

Surveying the Effect of the COVID-19 Pandemic on Public Confidence in Vaccines and Vaccine Messengers

Lessons Learned and Challenges Ahead

Executive Summary

The findings of a web-based survey conducted in March 2021 by the 2020-2021 American Academy of Family Physicians (AAFP) Vaccine Science Fellows suggest that vaccine confidence since the onset of the COVID-19 pandemic either increased or remained unchanged for the majority of respondents. However, the number of respondents who expressed a concerning decrease in confidence in vaccines since the onset of the pandemic is not insignificant.

The survey also highlights the importance of having a usual source of medical care. Results show a strong positive correlation between having a usual source of care and vaccine confidence with intent to vaccinate.

Results demonstrate a shift in where people obtained their vaccine information during the pandemic, showing a decrease in information coming from their primary care clinician and an increase in information coming from the news, internet, and social media.

Finally, demographic analysis suggests demographic characteristics of those expressing hesitancy toward COVID-19 vaccines are different than previously understood demographics of those expressing hesitancy toward traditional immunizations.

Background

In 2019, the World Health Organization (WHO) named vaccine hesitancy as one of the top ten threats to global health.¹ Vaccines save millions of lives per year.^{1,2} The decrease in vaccine acceptance, which is seen as a result of an increasingly active anti-vaccine movement, threatens to reverse the tremendous progress made in prevention of vaccine-preventable disease.^{3,4} For example, cases of measles surged worldwide in 2018, killing more than 140,000 people, most of whom were children under 5 years of age.⁵ In 2019, the United States almost lost its measles elimination status when the number of cases across the country jumped to a 25-year high.⁵ Similarly, we have seen outbreaks of other vaccine-preventable diseases (e.g., mumps, pertussis) as vaccination rates decline and international travel increases.^{6,7}

One common theory is that the rise of anti-vaccine sentiment is related to the success of vaccination programs in the United States and other high-income countries in years past and the resultant lack of vaccine-preventable

diseases in these countries today.⁸⁻¹⁰ This has led to complacency about infectious diseases, with some individuals now questioning the need for continued immunization and fearing the vaccines more than the diseases due to the rapid dissemination of misinformation and disinformation about vaccines.

In late 2019, a novel coronavirus (now known as SARS-CoV-2) was identified for the first time in humans and spread rapidly across the globe.¹¹ Not since the influenza pandemic of 1918 (also known as the Spanish flu) have we seen such destruction of lives and livelihoods due to infectious disease. By the end of July 2021, more than 600,000 lives had been lost due to SARS-CoV-2 in the United States alone.¹²

In 2020, many individuals and their children in the United States delayed or did not get medical care, likely due to a combination of factors including clinic closures early in the pandemic, financial strain on families, and fear of contracting COVID-19 in medical settings.^{13,14} This trend was not isolated to the United States. Indeed, approximately 23 million children under 1 year of age worldwide lacked basic vaccinations in 2020.¹⁵ This is the highest number seen in more than a decade, highlighting the importance of both local and global vaccination efforts and public health messaging and implementation focused on COVID-19 vaccines and routine immunizations.

In this COVID-19 pandemic setting, we, the 2020-2021 American Academy of Family Physicians (AAFP) Vaccine Science Fellows, conducted a web-based survey to examine vaccine confidence before and since the onset of the pandemic. We sought to clarify whether the emergence of this far-reaching, devastating illness, with its negative impact on nearly every aspect of human life, affected public confidence in vaccines; whether having an identified usual source of medical care impacted intent to vaccinate; whether the pandemic affected where people get their information about vaccines; and what demographic factors may positively or negatively correlate with vaccine intention.

Methods

Survey Platform and Audience Selection

We selected SurveyMonkey as the survey platform and utilized the platform's "Target audience - USA" as the survey population. This proprietary online panel of survey participants is representative of the general population in the United States and has been utilized since 2018. The platform uses an iOS and Android mobile app. Participants enroll in the panel and are then selected to receive invitations to surveys to be completed at their convenience. The participants earn credits (typically \$0.25 per survey) that they can redeem either for Amazon gift cards or as donations to charitable organizations.

The survey platform utilizes a router to ensure that each respondent represents one person and that each person does not reply more than one time. The router is able to select particular groups of participants in order to represent U.S. population demographics based on the most recent U.S. census data. For each survey, panelists receive notice that their responses are confidential. Additionally, they are given the option to "opt out" of the entire survey or of individual questions within the survey.

We chose this platform to ensure an anonymous method of reaching an established sample of respondents that represents the general U.S. population according to multiple demographics. Utilization of this established sample allowed for a larger sample size and quicker response time than other methods of survey deployment.

Survey Design

The survey was constructed with the goal of evaluating vaccine perceptions and attitudes prior to and since living in a pandemic caused by a vaccine-preventable disease. The questions were based on other validated survey questions related to vaccine confidence.¹⁶ They were selected with the Health Belief Model constructs in mind.^{17,18} These constructs include perceived risk susceptibility, perceived risk severity, perceived benefits to action, perceived barriers to action,

self-efficacy, and cues/calls to action. The survey included questions to assess these constructs for the survey respondents.

The survey included 50 total questions, with a combination of multiple-choice questions, ranking questions, and fill-in-the-blank responses for general information. Each question included an answer option of “I prefer not to answer” to allow respondents to “opt out” of a particular question. The survey assessed perceptions of and confidence in both childhood vaccines and adult vaccines; therefore, several questions may not have applied to all respondents. Some questions included “skip logic,” meaning that a respondent’s answer to the question determined what question they saw next. For example, if a respondent answered that they did receive a vaccine, they would “skip” a subsequent question that inquired why they did not receive a vaccine. This created an anticipated difference in response rates for some questions, as not all questions were seen by all respondents.

The survey focused on questions related to confidence in vaccines prior to and since the COVID-19 pandemic. It also included questions related to confidence in public health organizations, the medical community, and governmental organizations prior to and since the pandemic. Additionally, there were questions to assess the following demographic characteristics: age; gender; race/ethnicity; ZIP code; occupational status; number and age of dependents; educational status; and annual household income. When assessing

confidence, the survey employed a five-point Likert scale using the following ratings: Extremely confident; Very confident; Somewhat confident; Not so confident; and Not at all confident.

Survey Deployment

The survey was launched on March 4, 2021, at 4 p.m. EST and remained open until March 5, 2021, at 1 p.m. EST when the contracted number of surveys had been achieved. We received a total of 2,232 responses with a response rate of 90% of the survey audience. The average completion time for the survey was 6 minutes, 23 seconds.

Statistical Analysis

The survey data were cleaned and re-coded. Data from questions with a missing response or a response of “I prefer not to answer” were included in the frequency tables but were excluded from statistical analysis.

Statistical analysis using standard chi-squared tests was performed to test the association of the variable with the outcome of interest (in this case, intent to vaccinate). The P value represents the probability that the numbers/percentages are truly different (with a P value of $< .001$ being highly statistically significant).



Results

Respondent Demographics

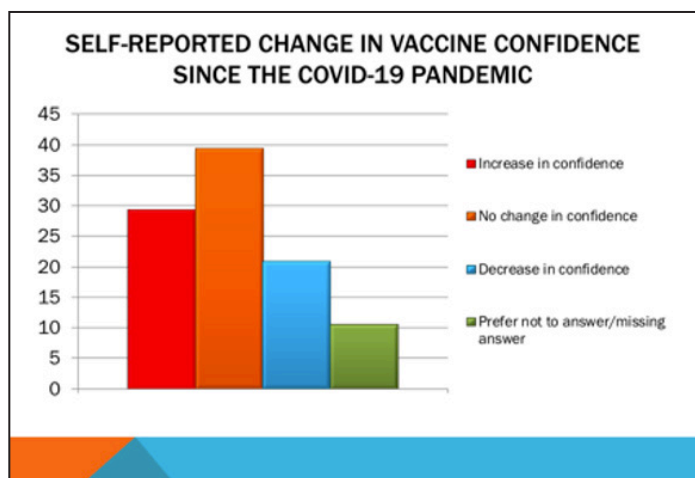
Table 1: Demographics of Vaccine Survey Respondents (N=2232)

| Characteristic | Frequency — n (%) |
|---|-------------------|
| Age (years) | |
| Under 18 | 17 (.8) |
| 18-24 | 244 (10.9) |
| 25-34 | 372 (16.7) |
| 35-44 | 403 (18.1) |
| 45-54 | 342 (15.3) |
| 55-64 | 250 (11.2) |
| 65+ | 371 (16.6) |
| Preferred not to answer or missing | 233 (10.4) |
| Education | |
| Less than high school | 72 (3.2) |
| High school graduate | 441 (19.8) |
| Some college | 563 (25.2) |
| College graduate | 598 (26.8) |
| Master's or doctorate level graduate | 302 (13.5) |
| Preferred not to answer or missing | 256 (11.5) |
| Race/ethnicity (respondents could choose all that apply) | |
| White or Caucasian | 1479 |
| Black or African American | 247 |
| Hispanic or Latinx | 159 |
| Asian or Asian American | 126 |
| American Indian or Alaskan Native | 53 |
| Native Hawaiian or other Pacific Islander | 25 |
| Other | 25 |
| Household income | |
| Less than \$25,000 | 430 (19.3) |
| \$25,000-\$49,999 | 603 (27.0) |
| \$50,000-\$99,999 | 563 (25.2) |
| \$100,000-\$199,999 | 264 (11.8) |
| \$200,000 or more | 60 (2.7) |
| Preferred not to answer or missing | 312 (14.0) |
| Region (based on ZIP code) | |
| Northeast | 401 (18.0) |
| Southeast | 473 (21.2) |
| Midwest and Northern Plains | 510 (22.9) |
| Central South | 204 (9.1) |
| West and Pacific Coast | 432 (19.4) |
| Preferred not to answer or missing | 212 (9.5) |
| Do you have any children/dependents? | |
| Yes | 1187 (53.2) |
| No | 937 (42.0) |
| Preferred not to answer or missing | 108 (4.8) |
| Gender | |
| Male | 922 (41.3) |
| Female | 1015 (45.5) |
| Non-binary | 37 (1.7) |
| Preferred not to answer or missing | 258 (11.6) |

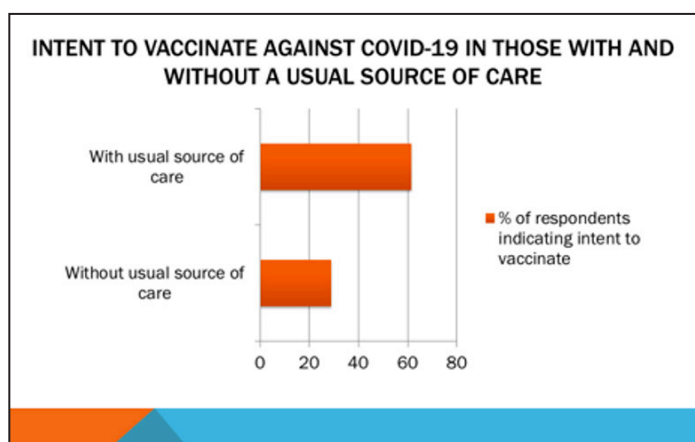
| Characteristic | Frequency — n (%) |
|--|-------------------|
| Did you or someone you know have COVID-19? | |
| Yes | 1193 (53.5) |
| No | 672 (30.1) |
| Unsure | 95 (4.3) |
| Preferred not to answer or missing | 272 (12.2) |
| Do you personally know anyone who was hospitalized or died of COVID-19? | |
| Yes | 811 (36.3) |
| No | 1050 (47.0) |
| Unsure | 90 (4.0) |
| Preferred not to answer or missing | 281 (12.6) |
| Usual source of care | |
| Yes | 1621 (72.6) |
| No | 265 (11.9) |
| Unsure | 73 (3.3) |
| Preferred not to answer or missing | 273 (12.2) |
| Before the pandemic, did you receive vaccines within the last 10 years? | |
| Yes, all recommended vaccines | 980 (43.9) |
| Some vaccines | 581 (26.0) |
| I do not take any vaccines | 263 (11.8) |
| I have not been offered any vaccines in the last 10 years | 296 (13.3) |
| Preferred not to answer or missing | 112 (5.0) |
| Since the pandemic, have you delayed your medical care due to concerns about COVID-19? | |
| Yes | 734 (32.9) |
| No | 1221 (54.7) |
| Preferred not to answer or missing | 277 (12.4) |
| Since the pandemic, have you delayed your child's/dependent's medical care due to concerns about COVID-19? | |
| Yes | 365 (16.4) |
| No | 1391 (62.3) |
| Preferred not to answer or missing | 476 (21.3) |
| Do you believe COVID-19 poses a serious health threat? | |
| Yes | 1370 (61.4) |
| No | 362 (16.2) |
| Unsure | 225 (10.1) |
| Preferred not to answer or missing | 275 (12.3) |
| Do you believe that current public health recommendations (wearing masks, social distancing, limited travel and group activities) are necessary for your health and the health of others? | |
| Yes | 1369 (61.3) |
| No | 369 (16.5) |
| Unsure | 203 (9.1) |
| Preferred not to answer or missing | 291 (13.0) |

Notable Findings

1. Numerous factors, including some outside the scope of the COVID-19 pandemic, undoubtedly played a role in respondents' self-reported change of confidence in vaccines. Broadly viewed, however, survey data showed the majority of respondents expressed either no change (39.3%) or an increase (29.3%) in vaccine confidence since the pandemic. A smaller, but not insignificant, number of respondents reported a decrease (20.8%) in confidence.

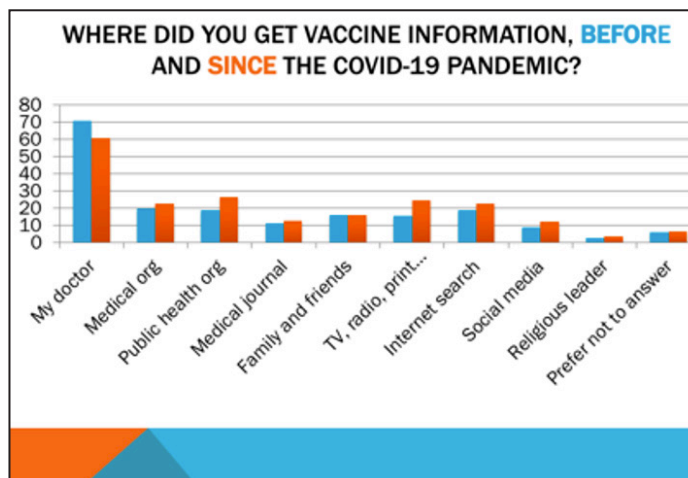


2. Survey results highlighted the vital role of family medicine in providing care to communities, with 72.6% of all respondents reporting that they had a usual source of care (USC) and 61.2% of respondents with a USC stating that a family physician or family medicine advanced practice provider (APP) provided that care. Survey data also showed that having a USC had a significant positive impact on intent to vaccinate against COVID-19. Of



respondents with a USC, 61.5% expressed intent to vaccinate, while only 28.9% of respondents without a USC expressed intent to vaccinate.

3. Numerous studies have shown that people most often seek vaccine information from their trusted medical professional.¹⁹⁻²¹ This survey confirmed those prior findings. However, it also showed that respondents reported a decrease in vaccine information coming from their usual source of care during the pandemic (down approximately 10%) and an increase in vaccine information coming from TV, print, or radio news (up approximately 10%), the internet (up approximately 4%), and social media (up approximately 3%). The survey also demonstrated that respondents reported an increase in information from public health organizations (up approximately 7.5%) and medical organizations (up approximately 3%) compared to pre-pandemic times.



4. This survey also attempted to elucidate the association of various demographic characteristics with change in vaccine confidence (*Table 2*) and with intent to vaccinate (*Table 3*). The following demographics show the greatest statistically significant correlation with intent to vaccinate (with P value < .001):

- Prior confidence in vaccines – Decreasing confidence in vaccines prior to the pandemic was associated with a decrease in intent to receive a COVID-19 vaccine.
- Age – Increasing age was associated with an increase in intent to vaccinate against COVID-19.

- c. Level of education – Higher levels of education correlated with a greater intent to vaccinate against COVID-19.
- d. Race/ethnicity – Individuals who identified as white or Caucasian, Asian or Asian American, or American Indian or Alaskan Native were significantly more likely to express intent to vaccinate than those who identified as Black or African American, Hispanic or Latinx, Native Hawaiian or other Pacific Islander, or Other.
- e. Household income – Higher levels of income correlated with a greater intent to vaccinate against COVID-19.
- f. Gender – Respondents who identified as male (62.6%) were more likely than those who identified as female (50.5%) to express intent to vaccinate against COVID-19, and respondents in both groups were more likely to vaccinate than respondents who chose non-binary gender identification (42.4%).
- g. Having a usual source of care – Of those with a USC, 61.5% expressed intent to vaccinate, while only 28.9% of those without a USC expressed intent to vaccinate.
- h. Having COVID-19 or knowing someone who had COVID-19 – Of those who reported having COVID-19 or knowing someone with COVID-19, 60.6% expressed intent to vaccinate, while only 50.6% of those who did not have COVID-19 or know someone who had COVID-19 expressed intent to vaccinate.
- i. Having received a flu vaccine in the prior flu season – Of those who had received a flu vaccine in the prior flu season, 77.2% expressed intent to vaccinate against COVID-19. Of those who had not received a flu vaccine in the prior flu season, only 33.0% expressed intent to vaccinate.

Table 2: Association of Respondent Characteristics and Change in Vaccine Confidence

| Characteristic | More Confident — n (%) combined category for any increase in confidence | P value |
|---|---|---------|
| Age (years, 18 and older) | | |
| 18-24 | 85 (37.4) | < .001 |
| 25-34 | 133 (37.6) | |
| 35-44 | 133 (34.1) | |
| 45-54 | 98 (29.8) | |
| 55-64 | 47 (19.5) | |
| 65+ | 128 (34.7) | |
| Education | | |
| Less than high school | 22 (33.3) | < .001 |
| High school graduate | 110 (26.7) | |
| Some college | 169 (30.5) | |
| College graduate | 196 (33.2) | |
| Master's or doctorate level graduate | 133 (45.1) | |
| Race/ethnicity (only included individuals who selected one race/ethnicity) | | |
| White or Caucasian | 423 (31.0) | .006 |
| Black or African American | 66 (34.0) | |
| Hispanic or Latinx | 43 (42.2) | |
| Asian or Asian American | 43 (45.3) | |
| American Indian or Alaskan Native | 9 (50.0) | |
| Native Hawaiian or other Pacific Islander | 6 (54.6) | |
| Other | 4 (44.4) | |
| Household income | | |
| Less than \$25,000 | 100 (24.5) | < .001 |
| \$25,000-\$49,999 | 208 (35.2) | |
| \$50,000-\$99,999 | 185 (33.9) | |
| \$100,000-\$199,999 | 100 (38.2) | |
| \$200,000 or more | 25 (43.1) | |
| Region | | |
| Northeast | 145 (38.0) | NS |
| Southeast | 146 (32.1) | |
| Midwest and Northern Plains | 139 (28.8) | |
| Central South | 71 (36.0) | |
| West and Pacific Coast | 134 (32.7) | |
| Gender | | |
| Male | 345 (38.5) | < .001 |
| Female | 268 (27.4) | |
| Non-binary | 17 (48.6) | |
| Usual source of care | | |
| Yes | 539 (33.7) | NS |
| No | 76 (30.0) | |
| Unsure | 20 (29.4) | |
| Type of clinican for usual source of care | | |
| Family physician, physician assistant, or family nurse practitioner | 393 (34.3) | NS |
| Internal medicine physician, physician assistant, or internal medicine nurse practitioner | 70 (32.6) | |
| Other | 73 (33.2) | |

Table 3: Association of Respondent Characteristics and Intent to Receive a COVID-19 Vaccine

| Characteristic | Yes — n (%) | P value |
|--|-------------|---------|
| Confidence in adult vaccines before pandemic | | |
| Extremely confident | 497 (81.2) | < .001 |
| Very confident | 362 (67.2) | |
| Somewhat confident | 176 (39.6) | |
| Not so confident | 32 (17.7) | |
| Not at all confident | 18 (11.6) | |
| Age (years, 18 and older) | | |
| 18-24 | 94 (40.8) | < .001 |
| 25-34 | 177 (49.6) | |
| 35-44 | 200 (50.8) | |
| 45-54 | 173 (52.0) | |
| 55-64 | 144 (58.8) | |
| 65+ | 285 (77.2) | |
| Education | | |
| Less than high school | 28 (40.6) | < .001 |
| High school graduate | 189 (44.7) | |
| Some college | 278 (50.1) | |
| College graduate | 384 (65.0) | |
| Master's or doctorate level graduate | 198 (66.9) | |
| Race/ethnicity (only included individuals who selected one race/ethnicity) | | |
| White or Caucasian | 810 (59.1) | < .001 |
| Black or African American | 71 (35.9) | |
| Hispanic or Latinx | 51 (49.0) | |
| Asian or Asian American | 67 (67.0) | |
| American Indian or Alaskan Native | 10 (58.8) | |
| Native Hawaiian or other Pacific Islander | 2 (20.0) | |
| Other | 4 (44.4) | |
| Household income | | |
| Less than \$25,000 | 163 (39.9) | < .001 |
| \$25,000-\$49,999 | 325 (54.8) | |
| \$50,000-\$99,999 | 340 (61.8) | |
| \$100,000-\$199,999 | 177 (67.1) | |
| \$200,000 or more | 40 (67.8) | |
| Region | | |
| Northeast | 233 (60.4) | .049 |
| Southeast | 245 (53.5) | |
| Midwest and Northern Plains | 279 (57.2) | |
| Central South | 95 (48.0) | |
| West and Pacific Coast | 230 (55.8) | |
| Gender | | |
| Male | 563 (62.6) | < .001 |
| Female | 502 (50.5) | |
| Non-binary | 14 (42.4) | |

| Characteristic | Yes — n (%) | P value |
|---|-------------|---------|
| Usual source of care | | |
| Yes | 991 (61.5) | < .001 |
| No | 75 (28.9) | |
| Unsure | 20 (29.4) | |
| Type of clinican for usual source of care | | |
| Family physician, physician assistant, or family nurse practitioner | 720 (62.6) | .003 |
| Internal medicine physician, physician assistant, or internal medicine nurse practitioner | 145 (67.1) | |
| Other | 115 (52.3) | |
| Did you or someone you know have COVID-19? | | |
| Yes | 721 (60.6) | < .001 |
| No | 337 (50.6) | |
| Unsure | 29 (31.9) | |
| Did you receive a flu vaccine last season (August 2019 - April 2020)? | | |
| Yes | 787 (77.2) | < .001 |
| No | 278 (33.0) | |
| Unsure | 23 (28.1) | |

Discussion

Study findings largely supported our hypothesis that the COVID-19 pandemic would be associated with an increase in the percentage of people with confidence in vaccines. However, the difference was not as remarkable as we had hoped. Nearly 21% of respondents indicated a decrease in confidence since the pandemic and just over 39% indicated no change in confidence in vaccines. It should be noted that no change in confidence could represent people with a high degree of confidence prior to the pandemic remaining confident; however, it could also represent people with a low degree of confidence remaining skeptical. The 21% of respondents expressing a decrease in confidence is concerning and is reflective of what we have seen in other surveys regarding COVID-19 vaccine intention.²²⁻²⁴

If we assume that confidence translates into action and lack of confidence translates into inaction, then 21% of people choosing against immunization—whether for COVID-19 vaccines or routine immunizations—puts the United States below levels necessary to maintain herd immunity for many vaccine-preventable diseases. In the case of measles, for example, 93% to 95% of the population needs to be immune by immunization or infection to keep measles from returning and spreading throughout the United States.^{25,26} It is theorized that at least 70% of the population will need to be immune to SARS-CoV-2 by vaccination or infection in order to achieve herd immunity without activity restrictions,²⁷ which protects those who cannot be immunized or do not mount an adequate response to immunization.

In clinical practice, clinicians hear a variety of reasons expressed for patients' lack of confidence in vaccines. For the COVID-19 vaccines, patients may state their belief that the vaccines were rushed, that there were political pressures placed on the development process, and that science and public health officials too often change their minds and sometimes put out contradictory guidelines. The general public has had a front-row seat to watch science and vaccine development in action, and there have been expected changes in recommendations as we learn more about SARS-CoV-2 and the vaccines. For many, especially for those without a science or public health background, this has been a source of frustration and confusion. Additionally, the timing of the pandemic and vaccine development, which occurred during a highly polarized presidential election year, resulted in the unfortunate politicization of both the virus and the vaccines meant to prevent it. In hindsight, it is not surprising that such factors would negatively impact some people's confidence in vaccines.

Another finding of our survey, which should come as no surprise, is that having a usual source of care played an important role in respondents' self-reported intent to vaccinate. Studies show that patients who have a primary care clinician tend to fare better with regard to multiple health outcomes.²⁸⁻³⁰ It makes sense that trusted clinicians would have a significant impact on their patients' decisions regarding immunization. However,

these findings also bring to light the notable percentage of respondents (15.2%) who reported not having a USC or were uncertain about having one.

When people encounter information online that brings up questions or doubts about vaccines, they are often encouraged to discuss those concerns with their trusted clinician. However, this assumes that every individual has an identified usual source of medical care. As made evident by this study, that is not always the case. Studies show that people from racial and ethnic minority groups and people of lower socioeconomic status, as well as young adults, are more likely to be without a USC.³¹⁻³⁴ This may help explain why some individuals in these communities have been harder hit by COVID-19 morbidity and mortality and, at least in part, why these groups tend to express a greater degree of COVID-19 vaccine hesitancy. When considering where to allocate funding for medical training going forward, we must continue to advocate for expanding the primary care workforce; growing the representation of individuals from racial and ethnic minority groups in the fields of science, medicine, and public health; and increasing support to those who care for rural and underserved communities.

In 2020, the general population saw decreased availability of medical care as clinics shut down or significantly restricted access during the early part of the pandemic.³⁵ Many people of color and individuals from lower socioeconomic groups, who make up a significant percentage of frontline workers,³⁶ were compelled to continue working when the rest of the country was in lockdown but were then further challenged to take time off of work to access available medical care and/or discuss vaccine concerns with their clinician.

It is understandable that we would see a relative decrease in people obtaining vaccine information from primary care clinicians during the pandemic and an increase in information coming from TV, print, and radio news, the internet, and social media. The potential concern with this turn of events is that people are more likely to come across misinformation when venturing into online spaces.³⁷ It is incumbent upon physicians and other health care professionals (particularly in family

medicine and other primary care specialties), scientists, those in public health, news outlets, and social media platforms to work together to ensure that accurate and reliable information is being shared with the public.

Regarding our demographic questions and their relationship to the outcome of interest, the following findings seem intuitive:

- Respondents who had a higher level of vaccine confidence before the pandemic expressed a higher level of confidence in COVID-19 vaccines.
- Respondents who received a flu vaccine in the prior flu season were more likely to express intent to vaccinate against COVID-19.
- Respondents who had COVID-19 or knew someone who had COVID-19 were more likely to express intent to vaccinate against COVID-19.

There were some surprising findings regarding demographic characteristics of those expressing COVID-19 vaccine hesitancy (using intent not to vaccinate as a proxy for vaccine hesitancy). In prior research regarding pre-pandemic vaccine hesitancy, individuals expressing hesitancy tended to be white, more highly educated, and from higher socioeconomic groups.^{38,39} Additionally, no significant political divide was previously noted. In pre-pandemic times, hesitancy was associated with having strongly held beliefs on either side of the political spectrum.⁴⁰ In our study, however, we noted a shift in the demographics of those expressing reluctance to vaccinate against COVID-19. Greater hesitancy was expressed by those with lower levels of education, those with lower household incomes, and people from racial and ethnic minority groups. Our survey did not specifically query the political views of respondents, but other recent surveys suggest a strong political divide, with Democrats being significantly more likely to vaccinate and Republicans expressing greater vaccine hesitancy.^{41,42}

We theorize that the following are possible contributors to these findings:

- Lower levels of education correlate with decreased exposure to STEM (science, technology, engineering, and math) curriculum, which may make grasping the

intricacies of the vaccine development process and the fluidity of scientific findings and public health guidelines more difficult.

- People with less education and people of lower socioeconomic status may have a lower level of trust in the government and the other large organizations that are at the forefront of developing and distributing vaccines and implementing public health mitigation measures.
- The rapidity and “experimental” nature of COVID-19 vaccine development may be reminiscent of prior unjust and unethical treatment of people of color and other disadvantaged groups by the scientific and medical community.

Continuing attempts to understand individuals’ motivations with respect to vaccine intention will remain vital as we look to improve immunization confidence and uptake.

We acknowledge that a survey taken at one point in time cannot fully capture the fluidity of respondents’ vaccine perceptions and intentions, whether regarding routine immunizations or, in particular, regarding COVID-19 vaccines.⁴³ However, our survey results provide a valuable snapshot of the public’s current pandemic and COVID-19 vaccine mindset. In addition, these findings further highlight the critical role played by family physicians and other primary care clinicians in improving uptake of and access to life-saving vaccines. As efforts are ongoing to gain control over the rapidly spreading SARS-CoV-2 virus variants and stave off a “twindemic” of influenza and COVID-19 infections, and as the medical and public health communities continue working to improve routine immunization rates, we hope that the findings of this survey will help inform future vaccine education and promotion strategies.

Biases/Limitations

Several biases may have affected the results of the study. The survey asked respondents to rate their confidence levels prior to the start of the pandemic. At the time of the survey deployment, people in the United States had been dealing with the pandemic for nearly one year.

There is a risk of recall bias when completing a survey that asks about prior feelings, attitudes, and confidence levels. Surveys also introduce selection bias. While the survey sample provided by the third-party vendor was reported to be representative of the U.S. population, study researchers were not privy to the exact makeup of these respondents. We relied on the respondents' answers to evaluate representation based on multiple demographic elements. The survey was conducted in English, which likely excluded respondents who do not speak English. Furthermore, those without internet or smartphone access and those who are not part of an established SurveyMonkey respondent panel for other reasons may be underrepresented.

Based on the wording of the questions posed, it was not possible to make an exact determination of how respondents' confidence may have changed over the course of the pandemic. We used slightly different versions of the question related to vaccine confidence prior to the pandemic and since the pandemic. The former question asked, "Before the pandemic, how confident were you in adult vaccines?" The wording for the latter version asked, "Since the pandemic, has your confidence in vaccines for yourself changed?" In retrospect, we should have asked the question in the same way to allow direct comparison. The question asking respondents to assess change in confidence could then have been used to aid in validation of findings.

A CALL TO ACTION

Based on our survey findings, we call upon our governing medical organizations and local and federal government agencies to do the following:

- Increase funding for primary care training programs with an aim to expand the primary care workforce
- Increase compensation for public health and preventive health care services
- Increase funding and support for health care professionals who work in rural and underserved communities
- Get vaccines and vaccine conversations back into the hands of primary care clinicians through funding for clinic-based vaccine programs
- Encourage the role of primary care clinicians and representative organizations, including the AAFP, in public vaccine messaging and in the news media
- Increase representation of people from racial and ethnic minority groups in the fields of science, medicine, and public health
- Focus on inclusion of people from racial and ethnic minority groups and other underrepresented populations in research trials
- Partner with leaders and community members from racial and ethnic minority groups to provide better education, nutrition, technology, and access to medical care on an ongoing basis, not just in times of crisis
- Value and promote public representatives and government officials who have a scientific or medical background
- Expand STEM curriculum in public schools and make higher education accessible to all who want it
- Encourage governmental organizations, such as the National Institutes of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the U.S. Food and Drug Administration (FDA), to have a more public presence and to increase transparency and improve communication with the general public in order to garner trust
- Set aside political differences to focus on the health of Americans and join forces to conquer our common enemy, the SARS-CoV-2 virus, using our greatest tool for success—immunization

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