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Brief Report

Who has not been vaccinated, fully vaccinated, or boosted for COVID-19?

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COVID-19 vaccination
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Vaccine hesitancy
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A B S T R A C T

We assessed COVID-19 vaccination coverage (≥ 1 dose, full vaccination, and booster vaccination) using a large, nationally representative survey of US households (December 29, 2021–January 10, 2022). Almost 1 in 6 adults have not been vaccinated or not been fully vaccinated, and almost one-half of fully vaccinated adults have not received a booster vaccine. All eligible individuals should receive the recommended number of vaccines to prevent further transmission of COVID-19.

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INTRODUCTION

COVID-19 vaccines and booster doses have been authorized and recommended for use among adults in the United States since December 2020 and October 2021, respectively, yet many people remain unvaccinated, not fully vaccinated, or not boosted for COVID-19.¹ For example, as of July 1, 2022, approximately 10% of adults had not received any dose of the COVID-19 vaccine, 23% of adults were not fully vaccinated, and 49% of fully vaccinated adults have not received a booster vaccine.² This is concerning, especially for vulnerable and high-risk populations, such as certain sociodemographic groups, essential worker groups, people in some employment categories, people with disabilities and mental health disorders, people with food insecurity, people living in some residential structures, and households with children.^{3,4} The recent surge in cases and hospitalizations due to new variants of COVID-19 viruses underscores the importance of achieving high and equitable vaccination coverage for preventing further transmission of COVID-19 and protecting all individuals from COVID-19 infection and severe health outcomes.⁵

Previous studies have examined possible reasons for nonvaccination, which include concerns about safety and side effects, wanting to 'wait to see' if it is safe, and mistrust of vaccines or the government.⁶ However, most studies have utilized data prior to August 2021 and to our knowledge, none have assessed uptake of the booster dose by groups with elevated risk for COVID-19 infection.

This study assessed receipt of at least one dose of COVID-19 vaccine, full vaccination, as well as receipt of a booster vaccine, overall and by sociodemographic factors and select high risk groups using a large, nationally representative survey of US households. In addition, factors associated with each vaccination status were examined. Understanding gaps and disparities in vaccination coverage is fundamental to reducing COVID-19–related morbidity and mortality, and preventing further transmission of SARS-CoV-2 variants.

METHODS

Data were collected from December 29, 2021 to January 10, 2022 in the Household Pulse Survey (HPS) (sample size = 74,995, response rate = 7.2%.⁷ The survey design of the HPS has been described

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previously.⁸ This study was reviewed by the Tufts University Health Sciences Institutional Review Board and considered not to be human subjects research.

Sociodemographic factors assessed were respondent age group (18–29, 30–39, 40–49, 50–64, ≥65 years), gender (male/female), race/ethnicity (Hispanic, non-Hispanic [NH] Asian, non-Hispanic Black, non-Hispanic white, non-Hispanic other/multiracial), educational attainment (high school equivalent or less, some college, college degree, or higher than college degree), annual household income (<\$35,000, \$35,000–49,999, \$50,000–74,999, ≥\$75,000, did not report), health insurance (yes/no), prior COVID-19 infection (yes/no), and Health and Human Services region.* Other characteristics assessed were employment status,[†] essential worker group,[‡] employment type,[§] disability status,^{||} mental health symptoms,[¶] oldest age of child in household [no children, <5 years, 5–11 years, 12–17 years], food insecurity (often not enough to eat, sometimes not enough to eat, enough to eat), and residential structure (single family home, townhouse/condo, apartment, mobile/boat/recreational vehicle).

The percentage of people who did not receive ≥1 dose of COVID-19 vaccine, were not fully vaccinated,** or were not boosted^{††} was assessed overall and by sociodemographic characteristics and select groups. Factors associated with not being vaccinated, fully vaccinated, or boosted were assessed using multivariable regression models. Analyses accounted for the survey design and weights to ensure a representative sample in Stata (version 16.1).

* Health and human services regions are defined as the following: Region 1 – Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; Region 2 – New Jersey, and New York; Region 3 – Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; Region 4 – Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; Region 5 – Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; Region 6 – Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; Region 7 – Iowa, Kansas, Missouri, and Nebraska; Region 8 – Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; Region 9 – Arizona, California, Hawaii, and Nevada; Region 10 – Alaska, Idaho, Oregon, and Washington.

† Employment status was assessed by the following question: “In the last 7 days, did you do any work for either pay or profit?” (yes/no).

‡ Essential worker status was assessed by the following questions: “In the last 7 days, have you worked or volunteered outside your home?” (yes/no). 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 from the U.S. Department of Homeland Security’s Cybersecurity and Infrastructure Security Agency’s (CISA), respondents were categorized as healthcare personnel (HCP) if their response falls in one of the following three primary location/work settings: 1) healthcare (such as hospital, doctor, dentist or mental health specialist office, outpatient facility, long-term care, home health care, pharmacy, and medical laboratory), 2) social service (such as child, youth, family, elderly, disability services), or 3) death care (such as funeral home, crematory, cemetery). Respondents were categorized as school if they replied with either one of the following settings: 1) education (pre-K, K–12 school) or childcare, or 2) other education (such as business or technical school, college, university). Furthermore, respondents were categorized as non-healthcare frontline essential workers if respondents replied with one of the following 8 settings: 1) first responder (such as police or fire protection, emergency relief services), 2) correctional facility (such as jail, prison, detention center, reformatory), 3) food and beverage store (such as grocery store, warehouse club, supercenters, convenience store, specialty food store, bakery, liquor store), 4) agriculture, forestry, fishing, or hunting, 5) food manufacturing facility (such as meat-processing, produce packing, food or beverage manufacturing), 6) non-food manufacturing facility (such as metals, equipment and machinery, electronics), 7) public transit (such as bus, commuter rail, subway, school bus), or 8) United States 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, IT and communication, news media, public safety, public health workers, finance, legal, and others. Respondents in either HCP, frontline, or other essential worker workers were categorized as “essential workers.” For all other workers, respondents were categorized as non-essential 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.

RESULTS

For all categories of vaccination, coverage was lowest for younger age groups (Table 1, Fig 1). For example, one in 5 adults ages 18–29 years had not received any COVID-19 vaccines and almost two thirds of fully vaccinated adults ages 18–29 years had not received a booster vaccination. NH Black adults were also more likely to not have received the booster vaccination than NH White adults (adjusted prevalence ratio = 1.22, 95% confidence interval = 1.16, 1.29). Adults with lower educational status and income levels were also more likely to have lower vaccination coverage across all vaccination groups. Adults without health insurance and those with a previous COVID-19 infection were less likely to be vaccinated, fully vaccinated, or boosted. Adults in the South, Midwest, and West (HHS regions 4, 6, 7, and 10) were more likely than adults in the Northeast (HHS region 1) to have lower vaccination coverage across all vaccination groups.

People who are unemployed, frontline essential workers, and those working in family businesses were more likely to be unvaccinated (Table 2). Households with children, particularly children <5 years, were more likely to be unvaccinated than households without children. Adults who often do not have enough to eat, or live in transient homes such as mobile home, boat, van, or recreational vehicles, were more likely not to have received any doses, not to be fully vaccinated, or not to be boosted than those with enough to eat or those living in single family homes, respectively.

§ 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) non-profit organization including tax exempt and charitable organizations, 4) self-employed, or 5) working in a family business. Due to small sample sizes, respondents that work in a family business were combined with those who were self-employed.

|| Questions on disability and functional status were derived from previously established measures: 1) Do you have difficulty seeing, even when wearing glasses? 2) Do you have difficulty hearing, even when using a hearing aid? 3) Do you have difficulty remembering or concentrating?, and 4) Do you have difficulty walking or climbing stairs? Response options were 1) no difficulty, 2) some difficulty, 3) a lot of difficulty, and 4) cannot do at all. Those who answered “a lot of difficulty” or “cannot do at all” were categorized as having the specific disability pertaining to that question (e.g., hearing disability). This produced four non-mutually exclusive groups for disability. An overall disability status variable was created for those who reported any of the four categories of disability.

¶ Questions on anxiety and depression were derived from a validated two-item Patient Health Questionnaire (PHQ-2) and the two-item Generalized Anxiety Disorder (GAD-2) scale. The questions were: 1) “Over the last 2 weeks, how often have you been bothered by ... having little interest or pleasure in doing things? Would you say not at all, several days, more than half the days, or nearly every day?” 2) “Over the last 2 weeks, how often have you been bothered by ... feeling down, depressed, or hopeless? Would you say not at all, several days, more than half the days, or nearly every day?” Questions from the GAD-2 were: “Over the last 2 weeks, how often have you been bothered by the following problems ... Feeling nervous, anxious, or on edge? Would you say not at all, several days, more than half the days, or nearly every day?” 2) “Over the last 2 weeks, how often have you been bothered by the following problems ... Not being able to stop or control worrying? Would you say not at all, several days, more than half the days, or nearly every day?” For each scale, responses were assigned a numerical value: not at all=0, several days=1, more than half the days=2, and nearly every day=3. The two responses for each scale were summed and a score equal to three or greater on the PHQ-2 was categorized as symptoms of depression (hereafter referred to as depression)⁹. A sum equal to three or greater on the GAD-2 was categorized as symptoms of anxiety (hereafter referred to as anxiety). Adults who had either symptoms of anxiety or depression were categorized as having either disorder.

** Full vaccination was defined as receiving ≥1 dose of the Johnson and Johnson (Janssen vaccine), ≥2 doses of Pfizer-Biontech or Moderna vaccine, or ≥2 doses of “one of the brands that requires two initial shots, but not sure which brand”

†† Booster vaccination was defined as receiving ≥2 dose of the Johnson and Johnson (Janssen vaccine), ≥3 doses of Pfizer-Biontech or Moderna vaccine, or ≥3 doses of “one of the brands that requires two initial shots, but not sure which brand,” among adults who are fully vaccinated for COVID-19. The data that support the findings of this study are openly available at <https://www.census.gov/programs-surveys/household-pulse-survey/datasets.html>.

Table 1
 COVID-19 vaccination status by socioeconomic characteristics, United States, December 29, 2021 – January 10, 2022

	Total			Not vaccinated (n = 7,314)				Not fully vaccinated* (n = 8,076)				Not boosted (n = 22,904) [†]			
	Unweighted (n)	%	95%CI	%	95% CI	aPR [‡]	95% CI	%	95% CI	aPR [‡]	95% CI	%	95% CI	aPR [‡]	95% CI
All	74,995			14.9	(14.4, 15.4)			16.6	(16.0, 17.2)			44.9	(44.1, 45.6)		
Age group (years)															
65+	19,593	22.2	(22.1, 22.4)	6.4	(5.7, 7.2)	ref.		7.3	(6.3, 8.2)	ref.		24.9	(23.5, 26.2)	ref.	
50-64	21,413	25.5	(25.3, 25.7)	11.6	(10.9, 12.2)	1.94	(1.69, 2.23)	13	(12.3, 13.8)	1.9	(1.65, 2.20)	41.1	(39.5, 42.8)	1.65	(1.54, 1.77)
40-49	14,108	16.5	(16.3, 16.8)	18.7	(17.5, 20.0)	3.4	(2.86, 4.03)	20.5	(19.2, 21.8)	3.23	(2.73, 3.82)	51.4	(49.4, 53.3)	2.68	(1.94, 2.23)
30-39	13,455	18.7	(18.3, 19.2)	21.2	(19.5, 22.8)	3.93	(3.31, 4.67)	23.1	(21.4, 24.8)	3.7	(3.12, 4.39)	55	(53.1, 56.9)	2.31	(2.16, 2.47)
18-29	6,426	17	(16.6, 17.3)	20.5	(18.7, 22.4)	3.29	(2.79, 3.87)	23	(21.2, 24.8)	3.21	(2.75, 3.76)	64.7	(62.8, 66.5)	2.51	(2.35, 2.68)
Gender															
Male	30,672	48.4	(48.4, 48.4)	15.5	(14.7, 16.3)	ref.		17.1	(16.2, 17.9)	ref.		43.2	(42.0, 44.4)	ref.	
Female	44,323	51.6	(51.6, 51.6)	14.4	(13.8, 15.0)	0.95	(0.89, 1.03)	16.1	(15.5, 16.8)	0.98	(0.91, 1.05)	46.4	(45.4, 47.4)	1.07	(1.03, 1.11)
Race/ethnicity															
NH White	54,977	62.2	(62.1, 62.3)	15	(14.5, 15.6)	ref.		16.5	(15.9, 17.1)	ref.		39.8	(39.0, 40.6)	ref.	
NH Black	5,752	11.4	(11.3, 11.5)	18.2	(16.6, 19.9)	0.85	(0.77, 0.94)	21.1	(19.3, 23.0)	0.86	(0.78, 0.94)	57.9	(55.8, 60.0)	1.22	(1.16, 1.29)
NH Asian	4,065	5.6	(5.4, 5.7)	3	(1.9, 4.2)	0.22	(0.14, 0.36)	3.4	(2.2, 4.5)	0.23	(0.15, 0.35)	34.4	(32.2, 36.7)	0.87	(0.80, 0.95)
NH multi/other	2,734	3.5	(3.3, 3.7)	21.9	(18.3, 25.5)	1.11	(0.96, 1.28)	23.8	(20.3, 27.3)	1.09	(0.95, 1.25)	48.6	(44.7, 52.4)	1.04	(0.96, 1.12)
Hispanic or Latino	7,467	17.3	(17.1, 17.5)	14.7	(13.1, 16.4)	0.55	(0.47, 0.63)	16.6	(15.0, 18.2)	0.56	(0.49, 0.64)	58.2	(55.6, 60.8)	1.03	(0.97, 1.08)
Educational attainment															
High school or less	10,062	39	(38.9, 39.0)	22.1	(21.0, 23.3)	3.78	(3.26, 4.37)	24.6	(23.2, 25.9)	3.52	(3.08, 4.02)	54	(52.2, 55.8)	1.94	(1.84, 2.05)
Some college and Associate degree	22,707	30.2	(30.2, 30.2)	15	(14.2, 15.8)	2.53	(2.21, 2.89)	16.7	(15.8, 17.5)	2.39	(2.12, 2.69)	49.9	(48.9, 50.9)	1.7	(1.62, 1.78)
College graduate (Bachelor degree)	22,086	17.2	(16.9, 17.4)	6.7	(6.2, 7.2)	1.27	(1.09, 1.49)	7.6	(7.1, 8.1)	1.25	(1.09, 1.44)	36.4	(35.3, 37.5)	1.32	(1.26, 1.38)
Above college graduate	20,140	13.7	(13.5, 13.9)	4.6	(4.0, 5.1)	ref.		5.2	(4.6, 5.7)	ref.		25	(24.1, 25.9)	ref.	
Annual household income															
Less than \$35,000	13,116	22.1	(21.5, 22.7)	19.9	(18.6, 21.1)	1.48	(1.34, 1.63)	23	(21.5, 24.5)	1.6	(1.45, 1.77)	55.1	(53.1, 57.0)	1.29	(1.23, 1.36)
\$35,000-\$49,999	6,831	9.8	(9.3, 10.2)	14.1	(12.3, 15.9)	1.15	(1.01, 1.31)	15.8	(13.9, 17.7)	1.21	(1.07, 1.37)	50.6	(48.6, 52.6)	1.23	(1.17, 1.30)
\$50,000-\$74,999	10,605	13.7	(13.1, 14.2)	13.1	(11.7, 14.6)	1.19	(1.04, 1.36)	14.2	(12.8, 15.6)	1.2	(1.06, 1.36)	45.5	(43.5, 47.4)	1.2	(1.14, 1.26)
\$75,000 and above	32,795	33.8	(33.4, 34.2)	8.7	(8.1, 9.3)	ref.		9.3	(8.7, 9.9)	ref.		33.4	(32.3, 34.4)	ref.	
Did not report	11,648	20.7	(20.0, 21.3)	21.6	(19.8, 23.3)	1.39	(1.15, 1.67)	24	(22.2, 25.8)	1.44	(1.23, 1.69)	53.4	(51.2, 55.5)	1.18	(1.10, 1.26)
Health insurance															
Yes	63,922	91.4	(91.0, 91.8)	11.9	(11.4, 12.4)	ref.		13.1	(12.6, 13.7)	ref.		41.3	(40.5, 42.0)	ref.	
No	3,281	8.6	(8.2, 9.0)	28	(24.6, 31.4)	1.46	(1.27, 1.69)	32.7	(29.0, 36.4)	1.54	(1.36, 1.75)	69.3	(66.0, 72.6)	1.17	(1.11, 1.24)
Previous COVID-19 infection															
Yes	14,682	23.6	(23.1, 24.2)	21.2	(20.0, 22.5)	1.6	(1.46, 1.77)	23.8	(22.6, 25.1)	1.63	(1.50, 1.77)	62.6	(61.1, 64.2)	1.39	(1.34, 1.43)
No	58,529	76.4	(75.8, 76.9)	11.9	(11.4, 12.5)	ref.		13.3	(12.7, 13.9)	ref.		39.8	(39.0, 40.6)	ref.	
HHS region [§]															
1	7,853	4.6	(4.6, 4.6)	8.1	(7.1, 9.2)	ref.		9.3	(8.2, 10.5)	ref.		38.1	(36.2, 40.0)	ref.	
2	3,093	8.6	(8.6, 8.6)	8.7	(6.9, 10.5)	1.09	(0.82, 1.43)	10.4	(8.3, 12.4)	1.08	(0.84, 1.41)	44.6	(41.6, 47.5)	1.1	(1.01, 1.20)
3	8,775	9.4	(9.4, 9.4)	13.4	(11.6, 15.2)	1.69	(1.40, 2.04)	14.7	(12.9, 16.6)	1.61	(1.33, 1.94)	42	(40.0, 44.0)	1.07	(1.00, 1.15)
4	10,259	20.8	(20.8, 20.8)	18.3	(17.0, 19.7)	2.15	(1.87, 2.46)	20.7	(19.2, 22.2)	2.09	(1.82, 2.39)	49.2	(47.5, 51.0)	1.21	(1.13, 1.28)
5	9,471	15.9	(15.9, 15.9)	16.9	(15.7, 18.1)	1.88	(1.60, 2.20)	18.5	(17.3, 19.7)	1.81	(1.53, 2.13)	41.4	(39.5, 43.3)	1.06	(0.98, 1.14)
6	7,714	12.8	(12.8, 12.8)	17.6	(16.0, 19.3)	1.85	(1.54, 2.22)	19.6	(17.8, 21.4)	1.78	(1.50, 2.11)	50.6	(48.6, 52.5)	1.15	(1.07, 1.23)
7	4,627	4.2	(4.2, 4.2)	16.7	(14.9, 18.4)	1.92	(1.59, 2.31)	18.5	(16.8, 20.2)	1.81	(1.52, 2.16)	43.9	(41.2, 46.6)	1.11	(1.01, 1.21)
8	6,752	3.7	(3.7, 3.7)	16.8	(15.2, 18.3)	2	(1.69, 2.38)	18.5	(16.9, 20.0)	1.92	(1.63, 2.26)	41.6	(39.6, 43.6)	1.04	(0.96, 1.13)
9	9,770	15.6	(15.6, 15.6)	12.2	(10.4, 14.1)	1.58	(1.25, 1.99)	13.3	(11.4, 15.2)	1.49	(1.19, 1.86)	44.1	(41.9, 46.3)	1.07	(1.00, 1.15)
10	6,681	4.5	(4.5, 4.5)	12.9	(11.6, 14.2)	1.57	(1.30, 1.88)	13.7	(12.4, 15.1)	1.44	(1.20, 1.72)	42.6	(40.8, 44.4)	1.1	(1.03, 1.18)

aPR, adjusted prevalence ratio; CI, confidence interval; HHS, Health and Human Services.

*Full vaccination was defined as receiving ≥1 dose of the Johnson and Johnson (Janssen vaccine), ≥2 doses of Pfizer-Biontech or Moderna vaccine, or ≥2 doses of “one of the brands that requires two initial shots, but not sure which brand”.

[†]Booster vaccination was defined as receiving ≥2 dose of the Johnson and Johnson (Janssen vaccine), ≥3 doses of Pfizer-Biontech or Moderna vaccine, or ≥3 doses of “one of the brands that requires two initial shots, but not sure which brand,” among adults who are fully vaccinated for COVID-19.

[‡]Model adjusted for age, gender, race/ethnicity, educational attainment, annual household income, health insurance, previous COVID-19 infection, and HHS region.

[§]Health and human services regions (HHS) are defined as the following: Region 1 – Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; Region 2 – New Jersey, and New York; Region 3 – Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; Region 4 – Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; Region 5 – Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; Region 6 – Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; Region 7 – Iowa, Kansas, Missouri, and Nebraska; Region 8 – Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; Region 9 – Arizona, California, Hawaii, and Nevada; Region 10 – Alaska, Idaho, Oregon, and Washington.

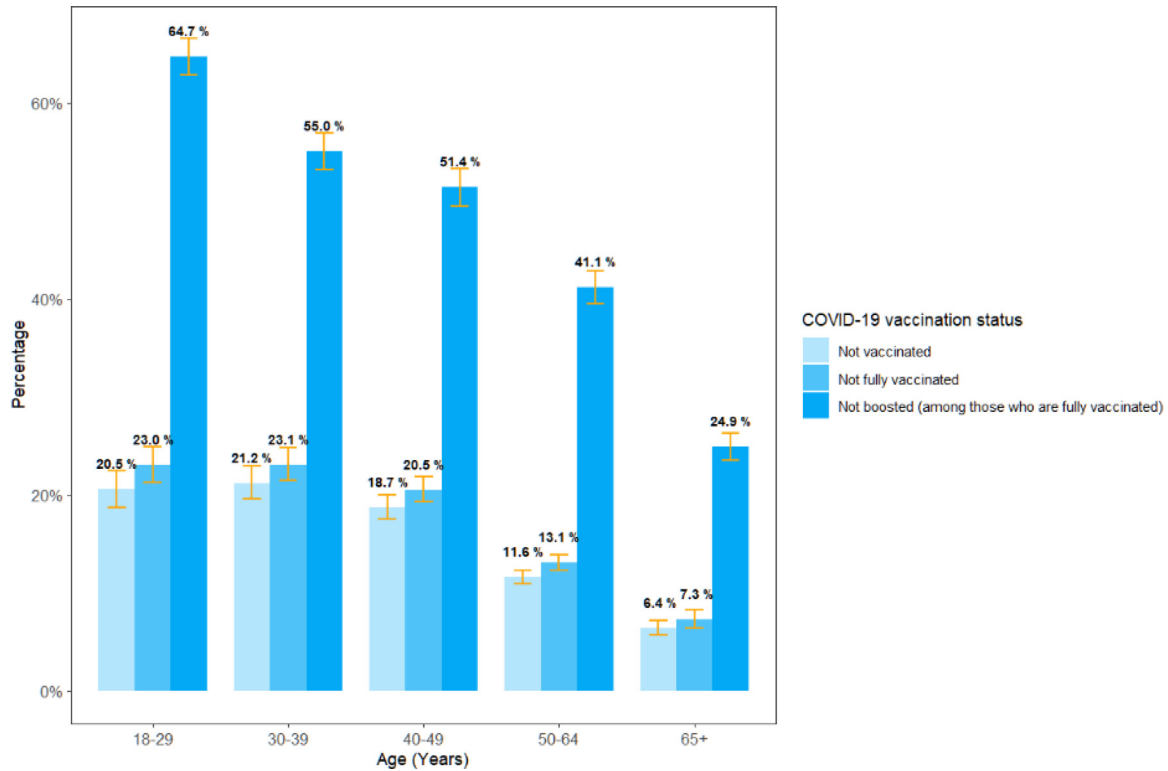


Fig 1. COVID-19 vaccination status by age group, United States, December 29, 2021 – January 10, 2022.

The main reasons for not being vaccinated were concerns about side effects (53.4%), lack of trust in vaccines (42.4%), lack of trust in the government (36.3%), and belief that a vaccine is not needed (29.8%; Fig 2)

CONCLUSION AND DISCUSSION

Despite increases in vaccination coverage since the beginning of the vaccination campaign,⁶ almost 1 in 6 adults have not been vaccinated or not been fully vaccinated, and almost one-half have not received a booster vaccine. Similar to sociodemographic characteristics for

nonvaccination found in previous studies,^{4,6} lack of booster vaccination was highest among younger adults, Hispanic and NH Black adults, adults with lower educational attainment and income levels, adults with no insurance, adults with a previous COVID-19 diagnosis, and adults living in the Southern region of the United States. Furthermore, adults who were not employed, were frontline essential workers or worked in a family business were more likely not to be vaccinated or boosted.

The findings in this study are 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,

Table 2
COVID-19 vaccination status by select groups, United States, December 29, 2021 – January 10, 2022

	Overall	Not vaccinated		Not fully vaccinated*		Not boosted [†]	
	% (95% CI)	% (95% CI)	aPR [‡] (95% CI)	% (95% CI)	aPR [‡] (95% CI)	% (95% CI)	aPR [‡] (95% CI)
Employed							
No	44.4 (43.7, 45.0)	15.4 (14.5, 16.4)	ref.	17.3 (16.2, 18.4)	ref.	42.5 (41.4, 43.7)	ref.
Yes	55.6 (55.0, 56.3)	13.1 (12.4, 13.8)	0.83 (0.76, 0.89)	14.5 (13.8, 15.2)	0.82 (0.76, 0.89)	46.2 (45.3, 47.2)	1.00 (0.96, 1.04)
Essential worker group							
Non-essential worker	64.8 (63.9, 65.8)	12.3 (11.5, 13.1)	ref.	13.5 (12.7, 14.3)	ref.	46.0 (44.7, 47.2)	ref.
Healthcare personnel	8.9 (8.4, 9.4)	5.9 (4.7, 7.0)	0.54 (0.45, 0.67)	7.9 (6.6, 9.1)	0.65 (0.55, 0.77)	40.6 (37.5, 43.8)	0.86 (0.79, 0.83)
School	4.7 (4.4, 5.0)	7.5 (5.9, 9.1)	0.91 (0.74, 1.12)	8.9 (7.1, 10.7)	0.96 (0.79, 1.17)	36.2 (32.8, 39.7)	0.88 (0.79, 0.98)
Frontline worker	9.5 (9.0, 10.0)	21.5 (19.2, 23.8)	1.36 (1.19, 1.56)	22.8 (20.4, 25.1)	1.32 (1.16, 1.49)	53.6 (50.4, 56.8)	1.03 (0.96, 1.11)
Other essential worker	12.0 (11.3, 12.7)	17.7 (15.3, 20.2)	1.15 (0.96, 1.39)	19.8 (17.3, 22.2)	1.78 (1.00, 1.38)	50.0 (46.6, 53.4)	0.98 (0.91, 1.06)
Employment type							
Non-profit	9.3 (8.8, 9.8)	6.1 (4.7, 7.6)	ref.	6.7 (5.3, 8.1)	ref.	35.2 (32.7, 37.8)	ref.
Private	63.4 (62.6, 64.1)	13.4 (12.5, 14.3)	1.37 (1.06, 1.76)	14.9 (13.9, 15.9)	1.42 (1.13, 1.78)	48.5 (47.2, 49.7)	1.18 (1.09, 1.27)
Government	14.0 (13.5, 14.6)	9.6 (8.1, 11.1)	1.24 (0.91, 1.69)	10.7 (9.1, 12.2)	1.28 (0.95, 1.71)	43.2 (40.8, 45.6)	1.11 (1.01, 1.22)
Family business (including self-employment)	13.2 (12.6, 13.9)	19.5 (17.1, 21.9)	2.26 (1.69, 3.03)	21.2 (18.7, 23.7)	2.29 (1.76, 2.98)	45.5 (42.9, 48.0)	1.15 (1.06, 1.26)
Disability status							
No	86.0 (85.4, 86.5)	12.9 (12.3, 13.5)	ref.	14.3 (13.6, 15.0)	ref.	42.4 (41.5, 43.3)	ref.
Yes	14.0 (13.5, 14.6)	16.1 (14.2, 17.9)	0.97 (0.87, 1.09)	18.4 (16.6, 20.1)	0.99 (0.91, 1.09)	48.4 (46.1, 50.7)	1.03 (0.98, 1.08)
Mental health symptoms							
None	67.9 (67.2, 68.7)	13.0 (12.4, 13.6)	ref.	14.3 (13.6, 14.9)	ref.	39.9 (39.0, 40.8)	ref.
Anxiety or depression	32.1 (31.3, 32.8)	14.6 (13.7, 15.5)	0.79 (0.72, 0.87)	16.7 (15.7, 17.8)	0.83 (0.76, 0.90)	50.9 (49.3, 52.5)	1.02 (0.97, 1.06)

(continued)

Table 2 (Continued)

	Overall	Not vaccinated		Not fully vaccinated ^a		Not boosted ^b	
	% (95% CI)	% (95% CI)	aPR ^c (95% CI)	% (95% CI)	aPR ^c (95% CI)	% (95% CI)	aPR ^c (95% CI)
Households with children							
None	63.3 (62.6, 64.1)	10.8 (10.3, 11.4)	ref.	12.1 (11.6, 12.7)	ref.	39.5 (38.6, 40.4)	ref.
<5 years old	7.1 (6.7, 7.5)	24.9 (21.5, 28.2)	1.75 (1.48, 2.06)	28.8 (25.0, 32.5)	1.86 (1.63, 2.13)	55.5 (52.6, 58.4)	1.13 (1.05, 1.21)
5–11 years old	10.9 (10.5, 11.4)	22.0 (20.4, 23.6)	1.53 (1.37, 1.72)	24.1 (22.5, 25.7)	1.51 (1.37, 1.67)	56.3 (54.3, 58.2)	1.16 (1.11, 1.22)
12–17 years old	18.7 (18.1, 19.3)	20.8 (19.3, 22.3)	1.51 (1.37, 1.68)	22.5 (21.0, 24.1)	1.48 (1.34, 1.62)	56.3 (53.7, 58.8)	1.12 (1.06, 1.19)
Food sufficiency							
Enough food to eat	89.8 (89.4, 90.3)	12.5 (11.9, 13.0)	ref.	13.7 (13.2, 14.3)	ref.	41.4 (40.6, 42.2)	ref.
Sometimes	7.9 (7.5, 8.4)	22.2 (19.3, 25.1)	1.14 (0.98, 1.32)	26.4 (23.3, 29.4)	1.21 (1.06, 1.38)	65.3 (62.4, 68.3)	1.12 (1.07, 1.18)
Often not enough to eat	2.2 (2.0, 2.5)	29.4 (24.6, 34.3)	1.33 (1.08, 1.66)	33.4 (28.3, 38.4)	1.34 (1.11, 1.62)	72.2 (66.9, 77.5)	1.16 (1.07, 1.27)
Housing type							
Single-family home	66.4 (65.7, 67.1)	12.5 (11.8, 13.2)	ref.	13.9 (13.1, 14.7)	ref.	39.8 (38.8, 40.7)	ref.
Townhouse/condo	7.6 (7.2, 7.9)	9.3 (7.8, 10.9)	0.69 (0.57, 0.84)	10.4 (8.8, 12.0)	0.69 (0.58, 0.82)	45.1 (41.9, 48.2)	1.01 (0.94, 1.09)
Multi-unit home	20.5 (19.9, 21.2)	13.3 (11.7, 14.9)	0.84 (0.74, 0.95)	14.9 (13.3, 16.4)	0.84 (0.75, 0.94)	49.9 (48.0, 51.8)	1.00 (0.96, 1.05)
Other- including mobile home, boat, van, RV	5.5 (5.1, 5.9)	26.9 (23.8, 30.1)	1.26 (1.09, 1.45)	30.8 (27.4, 34.3)	1.27 (1.13, 1.43)	56.5 (52.5, 60.4)	1.11 (1.03, 1.19)

aPR, adjusted prevalence ratio; CI, confidence interval; ref, reference.

^aFull vaccination was defined as receiving ≥ 1 dose of the Johnson and Johnson (Janssen vaccine), ≥ 2 doses of Pfizer-Biontech or Moderna vaccine, or ≥ 2 doses of “one of the brands that requires two initial shots, but not sure which brand”.

^bBooster vaccination was defined as receiving ≥ 2 dose of the Johnson and Johnson (Janssen vaccine), ≥ 3 doses of Pfizer-Biontech or Moderna vaccine, or ≥ 3 doses of “one of the brands that requires two initial shots, but not sure which brand,” among adults who are fully vaccinated for COVID-19.

^cSeparate multivariable logistic models were conducted for each group as the explanatory variable and adjusted for age, gender, race/ethnicity, educational attainment, annual household income, health insurance, previous COVID-19 infection, and Health and Human services region.

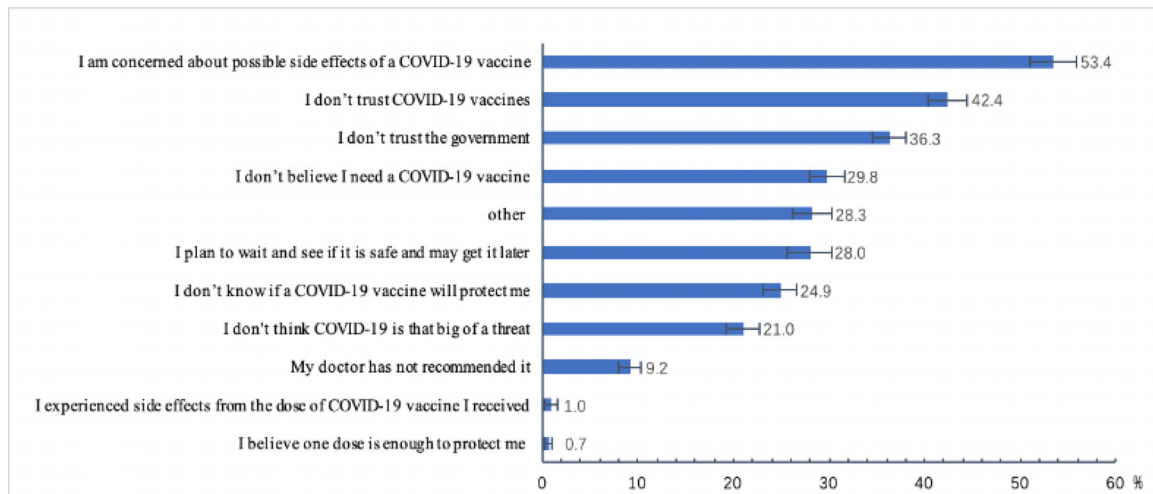


Fig 2. Main reasons for not intending to receive COVID-19 vaccination in United States.

vaccination status for respondents was self-reported and is subject to social desirability bias. Third, the survey did not collect dates of vaccination, so lack of full vaccination coverage or booster vaccination may be due to ineligibility in a small percentage of individuals. Finally, the HPS has a low response rate (<10%); although non-response bias assessment conducted by the Census Bureau found that the survey weights mitigated most of this bias.⁹

With preventive measures, such as social distancing and mask mandates, lifting throughout the United States,¹⁰ it is crucial that all eligible individuals receive the recommended number of vaccines as soon as possible to prevent further transmission of COVID-19 and to bring an end to the pandemic.

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