer outside the home.

vaccination. Although reasons for not getting vaccinated were similar across essential and nonessential groups, a higher proportion of adults who were self-employed reported that they did not trust the government and did not believe they needed

a COVID-19 vaccine, compared with adults in other work settings. People who are self-employed may not feel the need to get vaccinated or may not have any employer policies to get vaccinated for returning to work. Although the vaccine is

Table 3. Reasons for not getting vaccinated, by essential worker status, and stratified by employment type, United States, April 14–May 24, 2021^a

Reason	Essential workers ^b					Nonessential workers ^c				
	All essential	Nonprofit organization	Government	Private	Self-employed	All nonessential	Nonprofit organization	Government	Private	Self-employed
Concerned about possible side effects	53.5 (51.6-55.5)	60.4 (52.5-67.8)	55.2 (51.5-58.9)	52.8 (50.3-55.2)	51.2 (46.2-56.3)	49.3 (47.4-51.2)	57.4 (49.1-65.2)	51.0 (45.1-56.8)	48.2 (45.9-50.6)	49.5 (45.4-53.5)
Don't know if a vaccine will work	22.2 (20.6-23.9)	19.6 (14.8-25.4)	22.9 (18.9-27.5)	22.7 (20.8-24.7)	20.3 (16.1-25.2)	17.7 (16.4-19.0)	22.4 (16.4-29.8)	19.5 (14.5-25.7)	16.6 (15.0-18.2)	19.2 (15.8-23.0)
Don't believe I need a vaccine	28.6 (27.1-30.2)	20.8 (15.9-25.6)	28.7 (24.0-33.8)	29.0 (27.3-30.8)	31.0 (25.8-36.8)	21.4 (19.9-22.9)	17.8 (12.6-24.6)	21.6 (17.3-26.6)	20.5 (18.7-22.4)	25.3 (22.0-28.8)
Don't like vaccines	12.0 (10.7-13.5)	16.6 (11.3-23.6)	12.1 (8.1-17.8)	11.2 (9.7-13.0)	14.3 (11.1-18.3)	11.2 (10.1-12.3)	15.1 (10.0-22.0)	15.9 (11.2-22.1)	9.3 (8.0-10.8)	13.9 (10.9-17.5)
Doctor has not recommended it	6.3 (5.4-7.2)	5.1 (3.1-8.2)	6.8 (3.8-11.8)	6.4 (5.4-7.5)	5.9 (4.1-8.3)	5.5 (4.5-6.6)	10.1 (5.3-18.4)	7.0 (3.6-13.3)	5.1 (4.1-6.4)	5.0 (3.7-6.7)
Plan to wait and see if it is safe	42.1 (40.6-43.6)	50.7 (44.6-56.8)	45.9 (42.1-49.7)	41.7 (39.9-43.5)	34.7 (30.6-39.1)	43.9 (42.5-45.4)	50.1 (42.2-58.0)	48.6 (42.5-54.7)	42.9 (40.6-45.2)	43.6 (40.2-47.0)
Other people need it more right now	18.4 (16.9-19.9)	16.2 (11.8-21.9)	18.1 (13.9-23.1)	19.5 (17.7-21.5)	14.6 (11.4-18.4)	17.7 (16.2-19.3)	13.4 (9.2-19.0)	20.2 (14.8-27.0)	17.1 (15.7-18.7)	19.2 (15.7-23.2)
Concerned about the cost	3.4 (2.7-4.2)	4.2 (1.7-10.2)	4.1 (1.6-10.2)	3.4 (2.7-4.2)	1.9 (1.2-2.9)	4.2 (3.3-5.3)	7.3 (3.2-15.7)	7.0 (3.3-14.4)	3.5 (2.6-4.8)	4.3 (2.3-7.8)
Don't trust COVID-19 vaccines	34.4 (32.9-36.0)	34.1 (27.4-41.5)	36.8 (32.3-41.5)	33.4 (31.2-35.6)	37.5 (32.2-43.0)	30.7 (28.9-32.5)	32.8 (25.5-41.0)	33.4 (27.8-39.5)	29.9 (27.6-32.3)	31.7 (27.5-36.2)
Don't trust the government	28.8 (27.4-30.2)	24.8 (16.6-35.3)	25.7 (21.5-30.4)	28.9 (26.9-30.9)	33.4 (28.5-38.8)	24.2 (22.4-26.1)	25.9 (19.5-33.5)	26.0 (20.3-32.7)	22.8 (20.8-24.9)	27.9 (24.5-31.5)
Other reason	17.3 (16.0-18.7)	20.2 (14.9-26.8)	20.5 (16.6-25.0)	16.7 (15.0-18.4)	17.1 (14.0-20.7)	16.4 (15.4-18.7)	13.4 (10.1-17.6)	15.8 (12.2-20.2)	16.6 (15.1-18.1)	16.6 (14.6-18.9)

^aData source: US Census Bureau's Household Pulse Survey, fielded during April 14–May 24, 2021 (N = 218 787).¹⁷ All values are % (95% CI).

^bRespondents who were health care personnel, frontline, or other essential worker groups were categorized as essential workers.

^cRespondents were categorized as nonessential workers if they reported other work settings not classified as essential or if they reported that they currently work for either pay or profit but did not work or volunteer outside the home.

currently available to all adults, only 64.1%–86.3% of the workforce in our sample had been vaccinated, with the lowest coverage among self-employed adults and adults who were other (non–health care personnel and non–frontline) essential workers. These data highlight potential gaps in coverage and underscore the need to increase vaccine uptake and confidence in this population.

We found that adults with lower levels of vaccine receipt and intent to vaccinate were more likely to be younger, have lower levels of education and annual household income, be members of minoritized racial and ethnic populations (except non-Hispanic Asian), lack health insurance, and have a previous COVID-19 diagnosis. These findings are consistent with the findings of other studies of the general US population.²¹⁻²³ Importantly, our results support previous studies that found more racial and ethnic and socioeconomic disparities among essential workers than among nonessential workers²⁴⁻²⁹ and shed new light on gaps and disparities by employment type. Ensuring high and equitable vaccination coverage across the workforce is important for preventing the spread of COVID-19 and mitigating the impact of the pandemic.

Despite the availability of vaccines, gaps still exist in vaccination coverage.^{30,31} Given the risk of COVID-19 to workers and to people with whom they come into contact during work, reaching the remaining 20%–40% of unvaccinated employees is essential. Because the most commonly

cited reason for not getting vaccinated among employees in our sample was a concern about side effects, employers may be in an ideal position to address this concern—by educating employees about the benefits of vaccination; informing employees about potential, nonserious temporary side effects after vaccination (eg, sore arm, fatigue); and providing information about what to do if they experience side effects.³² Employers can also offer paid sick days for employees who experience stronger side effects (eg, fatigue, headaches, muscle pain) that may limit their ability to work.³² In addition, some employers have been able to offer vaccination on-site, thereby eliminating barriers such as appointment scheduling and transportation and time off for vaccination. Finally, incentives to get vaccinated, such as additional vacation time or cash prizes or rewards, can help boost vaccination uptake.^{33,34} In addition to promoting vaccination uptake, employers should continue to follow CDC's Guidance for Businesses and Employers Responding to Coronavirus Disease 2019 (COVID-19),³² and health care employers should follow the Interim Infection Prevention and Control Recommendations for Healthcare Personnel During the Coronavirus Disease 2019 (COVID-19) Pandemic.³⁵ These are important elements for ensuring a safe and healthy workplace.

Other reasons for not getting vaccinated were waiting to see if the vaccine is safe and lack of trust in COVID-19

vaccines or the government. For those who are self-employed, having consistent, positive messaging from local, state, and federal government and public health officials and recommendations from health care providers can also help boost uptake and confidence among these groups. Promotion of vaccination as important for protecting family and friends, reducing community transmission, and returning to work, school, or social activities can increase vaccination uptake.²¹ Furthermore, promoting social norms that encourage discussions about vaccination can help increase confidence.

Limitations

The findings in our study were subject to several limitations. First, although sampling methods and data weighting were designed to produce nationally representative results, respondents might not be fully representative of the general US adult population. Second, COVID-19 vaccination status and employment status were self-reported and, therefore, subject to social desirability bias or misclassification. Third, the dataset used in this study is only able to assess receipt of ≥ 1 dose of the COVID-19 vaccine, not full vaccination coverage (ie, 2 doses for Pfizer and Moderna), so full vaccination rates may be lower than the estimates reported in our study. Finally, the dataset used in this study has a low response rate ($< 10\%$) and may be subject to nonresponse bias. However, nonresponse bias assessment conducted by the US Census Bureau found that the survey weights help mitigate nonresponse bias.³⁶ Although some biases may remain, we would not expect them to be sufficient to dramatically alter our findings.

Conclusion

As more businesses reopen and more employees return to work or return to in-person work, it is important to protect the health of employees by increasing COVID-19 vaccination rates and confidence. Mandating COVID-19 vaccines or requiring employees to get vaccinated for COVID-19 may be implemented in some settings. However, mandates may not be applicable in all work settings (ie, among people who are self-employed or in some work settings) or among people who have religious or medical exemptions.³⁷⁻⁴⁰ Therefore, a public health strategy involving support from vaccinated peers and family members—together with consistent, positive messaging from the government, public health officials, and employers—is needed. Promoting a culture of health and safety in the workplace can help create a safer work environment for all employees and their families and bring an end to the pandemic.

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