

COVID-19 Vaccine Uptake Among US Child Care Providers

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OBJECTIVES: Ensuring high coronavirus disease-2019 (COVID-19) vaccine uptake among US child care providers is crucial to mitigating the public health implications of child-staff and staff-child transmission of severe acute respiratory syndrome coronavirus 2; however, the vaccination rate among this group was previously unknown. abstract

METHODS: To characterize vaccine uptake among US child care providers, we conducted a multistate cross-sectional survey of the child care workforce. Providers were identified through various national databases and state registries. A link to the survey was sent via e-mail between May 26 and June 23, 2021. A 37.8% response yielded 21 663 respondents, with 20 013 satisfying inclusion criteria.

RESULTS: Overall COVID-19 vaccine uptake among US child care providers (78.2%, 90% confidence interval: 77.5% to 78.9%) was higher than the US general adult population (65%). Vaccination rates varied between states from 53.5% to 89.4%. Vaccine uptake among respondents differed significantly ($P < .01$) based on respondent age (70.0% for ages 25–34, 91.6% for ages 75–84), race (70.0% for Black or African Americans, 92.5% for Asian Americans), annual household income (70.8% for <\$35 000, 85.1% for >\$75 000), and child care setting (73.0% for home-based, 79.7% for center-based).

CONCLUSIONS: COVID-19 vaccine uptake among US child care providers was higher than the general US adult population. Those who were younger, lower income, Black or African American, resided in states either in the Mountain West or the South, and/or worked in home-based child care programs reported the lowest rates of vaccination. State public health leaders and lawmakers should prioritize these subgroups to realize the largest gains in vaccine uptake among providers.

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WHAT'S KNOWN ON THIS SUBJECT: Ensuring a high coronavirus disease-2019 vaccine uptake among US child care providers is crucial to mitigating the public health implications of child-to-staff and staff-to-child transmission of severe acute respiratory syndrome coronavirus 2; however, the vaccination rate among this group was unknown.

WHAT THIS STUDY ADDS: Although the overall vaccine uptake among US child care providers was higher than the national adult average, certain subgroups continue to warrant focused attention for outreach and/or placement on the policy agenda.

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Promoting coronavirus disease-2019 (COVID-19) vaccine uptake among US child care providers is a vital step in restoring the United States to prepandemic functionality. Accurately billed as “the workforce behind the workforce,”¹ child care providers supply an essential service to parents seeking to reenter the US labor market.² Evidence of this can be found in national surveys³ conducted by the Department of Education, which estimated that almost 90% of parents in dual income households relied on some type of child care before the pandemic.⁴ Furthermore, in the aftermath of the pandemic, lack of available child care services and school closures have been among the leading causes preventing parents from returning to the workforce.⁵

In addition to the economic incentive, there exists a public health imperative to protect child care providers through vaccination given the potential implications of bidirectional transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) between staff and children. Staff-to-child transmission may lead to COVID-19 among children, many of whom tend to be either asymptomatic or paucisymptomatic relative to adults and who may unwittingly transmit the infection to household contacts.⁶ Household contacts may include parents and grandparents, many of whom are elderly and/or have underlying medical conditions, placing them at higher risk for COVID-19–related morbidity and mortality.⁷ Although the risk is low,⁸ it is possible that child-to-staff transmission of SARS-CoV-2 may lead to COVID-19 among child care providers,⁸ a disproportionate number of whom are members of racial and ethnic minority groups⁹ also at higher risk for COVID-19–related complications.

Ensuring a high vaccine uptake among child care providers, thus, extends beyond the immediate issue of personal health and serves to promote economic recovery, public health, and health equity.

Despite the importance of ensuring high vaccine uptake among US child care providers, little is known about the group’s current vaccination status. To better characterize current vaccine uptake among child care providers, we conducted a large-scale multistate cross-sectional survey of the US child care workforce.

METHODS

Survey Administration

We conducted a cross-sectional survey via Qualtrics (Qualtrics, Provo, UT) of child care providers throughout the US and territories. The survey was self-administered via e-mail and available in English and Spanish. A prenotification e-mail was sent through Yale University notifying potential respondents to expect an e-mail from Qualtrics regarding the survey. The survey was active between May 26, 2021, and June 23, 2021; 11 reminders for survey completion were sent spaced 2 to 3 days apart. Child care providers contacted were those who had expressed interest in participating in follow-up surveys from a previous survey conducted in May 2020 on COVID-19 transmission within US child care programs.⁸ The original respondents were identified through 2 national child care provider databases and numerous state registries: (1) Child Care Aware America and (2) National Association for the Education of Young Children; and (3) various state registries coordinated by the National Workforce Registry Alliance (out of a total of 41 states with child care provider registries, 28 states agreed

to participate, 11 states were unable to secure permissions in time, and 2 states declined). Eligibility criteria for the survey included individuals employed as child care providers at any point during or just before the COVID-19 pandemic, either remotely or in-person, including both center-based child care providers and home-based (family-based) child care providers. Respondents provided informed consent before data collection. Respondents were entered into a random drawing to be one of 20 selected to receive a \$500 incentive. All respondents also were invited to participate in an optional free webinar where results of the study would be discussed. The research protocol was approved by the Yale University Institutional Review Board (protocol number: 2000028232).

Survey Content and Design

All questions used in the current analyses were close-ended with either nominal or ordinal answering scales. For questions with ordinal answering scales, positive and negative options were balanced. The survey was composed of questions on the following characteristics of child care providers: age, race (ie, “American Indian or Alaskan Native,” “Asian,” “Black or African American,” “Native Hawaiian or Other Pacific Islander,” “white,” or “I prefer not to answer”), ethnicity (ie, “Hispanic, Latino or Spanish origin;” “not Hispanic, Latino or Spanish origin;” or “I prefer not to answer”), annual income level, current employment status in child care, history of COVID-19 (ie, previous positive COVID-19 test result and/or COVID-19–related hospitalization), vaccination status, vaccination date, vaccine brand, likelihood of vaccination if unvaccinated, reasons for nonvaccination pertaining to structural issues (eg, lack of transportation, inability to get time off work, etc) and vaccine hesitancy

(eg, vaccine-related concerns regarding lack of safety and/or efficacy, disease-related concerns regarding low perceived risk of disease acquisition and/or severity, etc), and child care type (ie, center-based versus home-based).

Data Analysis

Descriptive statistics (frequencies, percentages) were calculated for the sample demographic characteristics. Additionally, the frequency and percentage of COVID-19 vaccine uptake was calculated at the national and state levels. States were determined on the basis of child care providers' reported zip codes. Data were weighted on the basis of age, race and ethnicity (race and ethnicity were included in the analyses because of research findings that white people are more likely to have received COVID-19 vaccination relative to Black and Hispanic people¹⁰), and state to match employed child care workers (occupation code: 4600) 18 years of age or older in the United States (50 states and Washington DC), based on the 2015–2019 American Community Survey. Weights were trimmed top and bottom at 2.5%. All reported percentages and data analytics correspond to weighted estimates unless otherwise specified. For bivariate analysis, Pearson's χ^2 test was used for assessing the association between both the unweighted and weighted categorical variables. For multivariable analysis, logistic regression was performed on the weighted categorical variables with the largest group by sample size serving as reference group. Variables were adjusted on the basis of age, race, ethnicity, annual family income, and history of COVID-19. Data were analyzed by using Stata version 16 (StataCorp, College Station, TX).

RESULTS

Of the 57 335 child care providers who participated in the May and June 2020 baseline survey, 44 771 (78.1%) agreed to follow-up data collection and provided valid e-mail addresses. Of those agreeing to follow-up, 21 663 (48.4%) responded to the current survey, yielding an overall response rate of 37.8%. Of those responding, 20 013 (92.4%) satisfied inclusion criteria and are included in the current analyses.

To test for nonresponse bias, baseline characteristics of responders and nonresponders were compared by using χ^2 analyses in terms of race, ethnicity, age, and child care program type (center-based versus home-based). Responders differed from nonresponders in terms of race and ethnicity ($P < .01$, both); however, Cramér's V was in the trivial range for both (0.09 and -0.04 , respectively). For respondent age, a weak association was found ($P < .01$, Cramér's $V = 0.13$), primarily driven by younger (18 to 24 years old) respondents at baseline survey being less likely to respond to the follow-up survey (5.6% versus 1.9%, respectively). There was no significant difference based on child care program type ($P = .22$). To reduce the impact of nonresponse bias, age, race, and ethnicity (Hispanic origin) were included in data weighting, as previously described.

Overall vaccine uptake among all eligible respondents was 78.2% (90% confidence interval [CI]: 77.5% to 78.9%; unweighted 80.3%), and vaccine uptake among those still actively working as child care providers at the time of survey completion (92% of respondents) was 78.4% versus 75.8% for those not currently working in child care ($P = .09$). Most respondents

reported receiving either Pfizer-BioNTech (50.5%) or Moderna (42.1%), with a lesser proportion reporting receiving Johnson & Johnson (6.9%) or another vaccine (0.6%). The most commonly reported month for receiving the first dose was March 2021 (33.1%), with proportions steeply declining after March 2021.

Vaccine Uptake by State

Vaccine uptake between states varied from a low of 53.5% in Wyoming to a high of 89.4% in Massachusetts. States with the highest vaccination rates tended to be in either New England (eg, Massachusetts: 89.4%, New Hampshire: 88.0%; Connecticut: 86.4%) or the Pacific West (eg, Washington: 85.4%, Oregon: 82.9%, California: 81.8%), whereas states with the lowest vaccination rates tended to be in either the South (eg, Oklahoma: 62.4%, Florida: 63.8%, Alabama: 67.7%) or Mountain West (eg, Wyoming: 53.5%, Montana: 64.4%, Utah: 70.8%), although the latter were limited by small sample sizes. State-by-state vaccine uptake among child care providers is reported in Fig 1.

Vaccine Uptake by Demographics

As shown in Table 1, vaccine uptake was higher among respondents who were older: the vaccination rate of those between 25 and 34 years of age was 70.0%, whereas the vaccination rate of those between 75 and 84 years of age was 91.6% ($P < .01$), with progressively higher rates as age groups became older. Vaccine uptake was lower among Black or African American providers at 70.0% and higher among Asian Americans at 92.5% ($P < .01$). Annual household income level was associated with higher vaccine uptake, with those earning $< \$35\,000$ having a vaccination rate of 70.8% and those earning $> \$75\,000$ having a vaccination rate

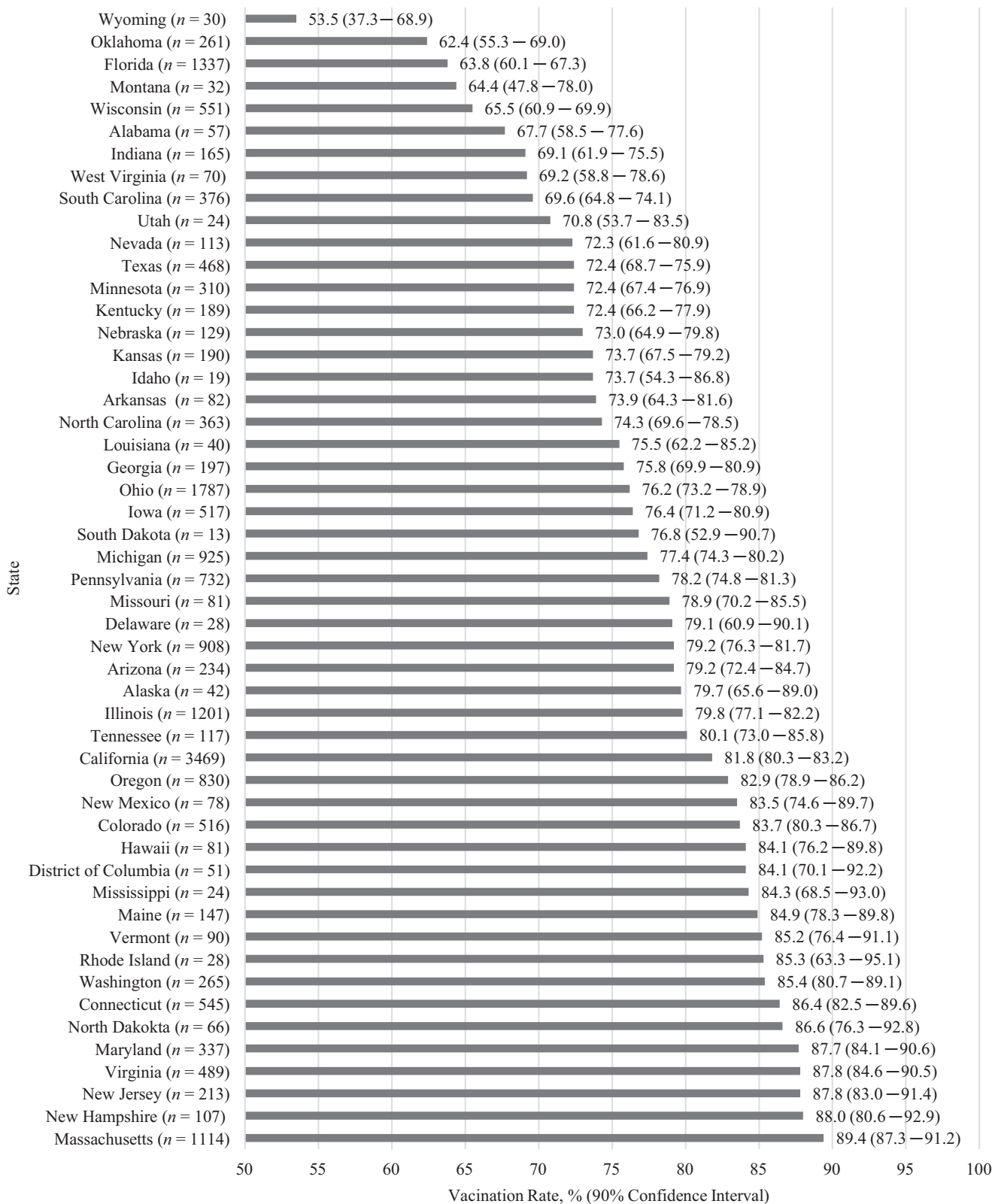


FIGURE 1
 COVID-19 vaccine uptake among US child care providers by state.

TABLE 1 Vaccination Rates of US Child Care Providers by Selected Characteristics

	Sample Size	Unweighted		Weighted	
		Percent	<i>P</i>	Percent	<i>P</i>
Overall					
All respondents	20 013	80.3	—	78.2	—
Age group					
18–24	380	73.4	.01	73.0	.01
25–34	2400	70.2	—	70.0	—
35–44	4637	75.3	—	74.4	—
45–54	6053	80.7	—	80.2	—
55–64	5078	86.6	—	86.4	—
65–74	1339	90.2	—	88.9	—
75–84	94	92.5	—	91.6	—
Race					
White	14 848	81.6	.01	79.9	.01
Black or African American	2132	71.2	—	70.0	—
American Indian or Alaskan Native	172	76.1	—	77.9	—
Asian	567	92.7	—	92.5	—
Native Hawaiian or other Pacific Islander	53	81.1	—	80.0	—
Multiracial	409	71.3	—	71.3	—
Prefer not to answer	1278	78.7	—	76.7	—
Ethnicity					
Hispanic, Latino or Spanish origin	3257	81.1	.22	78.7	.60
Not Hispanic, Latino or Spanish origin	16 377	80.2	—	78.1	—
Annual household income					
<\$35 000	3499	71.8	.01	70.8	.01
\$35 000–\$49 999	3308	77.1	—	75.5	—
\$50 000–\$74 999	4151	80.3	—	78.2	—
>\$75 000	6466	86.4	—	85.1	—
History of COVID-19					
Yes	2879	71.2	.01	70.5	.01
No	16 982	81.8	—	79.6	—
Setting of child care provider					
Home-based	5112	75.6	.01	73.0	.01
Center-based	12 887	81.7	—	79.7	—
Types of center-based settings					
For-profit	4160	79.9	.01	78.5	.01
Not-for-profit	3101	86.3	—	84.2	—
School-based	1706	82.8	—	81.2	—
Head start or early head start	1456	75.6	—	73.0	—
Drop-in	51	72.5	—	63.4	—
Faith based	1744	81.3	—	79.7	—
Other	650	84.1	—	82.6	—
Actively providing child care					
Yes	18 402	80.4	.01	78.4	0.09
No	1575	78.0	—	75.8	—

—, not applicable.

of 85.1% ($P < .01$), with progressively higher rates as household income increases. A history of COVID-19 was associated with lower vaccine uptake at 70.5% versus 79.6% in those without a history of COVID-19 ($P < .01$).

Vaccine Uptake by Setting of Child Care

Vaccine uptake was higher among center-based child care providers

relative to home-based providers with reported vaccination rates of 79.7% and 73.0%, respectively ($P < .01$). Notably, racial minority providers compose a higher proportion of home-based child care providers relative to center-based. Among the different types of center-based child care programs, vaccine uptake was as follows: for profit centers: 78.5%, not-for profit agency centers: 84.2%, school-based:

81.2%, Head Start or Early Head Start (federally funded centers): 73.0%, drop-in child care (the children change every day): 63.4%, faith-based child care programs: 79.7%, and other center-based: 82.6% ($P < .01$).

Reasons for Nonvaccination

Among those who were unvaccinated, only 5.0% were “absolutely certain” that they would

get vaccinated in the future, 6.9% were “very likely,” 28.2% were “somewhat likely,” and 59.2% were “not likely” (0.4% did not respond). Among those who reported being only “somewhat likely” or “not likely” to vaccinate in the future, the most common reasons for nonvaccination included concerns about vaccine safety (79.9%), concerns about the speed of vaccine development (66.8%), and lack of trust in the vaccine development process (32.0%). The most common structural barriers to vaccination were inability to take time off work (5.4%), too busy for vaccination (3.5%), and difficulty with scheduling a vaccine appointment date (2.7%). A complete list of reported reasons for nonvaccination can be found in Fig 2.

Results of Multivariable Analysis

Results of multivariable analysis (Table 2) mirrored bivariate analysis and held steady on adjustment, suggesting the relative

independence of predictors; age, race, and setting of child care all remained significant predictors of vaccine uptake whereas ethnicity did not. An interaction also was run between race and history of COVID-19 predicting COVID-19 vaccine uptake to test whether child care providers of color may have been less likely to get vaccinated because of their greater likelihood to have contracted COVID-19 in the past. A second interaction also was run between race and child care type predicting COVID-19 vaccine uptake to test whether home-based providers being more likely to be persons of color may potentially explain their lower vaccination rate. Results of both were not significant for any racial group ($P = .20$ to 0.99 for race \times history of COVID-19, and $P = .17$ to 0.96 for race \times child care type).

DISCUSSION

Overall vaccine uptake among US child care providers (78.2%; 90%

CI: 77.5 to 78.9) was significantly higher than that of the US general adult population (65%) at the time of the survey.¹¹ Notably, the vaccination rate among providers actively working in the child care industry at the time of the survey (92% of respondents) was slightly higher (78.4%). Of those reporting having not yet received the COVID-19 vaccine, another 11.9% stated that they were “absolutely certain” (5.0%) or “very likely” (6.9%) to get vaccinated in the future, suggesting that the final vaccine uptake among child care providers may settle around 90%. Our results are similar to those described in an April 6, 2021, media report¹² released by the Center for Disease Control and Prevention based on unpublished data. Additionally, our study provides a detailed breakdown of the vaccine uptake among child care providers based on demographics, location, and child care setting.

Increased vaccine uptake among child care providers relative to the

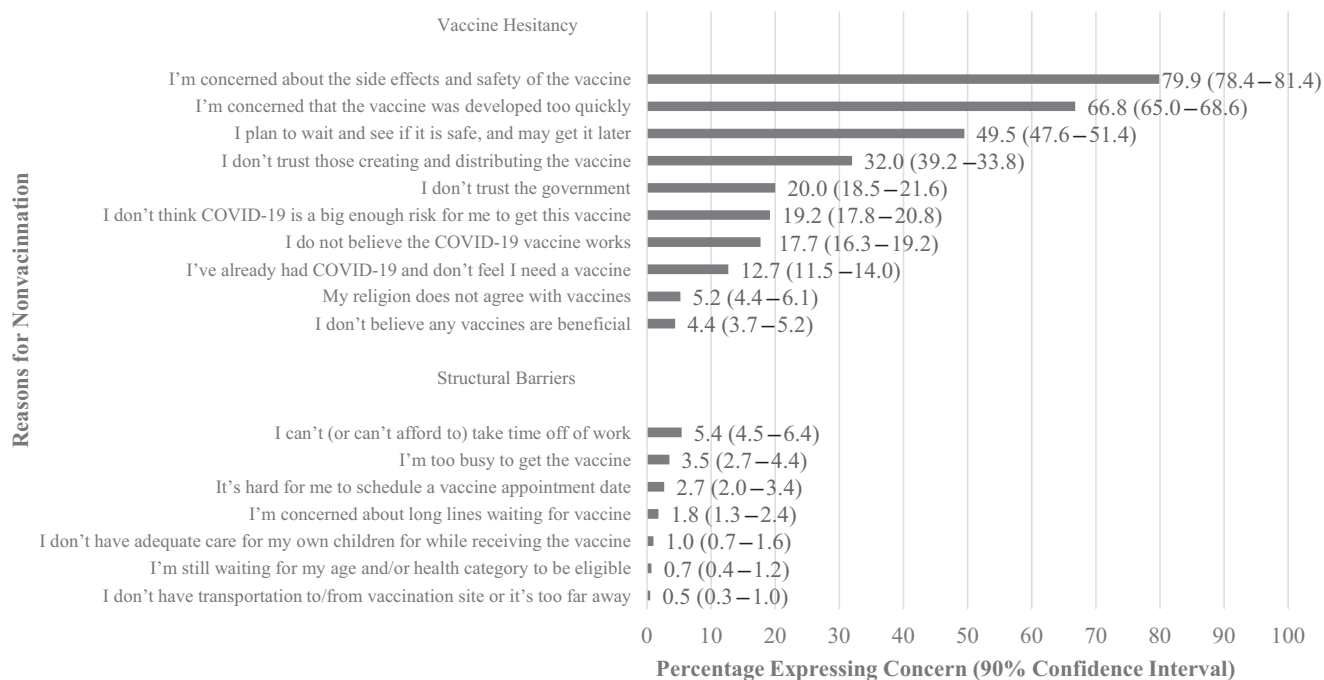


FIGURE 2 Reasons for nonvaccination among US child care providers.

TABLE 2 Unadjusted and Adjusted Logistic Regression Analysis Predicting Vaccination Status

	Unadjusted		Adjusted	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Age				
18–24	0.67	0.52–0.85	0.77	0.57–1.04
25–34	0.58	0.50–0.66	0.61	0.52–0.71
35–44	0.72	0.64–0.81	0.70	0.60–0.80
45–54	Reference	Reference	Reference	Reference
55–64	1.56	1.37–1.78	1.78	1.51–2.09
65–74	1.95	1.53–2.49	2.55	1.90–3.41
75–84	2.68	1.13–6.40	3.67	1.20–11.22
Race				
White	Reference	Reference	Reference	Reference
American Indian or Alaskan Native	0.89	0.58–1.35	0.97	0.60–1.55
Asian	3.12	2.09–4.66	3.98	2.50–6.33
Black or African American	0.59	0.51–0.67	0.65	0.55–0.76
Native Hawaiian or other Pacific Islander	1.01	0.46–2.22	0.87	0.36–2.05
Multiracial	0.63	0.48–0.81	0.69	0.51–0.94
Prefer to not answer	0.82	0.68–0.99	0.94	0.71–1.26
Ethnicity				
Hispanic, Latino or Spanish origin	1.03	0.91–1.17	1.24	1.03–1.49
Not Hispanic, Latino or Spanish origin	Reference	Reference	Reference	Reference
Annual family income				
<\$35 000	0.43	0.37–0.49	0.54	0.46–0.64
\$35 000–49 999	0.54	0.47–0.63	0.65	0.55–0.77
\$50 000–74 999	0.63	0.55–0.73	0.73	0.62–0.85
≥\$75 000	Reference	Reference	Reference	Reference
History of COVID-19				
Yes	0.61	0.54–0.69	0.61	0.53–0.71
No	Reference	Reference	Reference	Reference
Child care type				
Center-based child care	Reference	Reference	Reference	Reference
Home-based child care	0.69	0.62–0.76	0.59	0.52–0.67
Actively providing child care				
Yes	1.16	0.98–1.38	1.10	0.89–1.37
No	Reference	Reference	Reference	Reference

general population may be explained by an increased disease salience among this group pertaining to COVID-19. As an example, congregate settings (eg, schools,¹³ child care programs,⁶ nursing homes,¹⁴ prisons¹⁵) without appropriate infection mitigation measures are known vectors for community transmission. Also, young children were ineligible for pharmaceutical interventions such as vaccination at the time of data collection and may be unable to effectively adhere to nonpharmaceutical behavioral interventions. This is particularly relevant to child care providers who, unlike K–12 teachers, care for children who are mostly <5 years old.⁸ Child care providers may also

feel it is their responsibility to protect the currently unvaccinated children in their care. Furthermore, some child care agencies may require vaccination as a condition of employment.

Although overall vaccine uptake among US child care providers was significantly higher than the US general adult population, the pattern of relative differences in vaccination rates were similar in terms of demographics, state where they provided care, and reasons for nonvaccination in both bivariate and multivariable analysis.^{16,17} Those who were younger, lower income, and/or Black or African American reported the lowest rates of vaccination; conversely, those who

were elderly, higher income, and Asian American reported the highest rates of vaccination (one exception is child care providers between 18 and 24 years of age who reported higher vaccine uptake relative to the 25 to 34 year old group, perhaps because it was required by some higher educational institutions as a condition of enrollment¹⁸). Vaccine uptake was lowest in the Mountain West and the South and highest in New England and the Pacific West. The most commonly endorsed reasons for nonvaccination were related to vaccine hesitancy rather than structural issues regarding a lack of access; these included concerns about vaccine safety, lack of trust in the vaccine development process, and/or lack of trust in the government among other reasons.

Finally, COVID-19 vaccine uptake varied among the different child care settings. Center-based child care providers reported a higher vaccination rate compared with home-based providers (79.7% and 73.0%, respectively) in both bivariate and multivariable analyses. Home-based child care providers were more likely Black or African American, American Indian, and/or Hispanic relative to center-based child care providers, and individuals of color have been shown to have lower vaccine uptake relative to non-Hispanic white individuals.¹⁰ However, interactions between race and ethnicity, child care setting, and COVID-19 vaccination were insignificant, suggesting that the association between provider vaccination status and child care program type is not dependent or modified by provider race. Similarly, the association between vaccination status and history of COVID-19 infection also was independent of provider race. Another consideration that could account for the difference may be increased disease salience among center-based over home-based child care providers arising from variation in group sizes and the potential that some child care employers may have required vaccination of providers as a condition for returning to work. Both group size and child-staff ratios in child care settings are regulated,¹⁹ with home-based child care settings having a lower cap on group size relative to center-based settings. For example, in Connecticut,²⁰ licensed child care centers must have >12 children, whereas home-based child care settings in a private family residence can have no more than 6. It is thus possible that center-based child care providers may have had a higher vaccination rate compared with

their home-based counterparts given the increased perception of disease acquisition arising from the higher number of children and staff with whom they come into contact, although person density may be higher in home-based settings.

Limitations to our study include the following. First, our sample sizes from some states (mostly in the Mountain West) were relatively low and with a sampling error >5%. Second, the respondents of our survey were those who, last year, had completed our previous survey, indicated a willingness to complete later surveys, and then completed a one-year follow-up; therefore, it is possible that this subsample of respondents who are reliable survey takers may differ from the population in meaningful ways that could bias generalization. The major strengths to our study include a large national sample weighted to representativeness and a reasonable response rate.

CONCLUSIONS

COVID-19 vaccine uptake among US child care providers was higher than that of the US general adult population. Lowest vaccination rates were reported among child care providers who were younger, lower income, and Black or African American, resided in states either in the Mountain West or the South, and/or worked in home-based child care programs. State public health leaders and lawmakers should prioritize these subgroups for outreach and placement on the policy agenda to realize the largest possible gains in vaccine uptake among child care providers. Efforts to promote COVID-19 vaccine uptake among child care providers take on added significance when

considering the emergence of the more transmissible Delta Variant, which in July 2021 became the dominant strain of SARS-CoV-2 in the United States.²¹ Currently, children under the age of 12 remain ineligible for COVID-19 vaccination, and as such, the limiting factor in ensuring an adequate supply of child care services will be contingent on protecting the personal health of child care providers. Indeed, in late August 2021, Washington (August 18) and Connecticut (August 19) became the first states to require vaccination among child care providers.^{22,23}

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ABBREVIATIONS

CI: confidence interval

COVID-19: coronavirus disease-2019

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2

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