

COVID-19 Vaccine Knowledge, Attitudes, and Practices in Alabama: The Case for Primary Health Care Providers

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ABSTRACT

Objective: To examine knowledge, attitudes, and practices about COVID-19 in Alabama, with a primary focus on vaccination perception and utilization.

Design: We used a COVID-19 Knowledge, Attitudes, and Practices survey and recruited adult Alabama residents in April–May 2021.

Participants: Initial surveys from 1324 Alabamian participants were considered for analysis; after careful review of incomplete responses, 953 were ultimately included for analysis.

Main Outcome Measure: Vaccine behavior and hesitancy comprise a self-reported response contained in the survey instrument. Three primary vaccine groups were used to assess differences in demographic characteristics, health status, perception of susceptibility and severity of COVID-19, sources of information, and trust about COVID-19.

Results: Of the 953 survey participants included for analysis, 951 had self-identified vaccine status in which 153 (16.1%) reported to have received the vaccine at the time of the survey, 375 (39.4%) were very likely or somewhat likely to get an approved COVID-19 vaccine if it was offered, and 423 (44.5%) were somewhat unlikely or very unlikely to get an approved COVID-19 vaccine. Health care providers were the most trusted sources of information, regardless of vaccine status. For participants unlikely to receive a vaccine, social media and local news sources were consistently more trusted and utilized than those who were vaccinated or were likely to be.

Conclusions: The perceptions among unvaccinated participants are actionable and provide teachable opportunities to decrease vaccine apprehension.

KEY WORDS: COVID-19, vaccination hesitancy, vaccine

Ensuring that a significant percentage of the population is vaccinated against COVID-19 has become a major public health undertaking. Vaccines to prevent infection from SARS-CoV-2 have been available in the United States since

December 2020, provided first to those at highest risk for COVID-19, and eventually approved for use in children as young as 5 years. Despite its efficacy and safety profiles, and although it is now widely available in the United States at no cost, as of January 20, 2022, only 67.1% of the age-eligible population (63.1% of the total population) have been fully vaccinated.¹ In many states of the mountain west and the southeast, vaccination coverage is substantially lower than the national figure, with Idaho at 48% fully vaccinated, Wyoming at 49%, and Alabama at 49%, all with rates less than 50% fully vaccinated.² Vaccination coverage also varies widely by demographic groups, with 54% of African Americans, 60% of non-Hispanic White/Caucasian individuals, 81% of Asian Americans, and 60% of Hispanic/Latinx individuals having been fully vaccinated.³ Low vaccination rates greatly increase the likelihood that COVID-19 will both spread rapidly and that new variants will arise.⁴ This fear has manifested with the emergence of the Omicron mutation, classified as a variant of concern in November 2021.⁵

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Human Participant Compliance Statement: The study has been approved by the University of Alabama at Birmingham Institutional Review Board.

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Surveys conducted in July and October 2021 and reported in *The New York Times* indicated that the leading reasons given for not receiving vaccine included concerns about side effects (reported by 53% of those unvaccinated), waiting to see whether vaccines were safe (40%), “don’t trust vaccines” (37%), “don’t trust government” (27%), and “don’t believe they need it” (26%).⁶ Among the unvaccinated, attitudes and behaviors related to vaccines fell into 2 distinct groups: (1) those who adamantly refuse coronavirus vaccines, who tend to be “disproportionately White, rural, evangelical Christian, and politically conservative”; and (2) those who are open to getting vaccinated but are delaying, who tend to be “a more diverse and urban group, including many younger people, Black and Latino Americans, and Democrats.”^{6(p1)} Similar findings for reasons adults are not getting vaccinated have recently been published by Nguyen et al,⁷ while Teasdale et al⁸ reported that safety and lack of need were primary reasons for vaccine hesitancy/resistance by parents to have their children younger than 12 years vaccinated.

From the pandemic’s outset, responses to COVID-19 have differed significantly across states.⁹ Wide differences in vaccination coverage, knowledge, and attitudes related to COVID-19 vaccines vary by state. Similarly, the reasons for remaining unvaccinated likely differ by geography. Determining those reasons for any specific area is a necessary step to improving vaccine coverage. The purpose of this article is to explore knowledge, attitudes, and practices about COVID-19 in general, with a particular focus on vaccines in one state—Alabama. The insights gained are valuable to other states that are also struggling to attain higher vaccination coverage. This is particularly important in a region with significant health inequities and a history of mistrust of organized medicine among African Americans as a legacy of the Tuskegee syphilis experiment. For public health policy makers and practitioners, better understanding the health decision making of these populations is critical to promoting the vaccination acceptance rates necessary to significantly slow the disease’s spread.

Methods

We conducted an online survey of adults living in Alabama using Qualtrics, between April 5, 2021, and May 21, 2021. The sample was recruited using a combination of online panels from the Marketing Systems Group.¹⁰ To achieve the dual purpose of creating a representative state-level assessment and exploring target subgroups, some population strata were oversampled. In particular, individuals in rural, minority,

and at risk for COVID-19 (ie, older individuals) were oversampled. The targeted number of individuals was 1000 participants; however, we collected additional responses to meet our target sample in case some responses needed to be excluded during analysis. The total sample was drawn from a list of 15 000 Alabama residents. As the responses were received, subsequent requests were made for specific demographic groups to ensure that the stratification of subgroups (eg, race, gender, age—see later) was adequately represented. Survey data were weighted to produce unbiased estimates of population parameters and compensate for practical limitations of sample surveys, such as differential nonresponse and undercoverage. Participants were eligible if they were 18 years and older and had a device (mobile phone, tablet, or computer) that could open the survey link to the registration page of the Marketing Systems Group. Participants did not receive compensation for taking this survey.

The survey instrument

A survey instrument was developed from various COVID-19–related surveys curated on the PhenX Toolkit Web site¹¹ to assess the COVID-19 knowledge, attitudes, and practices among adults in Alabama. Items were drawn from other studies to allow for national comparisons and adapted to fit the current policies in Alabama. Additional items were created with a focus on recent events such as the release of vaccines. The survey instrument comprised subsections that included introductory questions, perception of susceptibility and severity of COVID-19, sources of information and trust about COVID-19, vaccine behavior and hesitancy, and health status.

A consent page was included to inform participants about the survey and the eligibility criteria to take the survey. The survey was piloted to ensure flow, clarity of language, and comprehension. The final survey instrument was then entered into Qualtrics, with the redirect links to the Marketing Systems Group registration page. Survey links were then sent to survey respondents using the sampling frame established by the Marketing Systems Group. This study obtained an exempt status from the institutional review board at the University of Alabama at Birmingham because it had minimal to no risk to the participants. Data were collected in a manner that participants’ identities could not be ascertained.

Statistical methods and weighting methodology

Initial surveys from 1324 Alabamian participants were considered for analysis; after careful review for incomplete responses, 953 were ultimately included

for analysis and the weighting process. Variables used for the estimation of survey weights include gender, age, race, ethnicity, education, number of children, household size, and household income. Using SUDAAN 11.0.3, final sampling weights were computed using iterative proportional fitting¹² with SUDAAN's WgtAdjust procedure incorporating adjustments to align weights to the geodemographic distributions of Alabama residents. In addition, missing values in survey data were imputed using a Hot-Deck procedure.¹³ Preliminary analyses included summaries of demographic characteristics that were used to establish weighted methodology. In addition, weighted cross-tabulations of key variables and graphical displays were used to investigate trends among survey responses. For ordinal survey response levels, response levels were combined by nearest neighbor when a level was rarely chosen. All analyses were conducted using SAS software, version 9.4, of the SAS System for Windows.

Results

Of the 953 survey participants included for analysis, 951 had responses for self-identified vaccine status/hesitancy and the unweighted summary is reported in the Table. Vaccine status was determined by either reporting to have received the vaccine at the time of the survey (already received, $N = 153$; 16.1%), very likely or somewhat likely to get an approved COVID-19 vaccine if it was offered (likely to receive, $N = 375$; 39.4%), or somewhat unlikely or very unlikely to get an approved COVID-19 vaccine (unlikely to receive, $N = 423$; 44.5%). The majority of participants were White/Caucasian and female, 658 (69.2%) and 656 (69.0%), respectively, and this was consistent regardless of vaccination status. Those who had received the vaccine were older, with 98 (64.1%) being 45 years and older. In contrast, of those who were unvaccinated, 260 (69.3%) of those who were likely to receive a vaccine and 320 (75.6%) of those who were unlikely to receive a vaccine were between the ages of 18 and 44 years. This age difference is most likely an artifact of access to vaccinations at the time the survey was administered, with vaccine being prioritized for older Americans. Increased vaccine hesitancy was associated with lower educational attainment, with 233 (55.1%) of those who were unlikely to receive the vaccine having completed high school or less education, and this rate decreased among those who were likely to be vaccinated ($N = 170$; 45.3%) and those who had been vaccinated ($N = 44$; 28.8%). As shown in Supplemental Digital Content Table 1 (available at <http://links.lww.com/JPHMP/A983>), which includes weighted results,

while White/Caucasian individuals reported higher receipt of vaccine ($N = 160.9$; 25.3%), other races (predominantly African American) reported a higher likelihood of receiving a vaccine once offered ($N = 171.6$; 54.6%).

When comparing current and trusted sources in federal and state government authorities, there was an inverse relationship between the use and trust in these sources and vaccination status (Figure 1). While the Centers for Disease Control and Prevention (CDC) was reported to be the most trusted government source, and the one that was most currently used, the difference in such trust between those who were vaccinated and unvaccinated was notable. The sole exclusion of this pattern of trust in government sources was the Food and Drug Administration (FDA), where the percent utilized and trusted was comparable across vaccine status. Overall, doctor or health care providers were the most trusted and used sources of all sources included in the survey, regardless of vaccine status (Figure 2). Close friends and family members, coworkers, classmates, and other known people were both trusted and utilized among those unlikely to receive the vaccine, more so than among those who were vaccinated. Considering social media sources—in particular, Google, Twitter, and Facebook—there was a large difference in trust between those unlikely to receive the vaccine and those who were vaccinated (Figure 3), and the utilization and trustworthiness of these sources. In addition, social media sources were among the most trusted and utilized of any source by those least likely to receive a vaccine.

Discussion

There are at least 3 key themes emerging from these survey data: (1) overall, of all the sources of information about COVID-19, people still trust their health care provider the most—and this was consistent across race, gender, and income groups (see Supplemental Digital Content Table 2, available at <http://links.lww.com/JPHMP/A984>); (2) a larger percentage of those unlikely to get vaccinated use social media (especially Twitter and Facebook) and local news sources as their most important sources of information about COVID-19, compared with those already vaccinated or likely to get vaccinated; and (3) the reasons for not getting vaccinated are modifiable and lend themselves to accurate, fact-based, and consistent messaging across trusted sources.

In a scoping review prior to vaccine being available, AlShurman et al¹⁴ identified 48 published studies, with 13 from the United States, which examined various factors associated with intent to receive vaccine. The authors classified the most relevant factors

TABLE
Demographic Factors by COVID-19 Vaccine Status^a

	Vaccine Status at Time of Survey ^b			Total ^c (N = 951)
	Already Received (N = 153)	Likely to Receive (N = 375)	Unlikely to Receive (N = 423)	
Gender				
Male	45 (29.4%)	116 (30.9%)	134 (31.7%)	295 (31.0%)
Female	108 (70.6%)	259 (69.1%)	289 (68.3%)	656 (69.0%)
Age, years				
18-24	23 (15.0%)	94 (25.1%)	122 (28.8%)	239 (25.1%)
25-34	13 (8.5%)	86 (22.9%)	103 (24.3%)	202 (21.2%)
35-44	19 (12.4%)	80 (21.3%)	95 (22.5%)	194 (20.4%)
45-54	18 (11.8%)	41 (10.9%)	49 (11.6%)	108 (11.4%)
55-64	34 (22.2%)	50 (13.3%)	35 (8.3%)	119 (12.5%)
65+	46 (30.1%)	24 (6.4%)	19 (4.5%)	89 (9.4%)
Race				
White/Caucasian	118 (77.1%)	230 (61.3%)	310 (73.3%)	658 (69.2%)
Black/African American or other races	35 (22.9%)	145 (38.7%)	113 (26.7%)	293 (30.8%)
Ethnicity				
Hispanic	1 (0.7%)	18 (4.8%)	12 (2.8%)	31 (3.3%)
Non-Hispanic	152 (99.3%)	357 (95.2%)	411 (97.2%)	920 (96.7%)
Highest education level completed				
High school or less	44 (28.8%)	170 (45.3%)	233 (55.1%)	447 (47.0%)
Up to an associate degree	58 (37.9%)	125 (33.3%)	145 (34.3%)	328 (34.5%)
Bachelor's degree or higher	51 (33.3%)	80 (21.3%)	45 (10.6%)	176 (18.5%)
Number of children younger than 18 y currently live in household				
None	120 (78.4%)	221 (58.9%)	229 (54.1%)	570 (59.9%)
1	14 (9.2%)	73 (19.5%)	84 (19.9%)	171 (18.0%)
≥2	19 (12.4%)	81 (21.6%)	110 (26.0%)	210 (22.1%)
Including participant, household size				
1	26 (17.0%)	73 (19.5%)	68 (16.1%)	167 (17.6%)
2	68 (44.4%)	96 (25.6%)	122 (28.8%)	286 (30.1%)
≥3	59 (38.6%)	206 (54.9%)	233 (55.1%)	498 (52.4%)
2020 household income before taxes				
\$0 000-\$14 999	16 (10.5%)	77 (20.5%)	109 (25.8%)	202 (21.2%)
\$15 000-\$19 999	10 (6.5%)	35 (9.3%)	55 (13.0%)	100 (10.5%)
\$20 000-\$24 999	15 (9.8%)	41 (10.9%)	42 (9.9%)	98 (10.3%)
\$25 000-\$34 999	11 (7.2%)	50 (13.3%)	52 (12.3%)	113 (11.9%)
\$35 000-\$49 999	31 (20.3%)	49 (13.1%)	56 (13.2%)	136 (14.3%)
\$50 000-\$74 999	34 (22.2%)	54 (14.4%)	57 (13.5%)	145 (15.2%)
\$75 000-\$99 999	17 (11.1%)	31 (8.3%)	24 (5.7%)	72 (7.6%)
≥\$100 000	19 (12.4%)	38 (10.1%)	28 (6.6%)	85 (8.9%)

^aTable statistics reported as frequency (column %) for all categorical factors. Missing data are reported and not included in summary statistics.

^b"Likely to receive" response includes "very likely" and "likely" survey responses. "Unlikely to receive" includes "very unlikely" and "unlikely" survey responses.

^cThe total reflected in this table corresponds to the 951 of the 953 participants who completed the response for vaccination status.

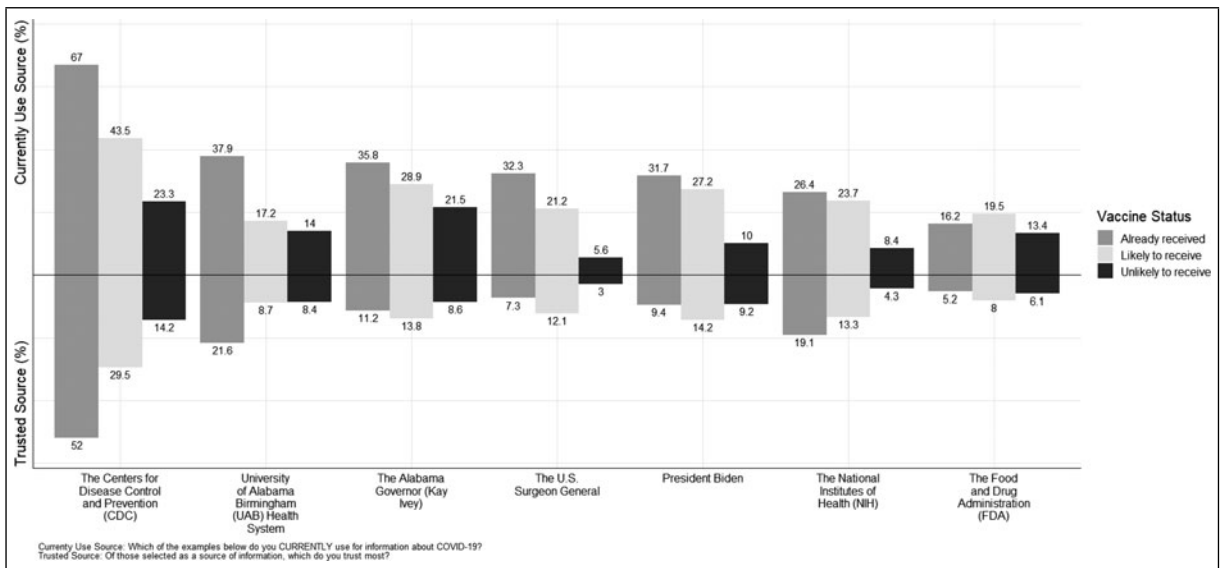


FIGURE 1 Federal and State Sources of Information: COVID-19 Knowledge, Attitudes, and Practices Survey, by Vaccine Status, Alabama, 2021

into 7 themes: demographics, social factors, vaccination beliefs and attitudes, vaccine-related perceptions, health-related perceptions, perceived barriers, and vaccine recommendations.¹⁴ Findings of relevance to the current study included (1) the much greater likelihood of White/Caucasian individuals to have received vaccine than Black/African American individuals and other races; (2) higher confidence in government, health providers, and scientists was associated with higher intent to get vaccinated, while reliance on social media was associated with lower vaccine intent; (3) trust and confidence in the efficacy and safety of

vaccine were associated with higher vaccine intent; and (4) a recommendation to get vaccinated from a health care provider was associated with high vaccine intent.¹⁴

Among the unvaccinated and those unlikely to get vaccinated, reliance on social media for COVID-19-related information is a consistent finding in surveys conducted in the United States,⁶ as well as in the United Kingdom,¹⁵ Norway,¹⁶ and Japan.¹⁷ In a US survey conducted in April 2020, trust in information from social media was negatively associated with both COVID-19 knowledge and use of preventive measures

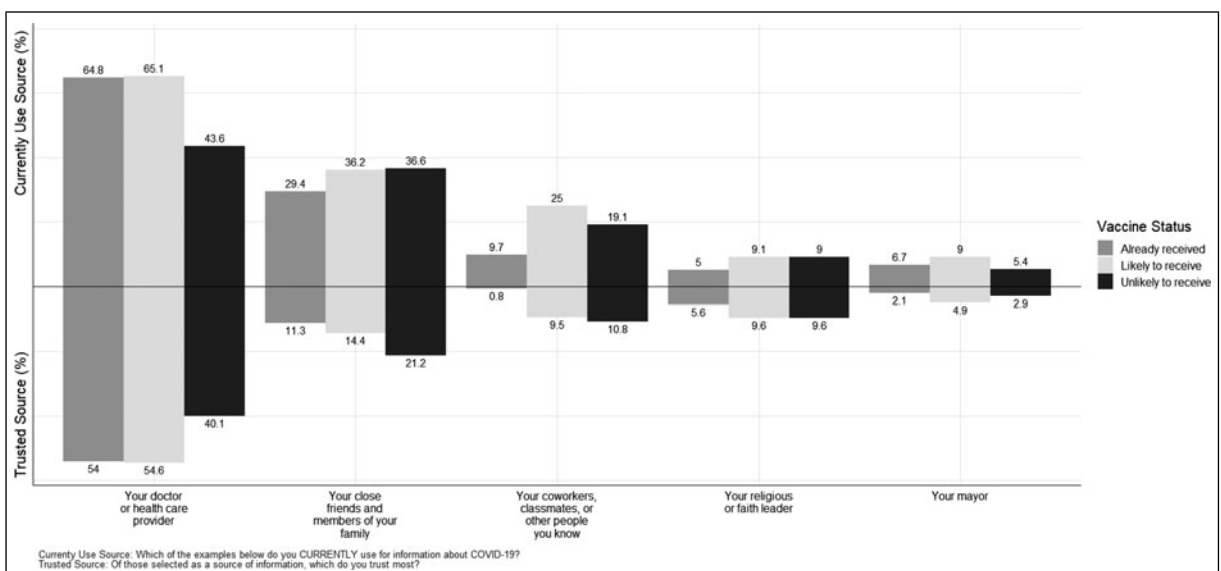


FIGURE 2 Community Sources of Information: COVID-19 Knowledge, Attitudes, and Practices Survey, by Vaccine Status, Alabama, 2021

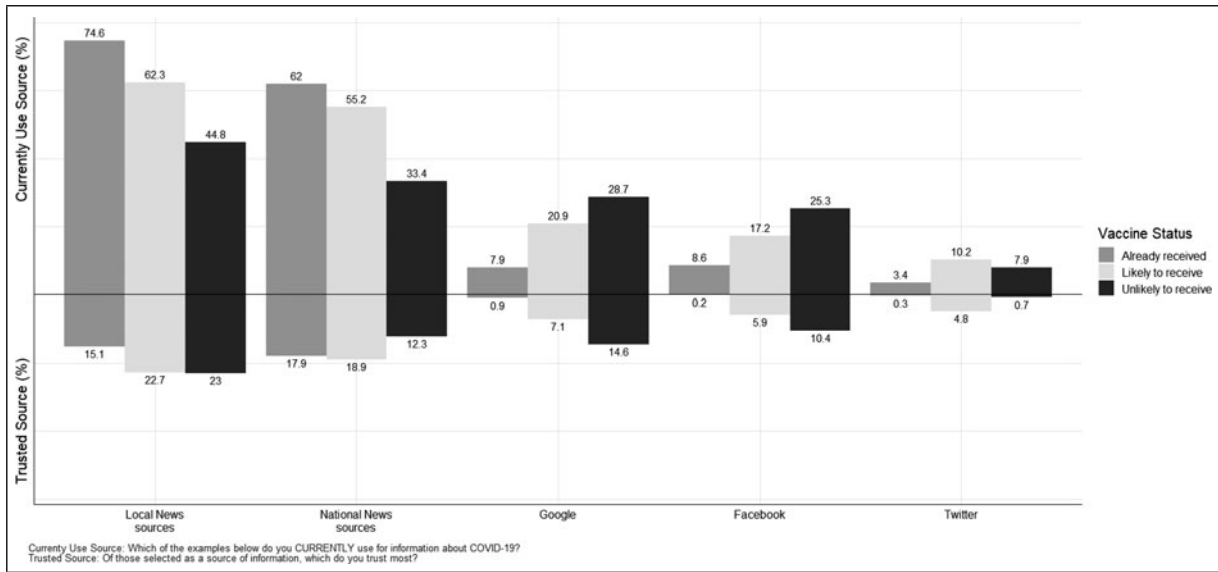


FIGURE 3 Media and Internet Sources of Information: COVID-19 Knowledge, Attitudes, and Practices Survey, by Vaccine Status, Alabama, 2021

(ie, adherence to social distancing).¹⁸ The sources of COVID-19 information, and trust in those sources, however, have changed over the course of the pandemic. A US nationwide survey conducted in March and repeated in April 2020 revealed that, initially, the largest individual information source was government Web sites, but both use of and trust in government sources of information fell between March and April (91% reported using government sources in March, decreasing to 83% in April).¹⁹ In that survey, doctors as sources of information fell below government sources, television, social media, newspapers, and Web sites, but trust in doctors was second only to trust in governmental sources of information. In very conservative Alabama, our survey indicated that only those already vaccinated included the CDC (ie, “the government”) among their top 3 sources of COVID-19 information. Another US national survey conducted in 4 waves between March and November 2020 revealed that high trust in governmental sources of information (including Dr Anthony Fauci and the CDC) was highly correlated with intention to receive vaccine when it became available, while high trust in the White House and conservative news sources was correlated with both low intentions to get vaccinated and the likelihood of discouraging friends from getting the vaccine.²⁰

Similar to the surveys conducted in July and October by *The New York Times*, in this study, among those unlikely to get vaccinated, the leading reasons were concerns about side effects, lack of trust in the safety of the vaccines, and insufficient knowledge about how well the vaccines work. These are rational responses; respondents did not cite concern

over microchips being injected into them or that they would become infertile if they received the vaccine. Their reasons for not getting a vaccine are both teachable and modifiable, meaning that knowledge transfer about vaccines has potential to change behavior. Vaccine hesitancy decreases when the knowledge transfer is from a trusted source, such as one’s health care provider. In retrospect, including primary care providers in the early distribution of vaccines could have provided opportunities for vaccine-hesitant persons to learn more about the vaccine from their most trusted source of information about COVID-19, on their way to receiving vaccine from that provider. As it was in the United States, however, the initial distribution of vaccine was to large health care sites, such as academic medical centers, or other large venues for providing mass vaccination, where those already committed to getting vaccinated showed up.

In this study, White/Caucasian individuals were more likely to have already received COVID-19 vaccines, while among the unvaccinated, African Americans reported a higher likelihood of getting vaccinated (see Supplemental Digital Content Table 1, available at <http://links.lww.com/JPHMP/A983>). Differences in vaccine intent were also noted across educational status, with vaccine intent positively correlated with education. In examining US vaccination data through April 2021, Agarwal et al identified associations “between racial disparities in COVID-19 vaccination and median income (negative), disparity in high school education (positive), and vote share for the Republican party in the 2020 presidential election (negative), while vaccine hesitancy was not related to disparities.”^{21(p1)} The COVID-19 Prevention Network

(CoVPN), led by the National Institute of Allergy and Infectious Diseases (NIAID)–funded networks, has provided a model community education and engagement framework meant to address vaccine hesitancy in communities of color, but such a framework—addressing questions such as “Were vaccines tested on people like me?” and “What types of reactions have been reported after vaccination?”—could make a difference in any community.²²

Limitations

There are several limitations to this study. First, the survey was conducted in April and May 2021, which coincides with the earliest that Alabamians older than 16 years were eligible for vaccination and when COVID-19 was on the decline in the United States.²³ Barriers to access to vaccine and lower concerns about contracting COVID-19 may have influenced responses. Second, the survey was fielded online, and access to the Internet is not fully available in Alabama; however, our weighting procedure makes an effort to account for this inconsistent access. Third, as with most surveys, the responses were not verifiable and there may have been an element of social desirability bias. In addition, while conducted in a state that is predominantly Republican, political affiliation was not included in the survey, which would have provided information on the potential influence of political affiliation and community-level politics. Despite these limitations, our findings are consistent with other recent vaccine-focused surveys.

If social media continues to be an important source of information for those who are unvaccinated, then accurate, evidence-based positive messaging about vaccines can also be channeled through those same social media platforms. While some trusted sources of information, such as the CDC, have social media platforms, their impact has been far less than misinformation widely spread through Facebook and Twitter. Ashworth et al²⁴ examined a variety of messages that emphasize different benefits from the vaccines (personal health, the health of others, and the recovery of local and national economies) and one message that emphasizes vaccine safety and found that messaging that emphasizes personal health benefits had the largest impact on intention to receive vaccine. Determining the best approaches to overcoming COVID-19 vaccine hesitancy will require more in-depth qualitative research. As new variants emerge, such as Omicron, it may be necessary to promote booster doses and new versions of the vaccine entirely. What we learn about improving vaccine coverage in the current pandemic will likely be beneficial in combating the next one.

Implications for Policy & Practice

- The primary public health implication of this study is that a significant segment of those unvaccinated and unlikely to get vaccinated have rational but modifiable reasons for not getting vaccinated and they still rely on and have trust in their health care provider as a source of information about COVID-19.
- Vaccine distribution should shift more and more to primary care sites and away from large vaccination venues, and greater attention needs to be directed to primary health care providers—including Federally Qualified Health Centers and local health departments that provide primary care—as sources of both COVID-19 information and vaccine.
- Clinical providers should use their influence and communication tools, such as the personal health record, to direct patients to other trustworthy sources of information.
- Social media will undoubtedly be a source of health information in the future—accurate, evidence-based messaging must effectively be implemented in those same social media platforms.

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