

COVID-19 Vaccination Coverage, Intent, Knowledge, Attitudes, and Beliefs among Essential Workers, United States

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We assessed coronavirus disease vaccination and intent and knowledge, attitudes, and beliefs among essential workers during March–June 2021. Coverage was 67%; 18% reported no intent to get vaccinated. Primary concerns were potential side effects, safety, and lack of trust in vaccines, highlighting the importance of increasing vaccine confidence in this population.

Essential workers, who conduct a range of operations and services to ensure the continuity and viability of critical infrastructure functions, have more coronavirus disease (COVID-19) exposures and experience greater risk for severe illness and death than do nonessential workers (1–4). In December 2020, the US Advisory Committee on Immunization Practices issued recommendations prioritizing healthcare personnel (HCP), nonhealthcare frontline essential workers, and other essential workers for COVID-19 vaccination (5) (Appendix, <https://wwwnc.cdc.gov/EID/article/27/11/21-1557-App1.pdf>). Previous findings indicate that <50% of essential workers intended to get vaccinated: 37.1% in September 2020 and 49.1% in December 2020 (6,7). Assessing vaccination coverage and intent among essential workers, who continue to face increased risk because of their public-facing roles can help tailor messages and strategies to increase vaccination uptake and confidence among this high-risk group. We analyzed data from surveys to assess COVID-19 vaccine coverage and intent and knowledge, attitudes, and beliefs (KABs) among essential workers.

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The Study

We analyzed data from 2 nationally representative household surveys collected over 6 COVID-19 waves during March 5–June 2, 2021, Ipsos KnowledgePanel (8) and NORC AmeriSpeak (9) (Appendix). Because of the small sample sizes, to bolster the strength of the study's estimates and increase the reliability of results, we combined data for analysis from each survey during the 6 waves of data collection.

The total sample size was 7,734 respondents; 5,303 were essential workers and 2,426 nonessential workers. We used the American Association for Public Opinion Research definition for cooperation rates (10), the proportion of all respondents interviewed of all eligible units ever contacted. Among respondents, cooperation rates were 20.3%–60.1%.

We categorized respondents as essential or nonessential workers. The essential worker category comprised the HCP, nonhealthcare frontline, and other essential worker groups (Appendix). We examined sociodemographic characteristics, including age group, sex, race and ethnicity, annual household income, health insurance status, marital status, urban versus rural status, and underlying conditions (Appendix).

We assessed vaccination status, intent, and KABs by worker group (Appendix). We categorized respondents as reachable or reluctant; reachable respondents said they probably would get or were unsure about getting a vaccine, whereas reluctant respondents said they probably or definitely would not get a vaccine. We assessed the following KABs about COVID-19 vaccination: reasons for not getting vaccinated, barriers to getting vaccinated, motivators for getting vaccinated, concerns about getting vaccinated, and concerns about vaccine side effects.

We weighted all surveys to ensure US population representation (Appendix). We used contrast

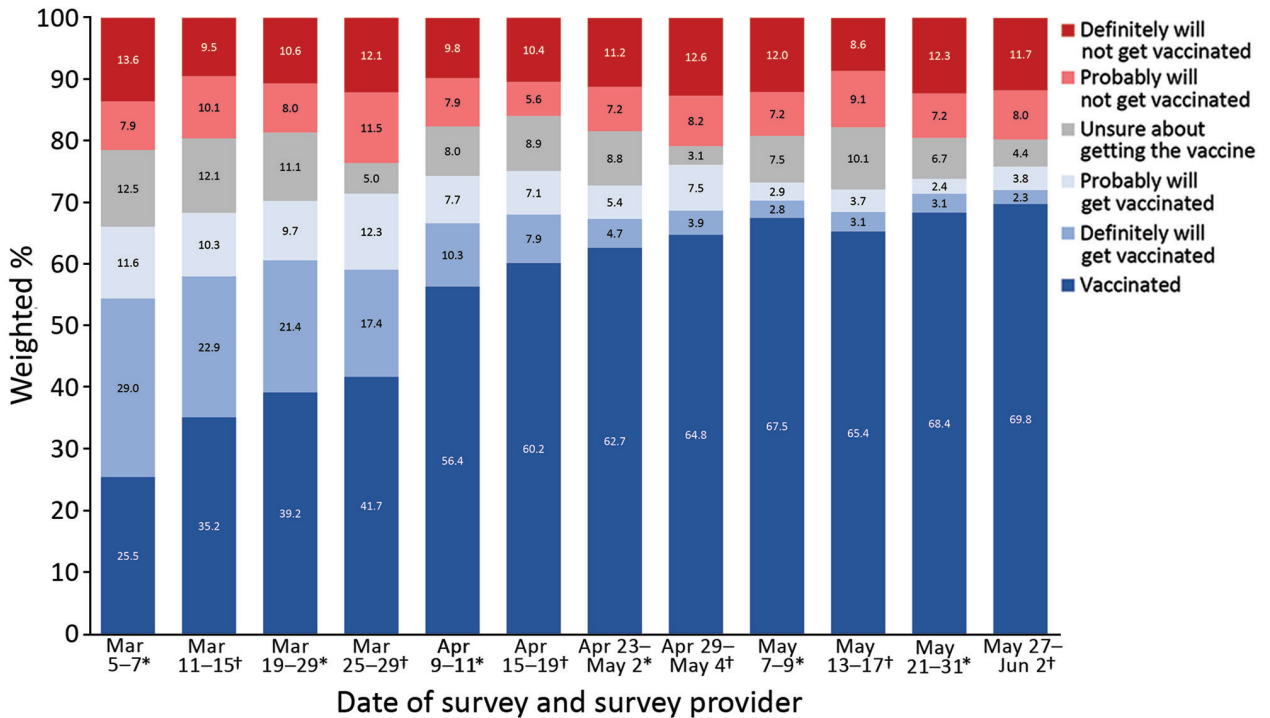


Figure 1. Trends in COVID-19 vaccination status and intent among essential workers, United States, March 5–June 2, 2021. *Data collected by Ipsos KnowledgePanel (8). †Data collected by NORC AmeriSpeak (9). COVID-19, coronavirus disease.

tests for differences in percentages to compare reachable versus reluctant groups among each of the worker categories. This activity was reviewed by the Centers for Disease Control and Prevention and was conducted consistent with applicable federal

law and Centers for Disease Control and Prevention policy (Appendix).

Vaccination coverage among essential workers increased from 25.5% in March 2021 to 69.8% in June 2021 (Figure 1). Average vaccination coverage during the

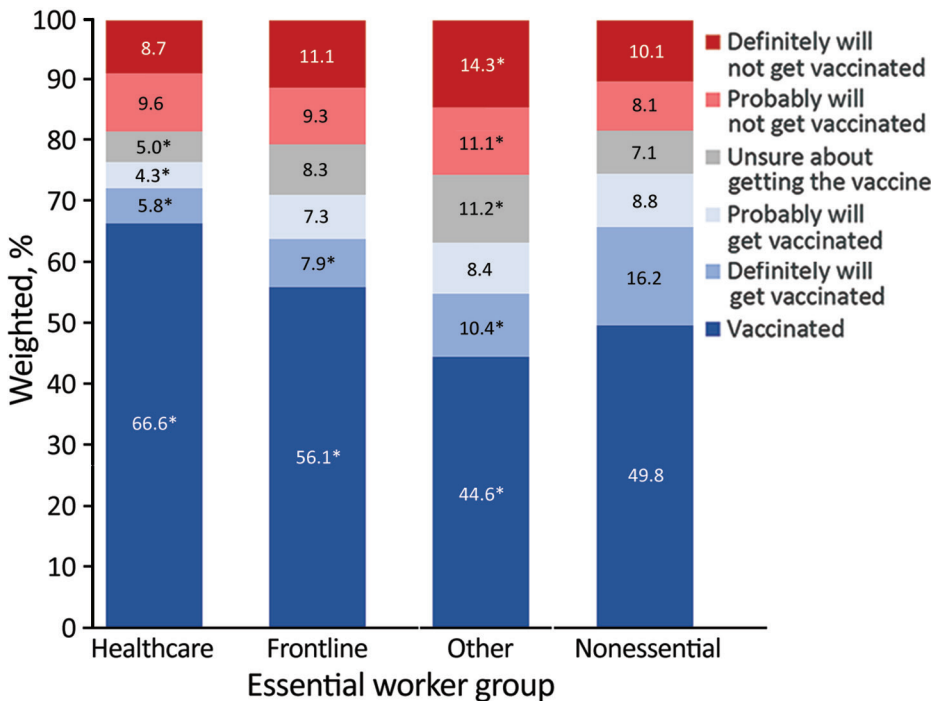


Figure 2. Average prevalence of COVID-19 vaccination status and intent by essential and nonessential worker groups, United States, March 5–June 2, 2021. Asterisk (*) indicates statistically significant ($p < 0.05$) differences between vaccination coverage and intent among each essential worker group versus vaccination coverage and vaccination intent among nonessential workers. COVID-19, coronavirus disease.

study period was higher for HCP (66.6%) and frontline essential workers (56.1%) and lower for other essential workers (44.6%) and nonessential workers (49.8%) (Figures 1, 2). The percentage of reluctant persons was lowest among HCP (18.3%) and highest among other essential workers (25.5%) (Figure 2). In addition, the percentage of reluctant adults was highest (25.0%) among persons 18–34 years of age; those who had a high school education or less (28.1%), income <\$25,000 (26.3%), or no health insurance (32.3%); and those who lived in rural areas (29.3%) (Appendix Table 1).

Among all unvaccinated essential workers, reasons for not getting vaccinated included concern for possible side effects (58.0%), vaccine safety (42.9%), and distrust of the vaccine (41.9%) (Table 1). Higher percentages of the reachable group than the reluctant

group planned to wait to see if the vaccine is safe (54.4% vs. 35.2%) and believed that other persons need the vaccine more (28.7% vs. 12.2%). A higher percentage of the reluctant group reported a lack of trust in COVID-19 vaccines compared with the reachable group (56.2% vs. 22.3%). More respondents in the reluctant group also did not believe a vaccine is needed (36.6% vs. 10.5% of reachable group), did not think COVID-19 is much of a threat (25.9% vs. 8.6%), and did not know whether a vaccine will work (27.8% vs. 19.9%).

Concern about COVID-19 disease was lower (38.5%) than concern about side effects from the vaccine (46.4%) among all essential workers (Appendix Table 2). Among reachable groups, 42.5% reported concern about getting COVID-19 compared with 21.8% of those in reluctant groups. Among HCP,

Table 1. Reasons for not getting a COVID-19 vaccine, by essential worker group and vaccination intent, United States, March–June 2021*

Reason	All groups, n = 5,308		Healthcare personnel, n = 1,308			Frontline workers, n = 2,300			Other workers, n = 1,700			
	Total	R, n =	RL, n =	Total	R, n =	RL, n =	Total	R, n =	RL, n =	Total	R, n =	RL, n =
Possible side effects	58.0 (55.0–60.9)	59.5 (54.7–64.2)	57.3 (53.4–61.1)	58.3 (50.6–65.7)	55.5 (44.1–66.4)	60.4 (50.2–69.9)	57.9 (53.3–62.3)	58.4 (51.0–65.5)	57.6 (51.5–63.5)	58.0 (53.3–62.6)	62.3 (54.5–69.7)	55.1 (49.2–60.9)
Wait and see if it is safe	42.9 (40.1–45.8)	54.4 (49.5 – 59.3)	35.2 (31.6–38.9)	46.3 (39.1–53.7)	57.7 (46.3 – 68.5)	41.0 (31.6–50.9)	41.4 (37.3–45.7)	50.4 (43.5 – 57.3)	35.0 (29.9–40.4)	43.0 (38.2 – 47.9)	57.6 (49.2–65.7)	32.1 (26.9–37.8)
Do not trust the vaccine	41.9 (39.0–44.8)	22.3 (18.6 – 26.4)	56.2 (52.3–59.9)	45.2 (37.7–52.8)	21.2 (13.3 – 31.1)	57.9 (48.2–67.2)	41.3 (37.0–45.6)	24.9 (19.1 – 31.5)	54.2 (48.2–60.2)	41.0 (36.6 – 45.5)	19.8 (14.4–26.3)	57.3 (51.4–63.0)
Vaccine is not needed	25.7 (23.1–28.5)	10.5 (7.8 – 13.7)	36.6 (32.8–40.5)	23.7 (17.3–31.1)	8.5 (4.2 – 15.0)	31.8 (22.6–42.1)	24.2 (20.5–28.2)	10.8 (7.1 – 15.6)	34.4 (29.0–40.2)	28.3 (24.1 – 32.8)	10.9 (6.3–17.2)	41.8 (36.0–47.7)
Concern about allergic reaction	25.0 (22.6–27.5)	26.7 (22.8–31.0)	23.9 (20.8–27.2)	23.0 (17.7–29.0)	32.6 (22.5 – 44.1)	17.3 (11.9–24.0)	26.1 (22.4–30.0)	23.5 (18.3–29.4)	28.4 (23.2–33.9)	24.9 (20.8–29.2)	28.1 (21.3–35.8)	22.6 (18.0–27.7)
Vaccine might not work	24.3 (21.8–27.0)	19.9 (16.3 – 23.9)	27.8 (24.2–31.5)	28.5 (21.6–36.2)	17.7 (11.1 – 26.3)	34.3 (24.8–44.8)	22.6 (19.3–26.3)	17.1 (12.3 – 22.9)	27.1 (22.3–32.4)	24.2 (20.2–28.6)	23.8 (17.6–30.9)	24.8 (19.6–30.5)
Others need vaccine more	19.0 (16.8–21.4)	28.7 (24.8 – 32.9)	12.2 (9.8–14.9)	14.9 (9.8–21.3)	19.7 (11.9–29.8)	12.6 (6.3–21.7)	18.2 (15.1–21.6)	26.0 (20.1 – 32.5)	12.4 (9.2–16.1)	21.8 (18.1 – 26.0)	35.1 (27.9–42.9)	11.8 (8.3–16.2)
COVID-19 is not a threat	18.7 (16.5–21.0)	8.6 (5.9 – 12.0)	25.9 (22.9–29.2)	16.3 (11.0–22.8)	3.1 (0.8 – 7.9)†	23.3 (15.5–32.6)	17.6 (14.6–21.0)	10.4 (6.2 – 16.1)	23.2 (18.9–28.0)	21.0 (17.4 – 24.9)	8.6 (4.3–15.0)	30.4 (25.3–35.9)
Do not like needles	10.4 (8.6–12.5)	12.3 (9.1–16.1)	9.2 (6.9–11.9)	8.7 (4.8–14.8)	6.6 (1.7–16.7)†	9.8 (4.3–18.4)†	11.2 (8.5–14.5)	14.7 (9.9–20.6)	8.8 (5.6–13.0)	10.4 (7.5–13.9)	11.8 (7.0–18.3)	9.3 (6.1–13.6)
Obstacles prevent vaccination	5.1 (3.8–6.8)	6.7 (4.4–9.6)	4.0 (2.4–6.3)	6.5 (2.8–12.6)†	7.5 (3.2–14.5)†	6.0 (1.4–15.9)†	4.9 (3.2–7.2)	6.2 (3.7–9.7)	3.8 (1.7–7.2)†	4.7 (2.7–7.6)	6.8 (3.0–13.1)†	3.1 (1.6–5.5)
Concerned about cost	4.6 (3.2–6.5)	7.2 (4.5 – 10.8)	2.8 (1.5–5.0)	3.8 (1.4–8.0)†	7.0 (1.6–18.2)†	2.1 (0.4–6.2)†	3.6 (2.0–6.0)	5.8 (3.0–10.1)	2.0 (0.5–5.3)	6.2 (3.4–10.2)	8.8 (3.9–16.7)†	4.2 (1.5–9.1)†
Community members are not getting vaccinated	3.1 (2.2–4.2)	2.6 (1.6–4.1)	3.4 (2.2–5.1)	1.2 (0.3–3.2)	1.3 (0.1–5.5)†	1.2 (0.2–3.9)	4.0 (2.5–6.1)	2.9 (1.3–5.4)	4.9 (2.6–8.4)	2.9 (1.7–4.6)	2.9 (1.3–5.6)	3.0 (1.3–5.6)

*Values are reported as % respondents (95% CI). n values indicate unweighted sample size/denominator. Bold text indicates statistical significance ($p < 0.05$) between reachable and reluctant groups; reluctant group is the referent. R respondents were defined as adults who probably would or were unsure about getting a COVID-19 vaccine. RL respondents were defined as adults who probably or definitely would not get a COVID-19 vaccine. COVID-19, coronavirus disease; R, reachable; RL, reluctant.

†Estimates do not meet the National Center for Health Statistics standards of reliability (https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf).

Table 2. Motivators for getting a COVID-19 vaccine, by essential worker group and vaccination intent, United States, March–June 2021*

Reason	All groups, n = 5,308			Healthcare personnel, n = 1,308			Frontline workers, n = 2,300			Other workers, n = 1,700		
	Total†	R, n =	RL, n =	Total	R, n =	RL, n =	Total	R, n =	RL, n =	Total	R, n =	RL, n =
Prevent COVID-19 spread to family and friends	51.4 (49.6–53.2)	26.0 (22.0 – 30.3)	4.7 (3.1–6.9)	58.0 (54.4–61.4)	30.5 (20.3 – 42.3)	7.7 (2.5–17.2)†	50.5 (47.7–53.3)	30.7 (24.4 – 37.5)	4.1 (2.2–6.8)	47.6 (44.7–50.5)	19.1 (13.7 – 25.4)	3.7 (2.0–6.3)
More information on vaccine effectiveness	44.4 (42.7–46.2)	31.1 (26.7 – 35.7)	14.1 (11.6–16.9)	46.0 (42.6–49.4)	26.4 (17.6 – 36.8)	13.7 (8.5–20.5)	44.9 (42.3–47.5)	29.1 (23.5 – 35.2)	17.1 (13.1–21.7)	42.6 (39.7–45.6)	35.0 (27.7 – 42.9)	11.0 (7.4–15.6)
Reduce COVID-19 spread in community	41.9 (40.2–43.6)	19.4 (15.9 – 23.2)	2.9 (1.7–4.7)	45.8 (42.3–49.4)	14.5 (8.3 – 23.0)	3.0 (1.1–6.5)†	42.5 (39.8–45.2)	20.9 (16.0 – 26.6)	3.2 (1.0–7.3)†	37.9 (35.0–40.9)	19.4 (13.5 – 26.4)	2.6 (1.1–5.2)
Ability to resume social activities	36.7 (35.0–38.3)	15.5 (12.3 – 19.2)	2.2 (1.3–3.3)	38.5 (35.1–42.0)	9.0 (4.5 – 15.7)	1.2 (0.2–3.8)	37.7 (35.3–40.2)	14.3 (9.9 – 19.6)	3.6 (1.9–6.1)	33.8 (31.1–36.5)	19.3 (13.4 – 26.3)	1.2 (0.4–2.8)
More severe COVID-19 cases	33.4 (31.8–35.0)	13.7 (10.8 – 17.0)	4.8 (3.4–6.6)	36.2 (32.9–39.5)	14.4 (7.8 – 23.6)	2.2 (0.7–5.4)	33.6 (31.2–36.1)	13.1 (9.1 – 18.1)	6.2 (3.5–10.0)	30.9 (28.3–33.6)	14.0 (9.3 – 19.9)	4.7 (2.7–7.5)
Ability to travel	31.3 (29.8–32.8)	16.9 (13.8 – 20.5)	6.9 (5.1–9.1)	32.5 (29.2–35.9)	15.0 (8.1–24.5)	7.4 (3.2–14.2)†	32.4 (30.1–34.7)	16.4 (12.1 – 21.6)	6.4 (4.1–9.4)	28.8 (26.2–31.4)	18.3 (12.7 – 24.9)	7.1 (4.3–10.8)
Someone I know became seriously ill or died from COVID-19	22.1 (20.8–23.5)	9.4 (6.8–12.6)	6.4 (4.6–8.5)	24.1 (21.4–27.0)	11.7 (5.6 – 21.0)†	2.7 (0.8–6.6)†	21.7 (19.7–23.9)	11.5 (6.9–17.8)	8.0 (5.2–11.6)	21.0 (18.7–23.4)	6.1 (3.6–9.6)	6.6 (3.9–10.4)
Recommend by a healthcare provider	17.2 (16.0–18.5)	14.1 (10.9 – 17.9)	3.6 (2.2–5.5)	19.9 (17.4–22.6)	13.5 (6.3 – 24.2)†	3.9 (0.8–11.0)†	16.8 (14.9–18.7)	15.5 (10.8 – 21.2)	4.2 (2.2–7.4)	15.7 (13.7–17.9)	12.9 (7.7 – 19.8)	2.8 (1.2–5.5)
Workplace or school requirement	14.9 (13.8–16.1)	29.1 (25.0 – 33.5)	14.2 (11.8–17.0)	19.9 (17.2–22.9)	39.5 (28.6 – 51.2)	10.8 (6.5–16.7)	13.7 (12.0–15.4)	27.2 (21.6 – 33.5)	17.1 (13.0–21.9)	12.8 (10.8–15.0)	27.4 (20.9 – 34.7)	13.0 (9.4–17.4)
Vaccine safety information available	14.8 (13.4–16.3)	39.8 (35.4 – 44.5)	20.8 (17.9–24.1)	11.7 (9.3–14.6)	46.6 (35.6 – 57.9)	21.2 (14.7–28.9)	14.2 (12.2–16.4)	36.8 (30.5 – 43.3)	21.7 (17.1–26.8)	18.0 (15.2–21.1)	40.7 (33.3 – 48.6)	19.7 (15.1–25.1)
Enables children back to school	14.8 (13.6–16.0)	8.1 (5.9 – 10.9)	1.5 (0.7–2.8)	16.5 (13.9–19.3)	12.6 (5.6 – 23.3)†	2.0 (0.6–5.1)	16.0 (14.2–17.8)	8.5 (5.4 – 12.4)	2.2 (0.6–5.2)	11.8 (10.0–13.8)	6.1 (3.3 – 10.1)	0.4 (0.0–1.6)
Enables me to get back to work or school	12.4 (11.2–13.7)	4.8 (3.2 – 7.0)	1.4 (0.7–2.7)	14.3 (11.7–17.3)	2.2 (0.4–6.7)†	1.7 (0.4–4.6)	14.9 (13.0–16.8)	6.4 (3.7 – 10.3)	2.0 (0.5–5.1)	7.5 (6.1–9.2)	4.1 (1.9 – 7.5)†	0.7 (0.1–2.1)
Recommended by a family member or friend	11.9 (10.8–13.0)	5.4 (3.7 – 7.7)	1.3 (0.6–2.4)	11.2 (9.0–13.7)	7.6 (2.3–17.8)†	2.2 (0.6–5.3)	13.0 (11.4–14.8)	5.9 (3.4 – 9.4)	1.7 (0.5–4.4)	10.8 (9.1–12.6)	4.2 (2.1 – 7.2)	0.3 (0.0–1.3)
See community members getting vaccinated	10.3 (9.1–11.5)	5.2 (3.4 – 7.5)	2.6 (1.3–4.6)	10.5 (8.2–13.2)	10.2 (3.7–21.3)†	2.1 (0.6–5.2)	11.7 (9.8–13.8)	5.3 (3.0–8.6)	4.5 (1.7–9.4)†	8.2 (6.7–9.9)	3.2 (1.4 – 6.0)	0.7 (0.1–2.2)
Large increase in COVID-19 cases in my area	3.1 (2.5–3.9)	10.1 (7.7 – 13.0)	3.2 (2.0–4.9)	2.3 (1.2–4.1)	13.5 (6.4 – 24.1)†	2.1 (0.5–5.3)	3.2 (2.2–4.4)	7.8 (5.1–11.4)	5.1 (2.6–8.8)	3.7 (2.5–5.4)	11.4 (7.2 – 17.1)	1.8 (0.7–3.7)
None of the above	19.9 (18.3–21.5)	14.1 (11.1 – 17.6)	55.9 (52.1–59.6)	15.6 (12.3–19.4)	10.7 (5.8 – 17.7)	54.1 (44.3–63.6)	17.7 (15.4–20.1)	11.9 (8.1 – 16.7)	52.7 (46.6–58.7)	26.2 (23.3–29.2)	17.8 (12.1 – 24.9)	60.5 (54.5–66.3)

*Values are reported as % respondents (95% CI). n values indicate unweighted sample size/denominator. Bold text indicates statistical significance (p<0.05) between reachable and reluctant groups; reluctant group is the referent. R respondents were defined as adults who probably would or were unsure about getting a COVID-19 vaccine. RL respondents were defined as adults who probably or definitely would not get a COVID-19 vaccine. COVID-19, coronavirus disease; R, reachable; RL, reluctant.

†Estimates do not meet the National Center for Health Statistics standards of reliability (https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf).

85.5% of reachable respondents were concerned about vaccine side effects compared with 68.8% of those in reluctant groups.

Among all essential workers, the main motivators for getting vaccinated were protection from spreading COVID-19 to family and friends (51.4%),

receiving more information on effectiveness of COVID-19 vaccines (44.4%), and reducing spread of COVID-19 in the community (41.9%) (Table 2). Motivators that were higher among the reachable than the reluctant groups were increased information on vaccine safety (39.8% vs. 20.8%) and effica-

cy (31.1% vs. 14.1%), requirement by workplace or school (29.1% vs. 14.2%), and protection for family and friends (26.0% vs. 4.7%).

Conclusions

Despite their increased risk for COVID-19 exposure, only about 70% of essential workers included in the sample received ≥ 1 vaccine dose by early June 2021, similar to the 69% of all adults in the sample population during the same time period (data not shown). Over the 6 waves of data collection, HCP had the highest vaccination coverage (66.6%); those in the other essential worker group had the lowest vaccination coverage (45%) during March–June 2021, and one quarter were reluctant to get COVID-19 vaccinations. Consistent with another study (11), we found that younger adults and those who have lower education or income levels are more vaccine hesitant.

The first limitation of our study is that although the panel recruitment survey methodology and data weighting were designed to produce nationally representative results, respondents might not be fully representative of the general US adult population. Vaccination coverage among respondents was self-reported and could be subject to recall or social desirability bias. Data were combined across multiple survey waves, which might overaverage any recent changes in vaccination coverage and intent. Finally, state-specific vaccine prioritization varied during the data collection period, which might have affected vaccination coverage responses to items related to attitudes, behaviors, and perceptions.

Among essential workers in this sample, predominant motivators for getting vaccinated were protecting family and friends, gaining more information about the safety and effectiveness of vaccines, and preventing community spread. These data suggest that clear, consistent messages from healthcare providers, public health officials, and immunization partners about the safety and effectiveness of the vaccine could increase vaccination coverage and vaccine confidence more broadly (12). In addition, framing messages in terms of benefits such as protecting family and friends; being able to travel; and resuming work, school, and social activities might further boost immunization coverage and confidence (12).

Among unvaccinated essential workers, nearly 60% were worried about vaccine side effects. Connecting employers and employees to credible resources on vaccine safety and expected side effects might improve vaccination coverage among essential workers. Implementing interventions to mitigate barriers to vaccination, such as flexible scheduling, paid time off for vaccination and illness resulting from

side effects, on-site vaccination, and walk-in clinics, also could improve vaccination coverage.

In conclusion, our findings suggest public health officials and other leaders should differentiate between continued challenges in accessing vaccines for all populations from behavioral factors associated with vaccination. To reach vaccination goals for essential workers and everyone in the community, healthcare providers, public health officials, and immunization partners should consider KABs when tailoring messages and strategies to increase vaccination uptake and confidence, especially at local community levels.

About the Author

Dr. Nguyen is an epidemiologist in the Immunization Services Division, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA. She is working with the CDC COVID-19 Vaccine Task Force. Her research interests include investigating gaps in COVID-19 vaccination coverage and developing strategies to increase vaccination uptake and confidence.

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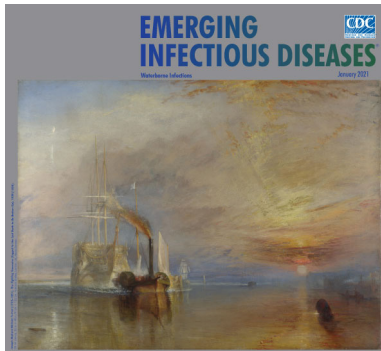
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**EMERGING
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COVID-19 Vaccination Coverage, Intent, Knowledge, Attitudes, and Beliefs among Essential Workers, United States

Appendix

Additional Methods

In December 2020, the Advisory Committee on Immunization Practices (ACIP) issued recommendations prioritizing persons for vaccination in a series of phases for COVID-19 vaccination (*1*). ACIP recommendations prioritized healthcare personnel (HCP) and long-term care facility residents in Phase 1a, persons aged ≥ 75 years and non-healthcare frontline essential workers in Phase 1b, and persons aged 65–74 years, persons with high-risk medical conditions aged 16–64 years, and essential workers who were not in Phase 1a or 1b into Phase 1c (*1*).

We analyzed data from 2 nationally representative household panel omnibus surveys collected during March 2, –June 5, 2021, Ipsos KnowledgePanel (2) and NORC AmeriSpeak (3). For Ipsos, data were fielded during March 5–7, March 19–29, April 9–11, April 23–May 2, May 7–9, and May 21–31, 2021. For NORC, data were collected during March 11–15, March 25–29, April 15–19, April 29–May 4, May 13–17, and May 27–June 2, 2021 (Figure 1).

We examined the following sociodemographic characteristics: age groups were 18–34 years, 35–49 years, 50–64 years, or ≥ 65 years; race/ethnicity were reported as non-Hispanic (NH) White, NH Black, Hispanic, NH Asian persons, or non-Hispanic other/multiple races persons; annual household income was reported as $< \$35,000$, $\$35,000$ – $\$49,999$, $\$50,000$ – $\$74,999$, or $\geq \$75,000$; health insurance status was reported as yes or no; marital status was reported as married or living with a partner, separated or divorced or widowed, or never married; urban versus rural status was reported as urban, suburban, or rural; and yes or no for any underlying conditions. Underlying condition status was ascertained through the following question: Have you ever been told by a doctor or other health professional that you had any of

the following medical conditions? Respondents could select any of the listed conditions, which were derived from a list of conditions that increase risk for severe illness from COVID-19 (4) (Appendix Table 2).

We weighted data to ensure representation of the US population by using demographic benchmarks from the 2019 American Community Survey (5), such as age, sex, race/ethnicity, education, and income. We also used the 2020 Current Population Survey (6) to determine respondent residence in a Metropolitan Statistical Area (MSA) or non-MSA, that is rural area.

This activity complied with Centers for Disease Control and Prevention (CDC) policy on human subjects research (7). The study also complies with federal laws, including 45 CFR part 46.102(l) (2) (8); 21 CFR part 56 (9); 42 USC Section 241(d) (10); 5 USC Section 552a (11); and 44 USC Section 3501 et seq (12).

Essential Worker Group Categorization

We categorized respondents according to ACIP's essential worker groups (13). We determined essential workers by using the following question: Which best describes the current primary location/setting where you work or volunteer? Respondents could select 1 response.

We categorized respondents as HCP if they replied that their work or volunteer duties fell into any of the following 3 categories: healthcare, such as hospital, doctor, dentist, or mental health specialist office, outpatient facility, long-term care, home health care, pharmacy, or medical laboratory; social service, such as child, youth, family, elderly, or disability services; or death care, such as funeral home, crematory, or cemetery.

We categorized respondents as nonhealthcare frontline essential workers if they replied that their work or volunteer duties fell into any of the following 10 categories: education, at a prekindergarten or kindergarten–12 school setting or in childcare; other education, such as business or technical school, college, or university; first response, such as police or fire protection, or emergency relief services; correctional facility, such as jail, prison, detention center, or reformatory; food and beverage stores, such as grocery store, warehouse club, supercenter, convenience store, specialty food store, bakery, or liquor store; agriculture, forestry, fishing, or hunting; food manufacturing facility, such as meat processing, produce packing, or food or beverage manufacturing; non-food manufacturing facility, such as metals, equipment and

machinery, or electronics; public transit, such as bus, commuter rail, subway, or school bus; or United States Postal Service. We categorized respondents as nonessential when they reported any work setting other than those classified as essential.

Vaccination Status, Intent, and Knowledge, Attitudes, and Beliefs Questions Toward Vaccination

We assessed vaccination status, intent, and knowledge, attitudes, and beliefs (KABs) through survey questions. We assessed vaccination status by using the following question: Have you received at least one dose of a COVID-19 vaccine? Respondents could select yes or no.

Among adults who were not vaccinated, we asked: How likely are you to get a COVID-19 vaccine? Response options were definitely will get a vaccine, probably will get a vaccine, unsure about getting a vaccine, probably will not get a vaccine, and definitely will not get a vaccine. We categorized respondents as reachable if they probably would or were unsure about getting a vaccine. We categorized respondents as reluctant if they probably or definitely would not get a vaccine.

We assessed the following KABs about the COVID-19 vaccine: reasons for not getting vaccinated, barriers in getting a vaccine, motivators for getting a vaccine, concerns about getting COVID-19, and concerns about having any side effects from a COVID-19 vaccine.

We asked about reasons for not getting vaccinated for all respondents except those who already were vaccinated or definitely planned to get vaccinated. We used the question, Which of the following, if any, are reasons that you (only probably will get/are unsure about getting/probably won't get/definitely won't get/won't receive all required doses of) a/the COVID-19 vaccine?

We assessed barriers in getting a vaccine by asking everyone who did not get vaccinated, What makes it difficult for you to get a COVID-19 vaccine? Possible responses were nothing; side effects will interfere with daily activities; difficult to make online appointment; not sure; do not have time off work; cannot find convenient appointment time; other (Appendix Table 2).

We asked all respondents, regardless of vaccination status, about motivators for getting vaccinated. We used the following question to assess vaccination barriers: Which of the

following [made/would make] you [definitely plan/more likely] to get a COVID-19 vaccine? Possible responses included prevent COVID-19 spread to family and friends; get more information on vaccine effectiveness; reduce COVID-19 spread in community; ability to resume social activities; more severe COVID-19 cases in the community; and ability to travel (Table 2).

We asked respondents whether they were concerned about getting COVID-19; How concerned are you about getting COVID-19? We also asked whether they were concerned about vaccine side effects; How concerned are you about having any side effects from the COVID-19 vaccine? Possible responses to COVID-19 and vaccination concerns included very concerned, somewhat concerned, slightly concerned, and not concerned. We categorized respondents as having concerns when they reported being very concerned or somewhat concerned. We did not include results for slightly concerned or not concerned in this report.

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Appendix Table 1. Proportion of reachable and reluctant adults, by essential worker status and socioeconomic characteristics, United States, March–June 2021*

Characteristics	All groups†		Healthcare personnel		Frontline workers		Other workers	
	R, n = 714	RL, n = 1,059	R, n = 121	RL, n = 197	R, n = 316	RL, n = 437	R, n = 277	RL, n = 425
All adults ≥18 y	15.3 (14.1–16.6)	21.5 (20.1–22.9)	9.3 (7.5–11.4)	18.3 (15.4–21.5)	15.6 (13.7–17.6)	20.4 (18.2–22.7)	19.6 (17.0–22.4)	25.5 (23.0–28.1)
Age groups, y								
18–34	18.8 (16.3–21.6)	25.0 (22.2–28.0)	11.2 (7.8–15.5)	25.4 (19.2–32.4)	18.8 (15.2–22.8)	21.4 (17.5–25.7)	26.2 (20.2–32.8)	30.8 (25.8–36.1)
35–49	15.8 (13.7–18.1)	24.1 (21.7–26.7)	10.3 (6.9–14.7)	19.0 (14.3–24.5)	16.2 (12.7–20.3)	24.1 (20.4–28.1)	19.2 (15.2–23.6)	27.7 (23.3–32.5)
50–64	12.9 (10.9–15.1)	17.4 (15.1–19.8)	7.7 (4.7–11.6)	11.9 (8.2–16.6)	13.5 (10.4–17.0)	17.1 (13.4–21.3)	15.2 (11.7–19.4)	20.9 (17.3–24.9)
≥65	5.8 (3.6–8.8)	9.6 (6.6–13.3)	3.7 (1.4–8.0)‡	5.9 (2.1–12.8)‡	4.1 (1.2–9.8)‡	12.5 (7.5–19.1)	11.4 (5.6–19.8)	10.2 (5.1–17.7)
Sex								
M	16.8 (14.8–18.9)	20.9 (19.0–23.0)	6.1 (3.9–9.1)	13.8 (9.9–18.6)	17.2 (14.4–20.2)	20.5 (17.7–23.6)	20.6 (17.0–24.5)	24.3 (21.1–27.7)
F	13.8 (12.1–15.6)	22.0 (19.9–24.2)	10.8 (8.4–13.6)	20.4 (16.6–24.6)	14.0 (11.4–16.8)	20.3 (17.1–23.8)	17.9 (14.1–22.1)	27.5 (23.3–32.0)
Race/ethnicity								
Non-Hispanic White	14.1 (12.6–15.6)	22.9 (21.2–24.7)	8.3 (6.1–10.8)	17.3 (13.8–21.3)	14.7 (12.5–17.2)	22.4 (19.7–25.2)	17.0 (14.1–20.3)	27.2 (24.3–30.2)
Non-Hispanic Black	19.1 (14.8–23.9)	20.7 (16.6–25.2)	15.5 (9.7–22.9)	17.0 (10.3–25.7)	22.0 (15.4–29.9)	19.3 (13.5–26.3)	18.2 (10.2–28.8)	28.6 (19.4–39.2)
Hispanic	16.8 (13.6–20.3)	19.4 (15.6–23.7)	8.8 (4.9–14.4)	24.8 (16.4–34.9)	14.4 (10.1–19.7)	16.2 (11.2–22.4)	26.9 (19.7–35.2)	19.2 (13.2–26.4)
Non-Hispanic	15.4 (10.7–21.2)	17.0 (12.4–22.4)	5.8 (1.8–13.6)‡	12.7 (5.2–24.5)‡	14.0 (8.0–22.0)	16.9 (10.9–24.5)	26.7 (15.3–40.8)	21.1 (11.0–34.7)
Other/multiple races								
Educational Status								
High school or less	21.9 (19.0–25.2)	28.1 (25.0–31.4)	12.2 (7.7–18.0)	29.5 (21.7–38.4)	23.5 (19.0–28.5)	26.4 (21.7–31.5)	25.8 (20.2–32.1)	29.6 (24.9–34.7)
Some college or college graduate	14.1 (12.7–15.6)	20.9 (19.2–22.6)	9.1 (7.0–11.5)	16.8 (13.7–20.3)	14.2 (12.1–16.5)	19.9 (17.4–22.7)	17.7 (15.0–20.7)	25.0 (21.9–28.2)
Above college graduate	5.0 (3.5–6.9)	9.4 (7.3–11.9)	6.0 (3.2–10.1)	6.7 (3.6–11.3)	3.6 (2.0–5.9)	9.9 (7.0–13.4)	7.0 (3.7–11.9)	12.8 (7.3–20.4)
Annual household income, \$US								
<25,000	21.8 (17.2–26.9)	26.3 (21.0–32.1)	9.9 (5.4–16.2)	26.9 (16.5–39.5)	24.4 (17.3–32.8)	25.4 (18.3–33.6)	37.0 (25.5–49.7)	27.4 (18.4–37.9)
25,000–49,999	18.4 (15.1–22.2)	25.8 (22.4–29.5)	12.3 (7.5–18.7)	17.6 (12.4–23.8)	17.7 (13.2–23.1)	28.6 (23.2–34.4)	24.2 (17.4–32.0)	28.3 (22.2–35.0)
50,000–74,999	15.4 (12.6–18.5)	24.4 (21.1–28.0)	9.1 (5.0–15.0)	24.8 (17.7–32.9)	17.4 (12.9–22.8)	21.8 (17.2–27.0)	16.9 (12.2–22.4)	27.5 (21.4–34.2)
≥75,000	12.2 (10.7–13.9)	17.3 (15.6–19.1)	7.9 (5.7–10.7)	13.1 (10.0–16.8)	11.4 (9.3–13.7)	14.8 (12.4–17.5)	16.4 (13.1–20.0)	23.3 (20.2–26.7)
Insurance status								
Insured	14.3 (13.0–15.6)	20.2 (18.7–21.7)	8.7 (6.9–10.8)	17.2 (14.3–20.4)	13.7 (11.9–15.7)	19.2 (17.0–21.6)	19.3 (16.6–22.2)	23.8 (21.2–26.5)
Not insured	23.5 (18.2–29.5)	32.3 (26.1–38.9)	11.0 (4.5–21.5)‡	33.6 (19.7–49.9)‡	28.2 (19.8–37.8)	28.2 (19.8–38.0)	25.6 (15.9–37.4)	37.7 (26.8–49.6)
Marital status								
Married/Living with partner	13.3 (11.9–14.7)	21.7 (20.0–23.6)	8.3 (6.2–10.9)	17.2 (13.8–21.0)	12.8 (10.8–15.1)	22.1 (19.1–25.2)	17.5 (14.6–20.7)	24.5 (21.4–27.9)
Separated/divorced/widowed	12.4 (9.1–16.3)	23.2 (19.7–27.0)	9.3 (5.2–14.9)	15.3 (9.1–23.6)	12.9 (7.4–20.3)	22.4 (17.1–28.4)	14.4 (8.7–21.8)	30.9 (24.2–38.3)
Never married	20.3 (17.5–23.4)	20.2 (17.4–23.2)	11.1 (7.3–15.9)	21.6 (15.4–28.9)	21.6 (17.4–26.3)	16.7 (13.0–20.9)	26.7 (21.0–33.0)	24.6 (19.7–29.9)
MSA								
Urban	15.7 (13.4–18.2)	16.5 (14.4–18.7)	8.9 (5.9–12.8)	13.9 (9.8–18.9)	14.6 (11.2–18.5)	15.2 (12.2–18.7)	23.7 (18.4–29.6)	20.8 (16.9–25.2)
Suburban	14.4 (12.7–16.2)	21.7 (19.6–23.9)	8.8 (6.5–11.7)	19.4 (15.3–24.1)	15.8 (12.9–19.0)	19.7 (16.4–23.2)	16.7 (13.5–20.4)	25.9 (22.4–29.7)
Rural	16.9 (14.3–19.9)	29.3 (26.1–32.8)	11.6 (6.8–18.0)	24.1 (16.1–33.7)	16.7 (13.3–20.7)	30.3 (25.6–35.3)	21.0 (15.6–27.3)	31.5 (25.8–37.7)
Underlying conditions								
Y	15.3 (13.6–17.2)	21.4 (19.5–23.5)	9.0 (6.6–11.9)	20.4 (16.3–25.0)	15.8 (13.0–18.8)	20.8 (17.8–24.0)	20.1 (16.6–23.9)	23.1 (19.8–26.7)
N	15.2 (13.3–17.2)	21.7 (19.6–24.0)	9.9 (7.1–13.3)	15.9 (12.0–20.6)	15.4 (12.7–18.5)	20.3 (17.3–23.7)	18.7 (15.0–22.8)	28.2 (24.4–32.2)

*Values are reported as % (95% CI). Bold text indicates statistical significance (p<0.05) between reachable and reluctant groups; reluctant group is the referent. Reachable (R) respondents were defined as adults who probably would or were unsure about getting a COVID-19 vaccine. Reluctant (RL) respondents were defined as adults who probably or definitely would not get a COVID-19 vaccine. COVID-19, coronavirus disease; MSA, metropolitan statistical area; R, reachable; RL, reluctant.

†n = unweighted sample size/denominator.

‡Estimates do not meet the National Center for Health Statistics standards of reliability (https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf).

Appendix Table 2. COVID-19 vaccination attitudes and barriers to vaccination by essential worker group and vaccination intent, United States, March–June 2021*

Barriers	All groups, n = 5,308			Healthcare personnel, n = 1,308			Frontline workers, n = 2,300			Other workers, n = 1,700		
	Total†	R, n = 714	RL, n = 1,059	Total	R, n = 121	RL, n = 197	Total	R, n = 316	RL, n = 437	Total	R, n = 277	RL, n = 425
Concerned about getting COVID-19‡	38.5 (36.8–40.2)	42.5 (37.8–47.3)	21.8 (18.5–25.3)	38.9 (35.5–42.3)	48.8 (37.3–60.4)	25.0 (16.5–35.0)	40.0 (37.3–42.6)	43.6 (36.8–50.6)	23.5 (18.7–28.7)	36.2 (33.3–39.1)	38.9 (31.1–47.1)	18.2 (13.5–23.6)
Concerned about vaccine side effects‡	46.4 (44.7–48.1)	73.1 (68.5–77.4)	70.9 (67.2–74.5)	41.0 (37.6–44.5)	85.5 (78.0–91.3)	68.8 (59.1–77.5)	47.4 (44.9–50.0)	72.7 (65.9–78.8)	73.7 (67.8–79.0)	49.3 (46.4–52.2)	69.0 (60.7–76.4)	69.1 (63.5–74.3)
What makes it difficult for you to get a COVID-19 vaccine?§												
Nothing, it is not difficult	52.0 (49.3–54.6)	40.7 (36.1–45.5)	71.3 (67.5–74.9)	55.2 (48.4–61.7)	44.5 (33.5–55.9)	69.7 (59.0–79.1)	50.8 (46.6–54.9)	40.2 (33.4–47.3)	68.6 (62.8–74.0)	51.8 (47.7–55.9)	39.9 (32.4–47.8)	75.2 (69.6–80.2)
Side effects will interfere with daily activities	16.5 (13.8–19.4)	25.2 (19.6–31.4)	11.7 (8.5–15.6)	13.4 (7.5–21.4)	21.8 (11.7–35.1)	9.7 (2.4–24.3)¶	18.3 (14.1–23.3)	26.9 (18.1–37.3)	12.4 (8.4–17.4)	16.0 (12.1–20.6)	24.6 (16.0–35.1)	12.1 (7.4–18.5)
Difficult to make online appointment	7.4 (6.1–8.9)	9.1 (6.7–12.1)	2.4 (1.3–4.1)	7.6 (4.9–11.1)	9.2 (4.1–17.3)¶	3.7 (1.3–7.8)¶	7.0 (5.3–9.2)	7.9 (5.1–11.6)	2.0 (0.9–3.8)	7.7 (5.4–10.6)	10.5 (6.0–16.6)	2.2 (0.3–7.0)¶
Not sure	5.8 (4.3–7.7)	7.4 (4.4–11.5)	6.2 (4.0–9.0)	7.3 (3.4–13.2)¶	11.8 (3.2–27.8)¶	6.4 (2.0–14.7)¶	5.7 (3.5–8.8)	9.0 (4.5–15.7)	5.7 (2.6–10.7)¶	5.3 (3.2–8.3)	3.7 (0.9–9.8)¶	6.5 (3.4–11.2)
Do not have time off work	5.4 (4.1–6.9)	6.0 (3.7–9.1)	3.2 (1.7–5.3)	3.3 (1.8–5.7)	2.4 (0.5–7.0)¶	1.3 (0.2–4.0)	5.0 (3.4–7.1)	6.1 (3.4–9.9)	3.8 (1.6–7.4)¶	6.7 (4.2–10.1)	7.2 (2.8–14.6)¶	3.6 (1.0–8.6)¶
Cannot find convenient appointment time	5.3 (3.6–7.4)	9.0 (5.3–14.0)	1.5 (0.3–4.0)	6.8 (3.0–12.9)¶	16.8 (6.0–34.1)¶	0.7 (0.0–4.2)	3.4 (2.0–5.4)	3.8 (1.4–8.0)¶	1.5 (0.4–3.9)	6.4 (3.4–10.8)	11.7 (5.3–21.6)¶	1.9 (0.0–9.9)¶
Other#	29.8 (26.7–33.1)	36.2 (30.5–42.2)	19.4 (15.5–23.8)	34.0 (26.1–42.7)	37.1 (24.4–51.3)	25.7 (15.0–39.2)	28.6 (24.1–33.5)	32.3 (24.0–41.5)	20.3 (14.9–26.7)	28.8 (24.1–34.0)	40.1 (30.3–50.5)	14.9 (10.1–20.7)

*Values are reported as % (95% CI). Bold text indicates statistical significance (p<0.05) between reachable and reluctant groups; reluctant group is the referent. Reachable (R) respondents were defined as adults who probably would or were unsure about getting a COVID-19 vaccine. Reluctant (RL) respondents were defined as adults who probably or definitely would not get a COVID-19 vaccine. COVID-19, coronavirus disease; R, reachable; RL, reluctant.

†n = unweighted sample size/denominator.

‡Asked of all respondents.

§Ask only of respondents who have not received at least one COVID-19 vaccine.

¶Estimates do not meet the National Center for Health Statistics standards of reliability (https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf).

#Other barriers included being too busy to get vaccinated, not knowing where to go to get vaccinated, being ineligible to get vaccinated due to a medical reason, inconvenient hours of operation, long waiting times, distance, transportation, childcare issues, physical limitation, or other reasons.