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Increasing COVID-19 Vaccine Uptake in the United States: Addressing Reasons for Vaccine Hesitancy through Effective Communications & Reform

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Abstract

The COVID-19 pandemic has and is still adding tremendous morbidity and mortality globally. Although vaccines are a major component in combatting COVID-19 and are widely available in the U.S., vaccine uptake is a major hurdle with 24% of the population having not received any dose of a COVID-19 vaccine. Literature review of reasons for COVID-19 vaccine hesitancy among adults in the United States. 27 articles included from PubMed and analyzed to find date of study, method of survey, population studied and generalization ability, and reasons for vaccine hesitancy or refusal. Most studies were cross-sectional surveys (88.89%) and conducted online (59.25%). Sample size ranged from 58 to 458,235. Populations studied include nationally representative U.S. (25.9%), specific populations within the U.S. (37.0%), specific locations within the U.S. (22.2%), and healthcare workers (14.8%). The most common reason for COVID-19 vaccine hesitancy is concern about side effects and general safety concerns (57.14%). Other significant reasons include: additional information needed (21.42%), distrust (14.28%), no reason/don't know (3.57%), and antivaccine beliefs (3.57%). Just over half (51.8%) of studies were conducted before the FDA EUA of the Pfizer-BioNTech COVID-19 vaccine, while 37.0% were after, and 11.1% spanned the time period or had follow-up surveys. To increase uptake among those who are still hesitant of COVID-19 vaccines, the American healthcare and education system must go through reform to ensure healthcare for all and address systemic racism. While increasing representation in health fields, already working clinicians can promote vaccinations through strengthening their patient relationships, following up on vaccination status, sharing educational resources and personal stories, and promoting community efforts. Teachers and schools can implement lessons on immunizations and disease. Communication efforts from institutions and local community organizations must work to increase trust, address fear of side effects, and combat misinformation. Promotion of social values and self-efficacy, as well as authentic community investment and engagement, can increase trust and vaccination levels.

Keywords: COVID-19, vaccine hesitancy, communication

1. Background

The COVID-19 pandemic has caused tremendous morbidity and mortality around the world, with the United States being severely affected. In the U.S., there have been a total of 77 million cases and 920,097 deaths as of February 15, 2022.[1] Although most Americans have access to vaccines, there are still around 146,921 daily cases according to the 7-day moving average cases and around 2,208 daily deaths according to the 7-day moving average deaths as of February 15, 2021.[1]

The available COVID-19 vaccines in the U.S. include Pfizer-BioNTech, Moderna, and Johnson & Johnson. The first approval issued by FDA was the Emergency Use Authorization (EUA) of the Pfizer-BioNTech COVID-19 vaccine on December 11, 2020.[2]

Shortly after, both the Moderna and Johnson & Johnson vaccines were approved for emergency use (see Figure 1).[3] The Pfizer-BioNTech vaccine for children ages 12 to 15 and 5 to 11 received EUAs on May 10th and October 29th, 2021, respectively (see Figure 1).[3] The Pfizer-BioNTech vaccine received official approval from the FDA for adults on August 23rd, 2021.[2] The timeline of approvals for different populations and age groups is important for research on vaccine hesitancy because the FDA plays a significant role in the establishment of trust and transparency of safety and effectiveness data. However, the actual roll-out based on priority groups and ages differed between states in the U.S.[3]

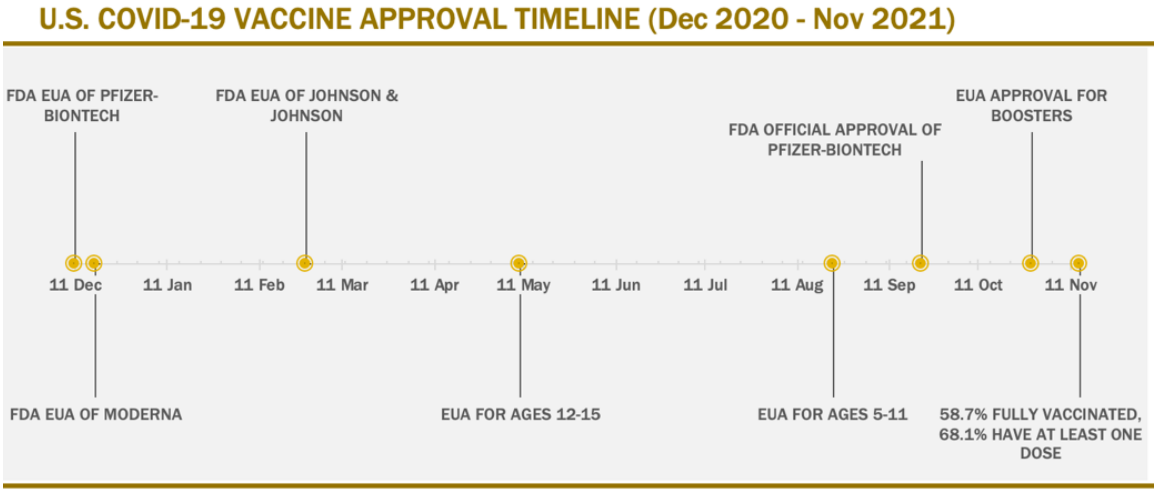


Figure 1: Timeline of U.S. COVID-19 Vaccine Approval from December 2020 to November 2021.[2-3] Pfizer-BioNTech vaccine received FDA EUA on December 11th, 2020.

Vaccines are essential in combatting the spread of the virus and deaths due to COVID-19.[4] Compared to vaccinated patients in a certain health system, unvaccinated patients were three times more likely to be infected with COVID-19, twice as likely to be hospitalized with COVID-19, and seven times more likely to die from COVID-19.[5] The stark difference in clinical outcomes based on vaccination status demonstrate that vaccines are essential to both the health of the population and the burden on the healthcare system.

In the U.S., 64.5% of the population are up to date with the COVID-19 vaccine, meaning they are fully vaccinated, and 76% have at least one dose, as of February 15, 2022.[6] Most of the 24% that have not received one dose makes up the vaccine hesitant, or those with low vaccine confidence.[7] Breaking this down by demographic characteristics, more of the Asian population, female, and older populations are vaccinated (see Figures 3-5).[8] 40.2% of the Black population is fully vaccinated, while 47.6% of the White population in the U.S. is fully vaccinated (see Figure 5).[8] However, the differences between racial groups are decreasing as vaccines become more available with increased uptake. There is also a correlation between counties with high social vulnerability indices and low rate of vaccination, meaning that poverty levels are a predictor of vaccine uptake.[9] States with the lowest total doses administered reported to CDC include Idaho, West Virginia, and many states in the Southeast region, as well as certain states in the Midwest (see Figure 2).[10] There is also a stark difference in urban and rural regions. As of December 2021, 81.9% of adults in urban areas were vaccinated, while only 69.3% of adults in rural counties were fully vaccinated.[11]

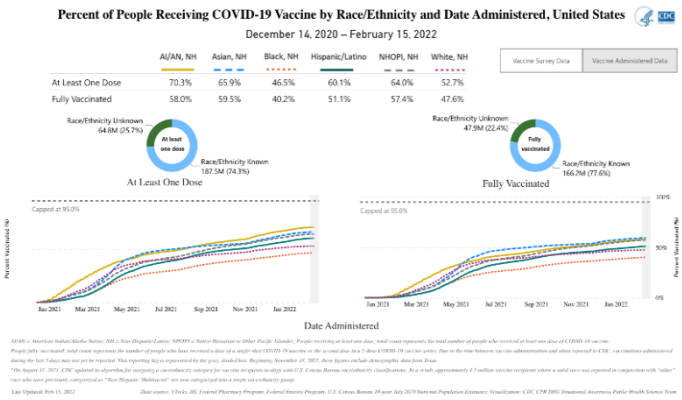


Figure 2: Percent of Total Population with at least one dose of All Counties in US. Map displays higher vaccination rates in urban counties when compared to rural counties. Vaccination rates also differ by region of the U.S.[10]

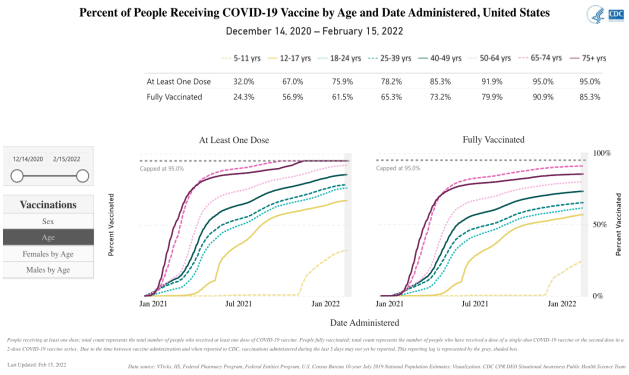


Figure 3: Percent of U.S. population Vaccinated by Age Group. Graph displays increasing vaccination rates among older age groups.[8]

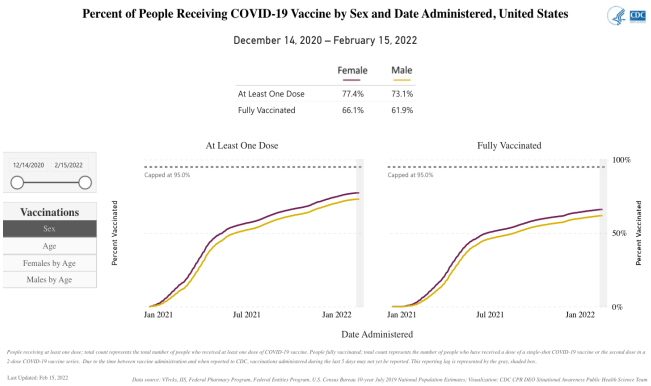


Figure 4: Percent of U.S. population Vaccinated by Sex. Graph displays that females are more vaccinated than males.[8]

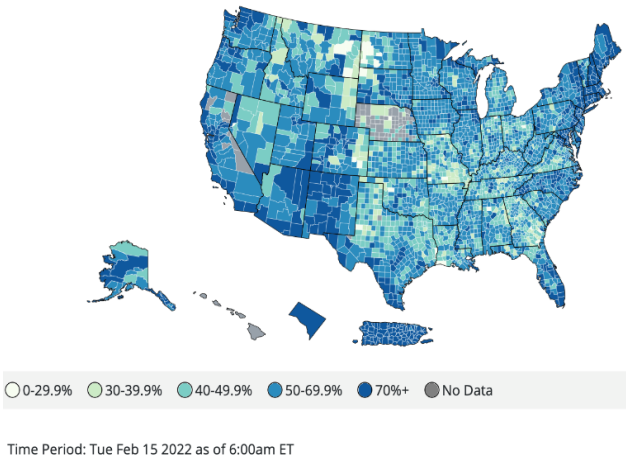


Figure 5: Percent of U.S. population Vaccinated by Race/Ethnicity. Graph displays race/ethnicity distributions of the 77.6% of those fully vaccinated with race/ethnicity known. The Asian population has the highest full vaccination rate (59.5%), followed by American Indian/Alaska Native (58.0%), Native Hawaiian or Other Pacific Islander (57.4%), Hispanic/Latino (51.1%), White (47.6%), and Black (40.2%).[8]

Increased vaccination rates are needed to protect the population from severe disease and reach herd immunity.[5, 13] Herd immunity is when enough of the population becomes immune to a disease, through either natural infection or vaccination, so that there is much less spread through the community.[12] High immunity levels in the community lead to indirect protection to those who are not immune.[13] The percentage vaccinated and/or infected to establish herd immunity against COVID-19 is not clear, as variants and changing protection affect this number. However, increasing the number of vaccinated individuals can make the effects of COVID-19 manageable, as the risk of severe illness decreases and waves will not be as disruptive.[13] Even so, the novelty of the virus and chance of breakthrough infection and re-infection can make this an impossible task. Even with adequate resources to vaccinate the whole population, the U.S. demonstrates the need to combat vaccine hesitancy everywhere to stop the impact of COVID-19.[14]

Vaccination is necessary for safety of those most at-risk by decreasing transmission, as well as personal protection against severe disease.[5, 13] However, there is still a large unvaccinated population in the U.S. To determine the reasoning of those who are still unvaccinated, a literature review of existing research on reasons for being unvaccinated against COVID-19 in the U.S. was conducted. These explanations will help policymakers and health communicators discover what messages and incentives work best to vaccinate the entire U.S. population against this deadly virus. The original hypothesis is that reasons for COVID-19 vaccine hesitancy in the US include distrust, misinformation, and lack of access. Therefore, these can be best combatted with general healthcare reform and community engagement, in person and on the internet.

2. Methods

the A scoping, systematic review of published literature on PubMed regarding reasons for COVID-19 vaccine hesitancy in the United States was conducted from September 1, 2021, to November 24, 2021.

2.1 Research Questions & Purpose of Review

The primary question in this literature review is: What are the most frequently given/most common reasons for vaccine hesitancy and refusal among the U.S. population? The secondary question is: How are these reasons impacted by timing of the study and participant population? Having identified the reasons, the paper discusses how this information and nuance might be used to increase vaccine uptake. By pulling literature surrounding general low vaccine confidence and health communication theories, creative ways are found to combat the current hesitancy effecting around 24% of the U.S. population who have not received one dose of the COVID-19 vaccine, and 19.2% of people ages 5 and older who have not received even one dose.[7]

The purpose of this literature review is to find the most frequently given reasons for COVID-19 vaccine hesitancy across the U.S. population, in order to identify most effective interventions to increase uptake. Objectives of this review include: 1) to assess most common reasons for COVID-19 vaccine hesitancy among U.S. adults, and 2) to analyze the best measures to combat these specific reasons.

2.2 Search & Analysis Process

The advanced search terms on PubMed were "(((COVID-19) AND (United States)) AND (vaccine hesitancy)) AND (reasons)." This resulted in a total of 38 results, which were reduced to 27 because of exclusion criteria detailed below. The inclusion criteria consist of adult population from the United States that include reasons for vaccine hesitancy. The exclusion criteria include: duplicates (1), articles on non-U.S. populations (4), non-COVID-19 specific data (2), did not include reasons but only incentives or prioritization (2), study framing and not actual data (1), mental health (1). 38 articles were scanned by both title and abstract for correct information relevant to the research question and hypothesis. The 27 articles included were analyzed, and information on the following was extracted using a table: date of study, method of survey, population studied and generalizability, and reasons for vaccine hesitancy or refusal. The results table (Table A1) was created with this information. In addition, a variable was created, included in the table, based on the date of survey on whether the study was done before or after the FDA EUA and actual roll-out to the general population.

3. Results

The purpose of the 27 included articles was to conduct surveys to identify the number and percentage of vaccine accepting, hesitant, or refusers within a certain population or general Americans, as well as find the reasons for not being vaccinated.

3.1 Type of Study

The majority of the studies were cross-sectional surveys conducted online (59.25%), as well as some in-person and on the phone (see Table 1). There was one qualitative study with focus groups, as well as two studies which incorporated a primary survey with a follow-up survey after a few months (see Table 1). Sample sizes ranged from participants of 58 in qualitative interviews (Harrison et al., 2021)[23] to 458,235 from a Census survey (Tram et al., 2021)[20] (see Table 2).

Table 1: **Type of study by number and percentage of articles (N = 27).** The majority of studies were cross-sectional surveys (88.89%), followed by those with follow-up surveys (14.81%), and focus group (7.40%).

Type of Study	N (%)	References
Cross-sectional survey	24 (88.89%)	
Online	16 (59.25%)	16, 18, 20, 21, 22, 24, 27, 26, 28, 30, 31, 33, 36, 38, 39, 40
In-person	2 (7.40%)	34, 35
Online & phone	4 (14.81%)	15, 17, 25, 32
Online, phone, & in-person	1 (7.40%)	37
Mail	1 (7.40%)	29
Focus group	1 (7.40%)	23
Follow-up surveys	2 (14.81%)	
Online	1 (7.40%)	19
Phone	1 (6.40%)	41

Table 2: **Number of study participants by number and percentage of articles (N = 27).** Sample sizes ranged greatly. The majority of sample sizes were between 1001-5000 participants (29.62% of articles).

Range of Number of Study Participants	**N (%)**	**References**
<50	1 (3.70%)	41
50-100	1 (3.70%)	23
101-500	5 (18.51%)	17, 18, 19, 29, 31
501-1000	4 (14.81%)	15, 28, 33, 36
1001-5000	8 (29.62%)	21, 27, 26, 32, 34, 38, 39, 40
5001-10000	2 (7.40%)	16, 35
>10000	6 (22.22%)	20, 22, 24, 25, 30, 37

3.2 Populations Studied

Out of the 27 articles included in this literature review, seven (25.9%) were nationally representative of the United States population. Ten (37.0%) surveyed specific populations across the United States, while six (22.2%) surveyed a specific location within the United States. Four (14.8%) of the articles focused on healthcare workers, one being nationally representative and the others surveying specific locations (Table 3).

Table 3: **Number and percentage of articles by population studied (N = 27).** The majority of populations studied were specific population across U.S. (37.0%), followed by nationally representative U.S. population (25.9%), specific location within U.S. (22.2%), and healthcare workers (14.8%).

Population Studied	**Number of Articles N (%)**	**References & Specifics**
U.S. Population (Nationally Representative)	7 (25.9%)	15, 18, 20, 26, 25, 32, 38
Specific population across U.S.	10 (37.0%)	• Refugees[17] • Adults with Multiple Sclerosis[19] • Employees[22] • Black community[31] • Emergency department patients[34] • Incarcerated population in four states[35] • Patients with IBS[36] • Parents of children who had COVID-19[41] • Parents of children under 12[40] • Groups prioritized for COVID-19 vaccination[27]
Specific location within U.S.	6 (22.2%)	• NYC & Phoenix[21] • Intellectual and development disabilities community in New York[28] • Ohio Amish[29] • Tennessee adults[33] • California adults[37] • Parents of children in NYC[39]
Healthcare workers	4 (14.8%)	• Nursing home and assisted living facility staff in Indiana[16] • Skilled nursing facility staff[23] • Hospital workers in Philadelphia[24] • General healthcare workers[30]

3.3 Top Reasons for Hesitancy

The majority of articles (57.14%) stated concern about side effects and general safety as the top reason for hesitancy. Of these 16 articles stating side effects as the main reason for hesitancy, twelve included general side effects, two included adverse/unknown effects, and two included general safety and effectiveness (see Table 4). Only five articles analyzed side effect concerns, which include well-documented flu-like symptoms after receiving the COVID-19 vaccine,[17, 18, 30] rare severe adverse reactions such as allergic reactions and thrombosis,[22, 18] and unknown and/or long-term effects.[30, 36, 17] 21.42% of the articles found additional information needed as the top reason for hesitancy among their population. This percentage includes those who "plan to wait and see if it is safe to get later" and those who cited lack of evidence. 10.71% of articles stated "mistrust in the vaccine itself" as the main reason for hesitancy, while one article stated "distrust of healthcare and other institutions" (see Table 4). Another article stated "no reason" or "don't know" as the top reason, and one stated "antivaccine attitudes, beliefs, or emotions" as the top reason among refusers (see Table 4). Antivaccine attitudes, beliefs, or emotions are defined as not liking, wanting, or believing in vaccines and/or misinformation regarding vaccines causing certain disorders.[15]

Other important reasons with percentages in close proximity to the top rationale include swiftness of development among skilled nursing facility staff and New York's intellectual and developmental disabilities community.[28, 23] In addition, distrust in COVID-19 vaccines closely followed side effects as the top reason among the general employed U.S. population.[22] One article also found that concerns about becoming infected from the vaccine and finding the virus to be less serious than public speculation differed between races as some of the main reasons for vaccine hesitancy.[32]

Table 4: Top reason for hesitancy by number and percentage of articles (N = 28)*. The majority of articles state concern of side effects and general safety as the top reason for hesitancy (57.14%), followed by additional information needed (21.42%), distrust (14.28%), no reason/don't (3.57%), and antivaccine attitudes, beliefs, or emotions (3.57%).

Top Reason for Hesitancy	Number of Articles N (%)	References
Concern about side effects & general safety	16 (57.14%)	
General side effects	12 42.8%)	• 16, 17, 18, 22, 24, 27, 26, 28, 29, 34, 41 • "Not sure" group[15]
Unknown and/or long-term effects	2 (7.14%)	• 30, 36
Safety & effectiveness	2 (7.14%)	• 39, 40
Additional Information Needed (includes "plan to wait and see if it is safe to get later" & lack of evidence)	6 (21.42%)	• 19, 33 • "Probably not" group[20] • Phoenix adults[21] • "Probably will not" group[25] • Hesitant group[35]
Distrust	4 (14.28%)	
In the vaccine	3 (10.71%)	• 31 • "Definitely not" group[20] • "Definitely not" group[25]
In healthcare or other institutions	1 (3.57%)	• Refusers[35]
No reason/don't know	1 (3.57%)	• NYC adults[21]
Antivaccine attitudes, beliefs, or emotions	1 (3.57%)	• Refusers[15]

*4 articles stratified the population into hesitant and refusers with separate top reasons for hesitancy.[15, 20, 25, 35] 1 article has different top reasons based on location.[21]

*4 articles were not included because of results without clear top reason.[23, 32, 37, 38]

3.4 Separating the hesitant & refusers

Four articles with top reasons for low vaccine confidence separated the participants between the hesitant and refusers with different top reasons for lack of vaccine uptake. The remaining nineteen articles differentiated between those who intended or had been vaccinated and those who did not intend and/or showed hesitancy (including hesitancy and refusal). Articles that separated between hesitant and refusers found that the most frequently stated reason for vaccine hesitancy among the hesitant or unsure is side effect and safety concerns, as well as waiting to see if it is safe.[15, 20, 25, 35] These same articles found that the most frequently stated reason for vaccine hesitancy among the refusers or "absolutely not" include distrust and beliefs. For example, the study by Fisher et al. (2021) found that among a representative sample of U.S. adults, 31.6% of participants were not sure and/or hesitant about getting the COVID-19 vaccine, and 10.8% did not intend, or refused.

The most frequently stated reason for being unsure or hesitant was concern about side effects and safety (34.1%), while the reason for refusal was "don't believe in, want, or feel comfortable with vaccines" (21.7%).[15] Second, the study by Tram et al. (2021) found that among a representative sample of U.S. adults, 10.2% stated that they would probably not get the vaccine, while 8.2% stated that they would definitely not. The majority of probably not (57.0%) stated "plan to wait and see if it is safe and may get it later" as the main reason, while the majority (49.0%) of "definitely not" stated "do not trust the COVID-19 vaccine" as the main reason.[20] Third, the study by Stern et al. (2021) found that among incarcerated individuals in Washington, Florida, California, and Texas, 45.4% would refuse the vaccine, while 9.8% would hesitate. Among the hesitant, the majority were waiting for more information (54.8%). Among the refusers, distrust of healthcare, correctional, or government personnel or institutions was the most common reason (20.1%).[35]

3.5 Qualitative data & predictive factors

Four of the twenty-seven articles included were qualitative or found correlations between vaccine intention/uptake and predictive factors. The qualitative study on skilled nursing facility staff found different reasons for hesitancy and gave more nuance to the topic. These include beliefs that the vaccine has been developed too fast and without sufficient testing, personal fear about pre-existing medical conditions, and general distrust of the government and institutions. These interviews also found the vaccine uptake is a "social enterprise" and influenced significantly by the actions of close friends in a social network.[23] The study by Latkin et al. (2021) found differences between demographic characteristics and predictive factors for COVID-19 vaccine uptake. Among a nationally representative population, Black, Hispanic, and woman-identifying populations in the U.S. are the most hesitant; however, reasons for hesitancy differed between these populations. Black populations were more likely to state concerns about being infected from the vaccine itself, while White populations were more likely to say that COVID-19 was not as serious as some say it is.[32] The study by Dorman et al. (2021) focused on the importance of confidence in vaccine willingness.[37] Lastly, the study by Allen et al. (2021) found that the greatest predictor of vaccination was agreement or disagreement with the statement that vaccines are safe and effective.[38]

3.6 Timing of Study

Just over half (51.8%; 14 out of 27) of the articles were done before the Federal Drug Administration issued an Emergency Use Authorization for the Pfizer-BioNTech vaccine in the United States on December 11, 2020, meaning before the actual roll-out to the public. These "before" surveys surrounded intention in a time where the vaccines were not yet approved for public use. 10 of the 27 (37.0%) articles had surveys conducted after the first EUA, meaning that safety and effectiveness were proven by the FDA. The FDA EUA should be proof to the public of the safety and effectiveness of the vaccine in combatting COVID-19, as safety and effectiveness data were transparent and recommended to prioritized populations and supported by healthcare professionals (FDA, 2019).[42] The remaining three articles included surveys both before and after the EUA. The follow-up surveys were given after the FDA EUA to the same participants to compare and see changes in vaccine uptake and reasons (Table 5).

Table 5: Number and Percentage of articles that were before or after FDA EUA of Pfizer COVID-19 vaccine (Dec 11, 2020) (N = 27). The majority of studies were conducted before FDA EUA (51.8%), followed by after (37.0%), and spanning both before and after (11.1%).

Date of Study	Number of Articles N (%)	References
Before	14 (51.8%)	15, 16, 18, 21, 24, 27, 29, 30, 31, 32, 33, 35, 37, 38
After	10 (37.0%)	17, 20, 22, 23, 25, 28, 34, 36, 39, 40
Both*	3 (11.1%)	19, 26, 41

*2 articles were comparisons with follow-up surveys.[41, 19] 1 article spanned from May 2020 to January 2021.[26]

3.7 Correlations between top reason, timing, & population

Out of the eleven studies conducted before the FDA EUA that included a top reason, seven stated side effects as their top reason, three stated mistrust, three stated more information needed, and one stated no reason for vaccine hesitancy. Out of the nine studies conducted after the EUA that included top reasons, eight were side effects and two were distrust. Out of the three studies conducted over the span or follow-up both before and after, one stated additional information needed as the top reason for hesitancy and two stated side effects. Both follow-up surveys found an increase in vaccine willingness over time, as seen in the general trend in vaccine uptake across the U.S.[19, 41] Although general vaccine willingness increased, the FDA EUA did not result in a decrease in concerns over side effects among populations studied in this literature review. A large number of hesitant populations were still concerned about side effects after the official FDA EUA with transparent safety data and CDC recommendations urging adults to get vaccinated.

4. Discussion

4.1 General trends in reasons for vaccine hesitancy in the US

It is imperative that reasons for vaccine hesitancy and vaccine refusal in the United States are addressed. There is still a significant percentage (35.5%) of the population not fully vaccinated against COVID-19 as of February 15, 2021.[6] In addition, 24% of the population has not received one dose.[6] It is important to recognize that children recently became eligible for COVID-19 vaccination, making up a certain percentage of the unvaccinated population (see Figure 1). The majority of unvaccinated adults are those in the middle-age range, from 18-24 years old and 25-39 years old (see Figure 3).[8]

According to the literature review on reasons for COVID-19 vaccine hesitancy, the most cited reason in 16 out of 27 (57.14%) articles is "side effects" and general safety concerns (see Table 3). The American population expressed concern about short-term side effects, including flu-like symptoms such as headache and fatigue, as a reason for vaccine hesitancy.[17, 18, 30] Those who are hesitant because of side effects also expressed concern about long-term impacts, which include side effects that are "unknown" and could be detrimental to personal health,[36, 30, 17] as well as

severe and adverse allergic reactions.[22, 18] Fear of these side effects stem from transparent data on flu-like symptoms, rare allergic reactions, and rare thrombosis cases. However, fear of unknown, adverse, and long-term effects stems from misinformation, mostly found on social media and the internet.[34, 41, 26]

This finding is slightly different from the original hypothesis that the most common reasons for COVID-19 vaccine hesitancy in the U.S. include distrust, misinformation, and lack of access. The literature review also shows that separating the hesitant from the refusers to find the reasons for not being vaccinated is imperative to adequately address the low uptake in vaccines in the United States. Refusers are more likely to express feelings of distrust and not be vaccinated because of beliefs, while the hesitant are more worried about personal safety and side effects.[20, 15] However, similarities exist between ideas of concern of safety and mistrust of the vaccines. Lasting concerns over vaccine safety and side effects, even with transparent data from official institutions, suggest that there is distrust among all vaccine hesitant. Most distrust in COVID-19 vaccines comes from pre-existing distrust in healthcare, misinformation and conspiracy theories on social media, and beliefs from one's social network.[23, 43]

4.2 Reasons for hesitancy among Black populations

Distrust in COVID-19 vaccines spans all racial/ethnic, hesitant groups, but affects Black populations at a disproportionate rate.[32] Reasons for COVID-19 vaccine hesitancy among Black Americans require recognition of structural racism within the medical and health fields. The history of racism in the medical and health fields, as well as with many institutions in this country, can be a cause for distrust in medicine.[44, 31] "Medical mistrust" is "an understandable, rational, self-protective response to historical and ongoing structural and interpersonal discrimination and racism in healthcare, and lack of trustworthiness of healthcare system and institutions in U.S. society".[31] Medical mistrust may lead to a decreased use of healthcare among Black Americans, which includes vaccinations, and decreased confidence in the safety and efficacy of the COVID-19 vaccines.[31] Distrust in COVID-19 vaccines also includes lack of trust in the government and other institutions. Bogart et al. (2021) found that there was a significantly high percentage of Black Americans who were "unsure" about the COVID-19 vaccines, rather than absolute refusers. This means that interventions focused on minority, specifically Black, populations in the U.S. must work on building trust through authentic representation and community investment (see *Recommendations* section below).

4.3 Recommendations

This literature review found that concerns around side effects and general safety, as well as distrust in the vaccines, are the top reasons for vaccine hesitancy in the U.S. Interventions and communications addressing the vaccine hesitant and refusers must focus on increasing trust and providing evidence. Five recommendations are listed below to increase COVID-19 vaccine uptake in the U.S.

Communications addressing side effects: The most cited reason for COVID-19 vaccine hesitancy in the US is side effects and wanting to wait and see if the vaccine really is safe. In order to address this, communications from local health providers, institutions, and community organizers must focus on the fact that vaccines work quickly, do not alter DNA, and give instructions to our cells to make a protein that our immune cells work to fight off providing future protection.[45] Serious side effects (allergic reactions and myocarditis) from the vaccine are highly unlikely, and those that do

occur happen within two weeks of vaccination. Most side effects are flu-like symptoms and arm pain for about 24 hours. There is a risk of severe allergic reaction that can be mitigated if caught quickly.[46] Communication must also highlight the fact that there is a higher risk of long-term effects from infection with COVID-19 than from the vaccine itself. These include difficulty breathing or shortness of breath, tiredness or fatigue, difficulty thinking or concentrating, cough, chest or stomach pain, and myocarditis, among many others.[47, 48] Communications must frame COVID-19 vaccination as the main way to reduce the risk of COVID-19 and a way to increase self-efficacy and protect one's health, as well as the health of the community.[49] In addition, employers must provide paid time-off after vaccination for known side effects, such as headache and fatigue.[17]

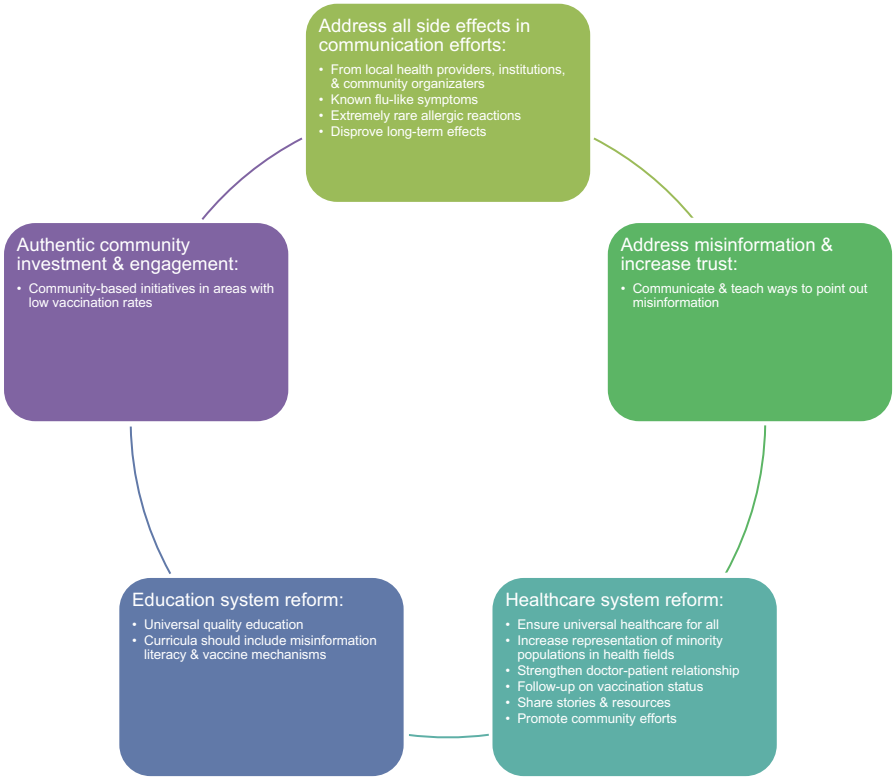
1. ***Interventions addressing misinformation***: Distrust stems from either medical mistrust or misinformation and anti-vaccination propaganda.[31, 49] Misinformation on the internet and social media has become a significant issue during the COVID-19 pandemic, as it preys on negative emotion and fear. Institutions, such as schools, must provide citizens with help in identifying misinformation and how they can have the self-efficacy to make the decision about getting vaccinated with the correct information. This is also called "misinformation literacy".[49]

2. ***Healthcare system reform***: In order to create trust in healthcare, there must be complete reform to universal healthcare with better primary care and health insurance for all. In a nationally representative survey in September of 2021, the Kaiser Family Foundation also found that the lack of health insurance was the most powerful predictor of who remained unvaccinated.[50, 51] This further suggests the need for a trusted primary care physician or general doctor for every person in the U.S. Quality, universal healthcare for all Americans would increase vaccination rates and make for a more equitable COVID-19 response. More specifically, systemic racism and distrust among minority populations due to mistreatment and underrepresentation must be addressed.[44] The medical field must authentically increase representation of minority populations in clinical trials, medical schools, doctors, and institutions such as the CDC and FDA. Clinicians must also promote vaccinations to their patients through follow-up on vaccination status, sharing educational resources stories, and promoting community efforts.[52] In addition, doctor-patient relationships can be strengthened to increase trust through personal stories and quality care.[53]

3. ***Education system reform***: In addition, quality education must be free and equitable in all parts of the U.S. and world. Curricula can teach about identifying sources and misinformation in schools and about how vaccines and medications work, in order to educate the population from a young age about the benefits of vaccination and increase health literacy.[44] The Vaccine Makers Project has a program that can be implemented in the classroom surrounding immunizations and disease.[54]

4. ***Authentic community investment & engagement***: Minority populations need to be more heavily represented in clinical trials for vaccines and medical field research in general.[44] Trust can be built with authentic investment in both time and resources in unvaccinated communities, specifically in the health field.

Figure 6: Recommendations to Increase COVID-19 Vaccinations & Vaccine Confidence in the U.S. Suggestions include specific communication efforts, system reform, and community-based initiatives.



4.4 Remaining Gaps in Knowledge

More research is needed about COVID-19 vaccine confidence in general, as well as specification between demographic characteristics. Because of the novelty of COVID-19 vaccines and the virus, sustained research and investigation is necessary. Qualitative research is essential to better understand the nuances in vaccine hesitancy, including the similarities and differences between fear of side effects and safety versus distrust. Surveys must specify which side effects populations are most concerned about. Health research is needed on the impact of social media and social networks on COVID-19 vaccine uptake, as well as where these fears and ideas stem from. The intersections between social sciences and health requires more research in the COVID-19 context. Research is also needed on correlations between timing of FDA approvals and reasons for vaccine refusal.

4.4 Limitations

There are several limitations to this literature review. The surveys utilized did not have a consistent wording of questions or provide the same questions. Some articles differentiated between those who are unsure and those who refuse, while some divided this into a broader hesitant category.

5. Conclusion

This literature review found that concerns about side effects is the top reason for COVID-19 vaccine hesitancy in the U.S., followed by need for additional information and distrust. In order to gain trust and therefore increase uptake

among those who are still hesitant of the available COVID-19 vaccines, the American healthcare and education system must go through reform to address systemic racism. While increasing representation in health fields, already working clinicians can promote vaccinations through strengthening their patient relationships, following up on vaccination status, sharing educational resources and personal stories, and promoting community efforts. Teachers and schools can implement lessons on immunizations and disease. Communication efforts from institutions and local community organizations must work to increase trust, address fear of side effects, and combat misinformation, while also promoting social and self-efficacy values. Promotion of social values and authentic community investment and engagement can increase trust and vaccinations. Vaccination of the global population is necessary to combat this virus. Addressing hesitancies to COVID-19 vaccines can increase uptake in order to protect all.

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Appendix
Table A1. PubMed search results: "covid-19 united states vaccine hesitancy reasons"

Authors, Year, Title	Purpose of Study	Method	Before, After, or Both FDA EUA of Pfizer (Dec 11, 2020)	Population studied (sample size, can it be generalized, specific location within US)	Reason(s) for hesitancy (with percentages)
Fisher, et al. (2020). Attitudes Toward a Potential SARS-CoV-2 Vaccine: A Survey of U.S. Adults[15]	To assess intent to be vaccinated against COVID-19 among a representative sample of adults in the United States and identify predictors of and reasons for vaccine hesitancy.	Online or telephone cross-sectional survey, fielded from 16 through 20 April 2020.	Before	991 AmeriSpeak panel members responded Approximately 1000 adults drawn from the AmeriSpeak probability-based research panel, covering approximately 97% of the U.S. household population. 16.1% response rate	Of the 31.6% who were not sure about being vaccinated & the 10.8% who did not intend to be vaccinated, 72.1% (n=220 not sure & n=83 no) responded with reasons. The most common reasons cited by participants who were not sure whether they will be vaccinated included specific concerns about the vaccine (such as safety or effectiveness) (57.3% of not sure) or a need for more information (22.3% of not sure) In contrast, the most common reasons provided by participants who did not intend to be vaccinated included antivaccine attitudes, beliefs, or emotions (56.6% of no), and lack of trust (32.5% of no) More specific top reasons: 34.1% of not sure: side effects, safety & 21.7% of no: don't believe in, want, or feel

					comfortable with vaccines
Unroe, et al. (2021). Willingness of Long-Term Care Staff to Receive a COVID-19 Vaccine: A Single State Survey[16]	To plan for coronavirus infectious disease 2019 (COVID-19) vaccine distribution, the Indiana Department of Health surveyed nursing home and assisted living facility staff.	Cross-sectional analysis of an anonymous survey sent via text message link to personal cell phones and emails in November of 2020	Before	Nursing home and assisted living facility staff in Indiana 8,243 responses – sent to 23,232 November 2020	Of those unwilling to take the vaccine when first available (55% of participants), 44% would consider in the future. Concerns about side effects was the primary reason for vaccine hesitancy (70% of those unwilling). - Health concerns (34%) - Questioning effectiveness (20%) - Religious reasons (12%) Characteristics associated with increased willingness were age over 60, male, and white race (P < .0001).
Zhang, et al. (2021). Acceptance of COVID-19 Vaccine Among Refugees in the United States[17]	Little is known about COVID-19 vaccination intentions among refugee communities in the United States. The objective of this study was to measure COVID-19 vaccination intentions among a sample of refugees in the United States and the reasons for their vaccine acceptance or hesitancy.	Email and text message anonymous online surveys to refugee populations in US From December 2020 through January 2021 (very beginning of roll-out, approved vaccines)	After	435 respondents, refugees in the US	70.3% intended to get vaccine, 7.6% no, 22.1% unsure Reasons: Among respondents who were unsure about receiving the COVID-19 vaccine or who did not intend to receive the vaccine, most were worried about side effects (71.3%), followed by concerns about the effectiveness of a COVID-19 vaccine (12.4%) and a fear of needles (8.5%).

Solís Arce, et al. (2021). COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries[18]	Comparison of vaccination between LMICs and US and Russia	Online, Cross-sectional survey conducted Dec 4-5, 2020	Before	462 of U.S. participants replied with reasons for vaccine hesitancy, 1313 replied with reasons for getting vaccine nationally representative sample of adult internet users recruited through the market research firm Lucid	Acceptance rate in US is 64.6% Vaccine hesitancy reasons: concern about side effects (79.3% of hesitant), skepticism about effectiveness (46.8%), lack of concern about COVID-19 infection (39.3%)
Ehde, et al. (2021). COVID-19 vaccine hesitancy in adults with multiple sclerosis in the United States: A follow up survey during the initial vaccine rollout in 2021[19]	To assess COVID-19 vaccine hesitancy before and after roll-out among adults with MS in the U.S.	2 online surveys in April/May 2020 and Jan/Feb 2021	1 before 1 after	Adults with MS living in the US (N = 359)	Participants who were vaccine hesitant (20.3%) reported concerns about the long-term effects of the vaccine, the vaccine approval process, and the potential impact of the vaccine given their own health conditions/history. 90% of hesitant wanted additional information about the vaccine before deciding Vaccine willingness among this group increased over time
Tram, et al. (2021). Deliberation, Dissent, and Distrust: Understanding distinct drivers of COVID-19 vaccine hesitancy in the United States[20]	To assess reasons for COVID-19 vaccine hesitancy and refusal in the U.S.	Data analysis of the US Census Bureau's Household Pulse Survey (biweekly cross-sectional survey of US households) in Jan-March 2021	After	459,235 participants in Jan-March 2021 Representative because weighted 140 million housing units contacted	10.2% reported that they would probably not get the vaccine & 8.2% that they would definitely not get a vaccine Those who expressed reluctance invoked mostly "deliberative" reasons, while those who rejected the vaccine were also likely to invoke reasons of "dissent" or "distrust

					"probably not": deliberative reasons – "plan to wait and see if it is safe and may get it later" (57.0%), "concern about possible side effects" (52.1%), "other people need it more than I do right now" (26.7%) "definitely not": distrust – do not trust the COVID-19 vaccine (49.0%) & do not trust the government (40%)
Trent, et al. (2021). Trust in government, intention to vaccinate and COVID-19 vaccine hesitancy: A comparative survey of five large cities in the US, UK, and Australia[21]	To identify predictors of willingness to vaccinate against COVID-19 in five cities with varying COVID-19 incidence in the US, UK, and Australia.	Online, cross-sectional survey of adults from Dynata's research panel in July-September 2020.	Before	Adults aged 18 and over in Sydney, Melbourne, London, New York City, or Phoenix. 1204 adults in NYC 500 adults in Phoenix May NOT be representative of entire population	Participants with high or very high confidence in their current government were less likely to be willing to receive the vaccine Highest reason in NYC for not vaccinating is no reason/don't know (42% of hesitant in NYC) Highest reason in Phoenix is not sure or waiting for more information (30%)
King, et al. (2021). COVID-19 vaccine hesitancy January-May 2021 among 18-64 year old US adults by employment and occupation[22]	Vaccine hesitancy in US by employment status and occupation category	Online, cross-sectional survey on Facebook from Jan to May 2021	After	US adults 18-64 years completed an online COVID-19 survey 3,179,174 times from January 6-May 19, 2021. Employed participants that responded with reasons: 55375 Data on employed participants	Over half of employed hesitant participants reported concerns about side effects (51.7%), not trusting COVID-19 vaccines (51.3%), and not liking vaccines in general (15%) Over a third didn't believe they needed the vaccine (45.1%), didn't trust the government (44.6%), and/or were

					waiting to see if it was safe (35.2%)
Harrison, et al. (2021). "Somebody Like Me : Understanding COVID-19 vaccine hesitancy among staff in skilled nursing facilities[23]	To describe reasons for COVID-19 vaccine hesitancy reported by staff of skilled nursing facilities and understand factors that could potentially reduce hesitancy	Focus groups (qualitative interviews) with 58 staff members were conducted virtually over Zoom in Dec 2020	After	58 skilled nursing facility staff in U.S. Small sample size	Reasons for hesitancy: beliefs that the vaccine has been developed too fast and without sufficient testing; personal fear about pre-existing medical conditions, and more general distrust of the government Vaccine uptake is a social enterprise.
Momplaisir, et al. (2021). Racial/Ethnic Differences in COVID-19 Vaccine Hesitancy Among HCWs in 2 large academic hospitals[24]	To assess hesitancy to COVID-19 vaccination among HCWs across different racial/ethnic groups and assess factors associated with vaccine hesitancy.	Online, cross-sectional survey study was conducted among HCWs from 2 large academic hospitals (ie, a children's hospital and an adult hospital) over a 3-week period in November and December 2020.	Before	12,034 HCWs at 2 hospitals in Philadelphia who responded to the survey (34.5% response rate)	Among 5440 HCWs with vaccine hesitancy, reasons given for hesitancy included concerns about side effects (4737 individuals [87.1%]), newness of the vaccine (4306 individuals [79.2%]), and lack of vaccine knowledge (4091 individuals [75.2%]).
Nguyen, et al. (2021). COVID-19 Vaccination Intent, Perceptions, and Reasons for Not Vaccinating Among Groups	To assess vaccine intent, perceptions, and reasons among prioritized groups in the US as of Sept and Dec 2020	Online CDC surveys in Sept and Dec 2020	Before	Representative sample of prioritized US adults (3541 in Oct and 2033 in Dec) Groups for prioritization (essential workers, underlying medical conditions, aged 65 and over)	Among adults in the December surveys who did not intend to get vaccinated (32.1% of participants), the main reasons most frequently cited were concerns about side effects and safety of the COVID-19 vaccine (29.8%), planning to wait to see if the vaccine is safe

Prioritized for Early Vaccination – United States, September and December 2020[25]					and consider receiving it later (14.5%), lack of trust in the government (12.5%), and concern that COVID-19 vaccines were developed too quickly (10.4%)
Mondal, et al. (2021). Sociodemographic predictors of COVID-19 vaccine acceptance: a nationwide US-based survey study[26]	Our primary objective was to determine the relative influence of sociodemographic predictors on COVID-19 vaccine acceptance. The secondary objectives were to understand the reasons behind vaccine refusal and compare COVID-19 vaccine acceptance with influenza vaccine uptake.	Online cross-sectional survey conducted between May 2020 and Jan 2021	Both (mostly before)	2978 participants in US Nationally representative	Information channels: Both vaccine-compliant and vaccine-hesitant groups had equivalent reliance on television, social interaction and social media (e.g. Facebook) to acquire COVID-19-related information. However, a significantly higher number of vaccine-compliant participants gained COVID-19 information from the CDC and other official health websites. 18.9% not accepting of vaccine Potential adverse effects (84.2%), followed by doubt about vaccine efficacy (44.4%), were the primary reasons reported by the vaccine-hesitant group. Even 51.0% of the vaccine-compliant participants were concerned about adverse effects; however, only 5.4% doubted the efficacy of the vaccine. Also have racial/ethnic breakdown of reasons

Nguyen, et al. (2021). Changes in COVID-19 vaccination receipt and intention to vaccinate by socioeconomic characteristics and geographic area, United States, January 6 – March 29, 2021[27]	The purpose of this study was to examine **changes** in vaccine intentions and attitudes by sociodemographic characteristics and geographic areas, factors associated with vaccination intent, and reasons for non-vaccination among a nationally representative sample of U.S. adults.	Household Pulse Survey from Jan to March 2021 Online & phone cross-sectional survey	After	Approx. 75,000 respondents, U.S. adults Response rates of 6.4-7.5%	Reasons for not getting vaccinated changed slightly from January to March (The belief that a vaccine is not needed increased by more than five percentage points from early January to late March.) In late March, among "probably will": plan to wait and see if it's safe (54.5%), concern about possible side effects (50.9%), other people need it more right now (35.5%) Among probably will not: plan to wait (56%), side effects (51.1%), other people need it more right now (25.4), don't trust COVID vaccines (25) Definitely not: concern about side effects (46.5%), don't trust COVID-19 vaccines (47.9), don't trust government (40.1) 7.6% in late March do NOT plan to be vaccinated – reasons above
Iadarola, et al. (2021). COVID-19 vaccine perceptions in New York State's intellectual and developmental	To explore COVID-19 vaccine perceptions in individuals with IDD, their family members, and those who work with	Online survey distributed to a convenience sample of IDD Organizations throughout NY state	After	New York's intellectual and development disabilities community 825 respondents	25% hesitant - Concerns about side effects (16%) and swiftness of vaccine (15%) development, being an "experiment" for the vaccine (14%) and not trusting government (14%)

disabilities community[28]	them, to inform a statewide vaccine information and messaging project.	Jan-Feb 2021			Regarding trusted sources of vaccine information, health professionals ranked highest (92%), followed by friends and family (74%). Newspapers and television were trusted by twice as many people as social media.
Scott, et al. (2021). Vaccination patterns of the northeast Ohio Amish revisited[29]	To evaluate; the rate and influences of vaccine hesitancy compared to a decade ago, vaccination patterns between Amish affiliations, vaccine practices of Amish special needs children, and the Amish's acceptance of a COVID-19 vaccine.	April 2020, survey mailed to 1000 Amish families	Before	391 respondents of Ohio Amish	75% would reject a COVID vaccine Fear of adverse effects was the most common reason to reject vaccines (83.9% of refusers) & 46% believed that shots could have dangerous preservatives or chemicals in them. Families that accepted vaccines were more likely to cite a healthcare worker as the primary influence to vaccinate. Wives were more likely to cite their spouse as the primary influence to vaccinate. Families that rejected vaccines were more likely to state their bishop was the most influential person on vaccination.
Meyer, et al. (2021). Trends in Health Care Worker intentions to receive COVID-19 vaccine and reasons for hesitancy[30]	To assess intentions of employees of a health care system before COVID-19 vaccine distribution to receive a vaccine and to understand their reasons	Online Nonidentifiable administrative survey data Sent in Dec 2020	Before	16292 employees – HCWs across U.S. 68.5% response rate	28.4% undecided on vaccine, 16.3% said no Most (90.3% [6569 employees]) of those who responded no or undecided reported concerns about unknown risks of the vaccines, 44.3% (3226 employees) reported they wanted to wait until others' vaccine

	for hesitancy to do so.				experiences are known, and 21.1% (1539 employees) reported that they do not trust the rushed FDA process. More than one-half (57.4% [4187 employees]) cited concerns about known adverse effects, such as headache and fatigue.
Bogart, et al. (2021). COVID-19 vaccine intentions and mistrust in a national sample of Black Americans[31]	To assess vaccine intentions and reasons for hesitancy among the Black American population	Web-based survey in Nov-Dec 2020	Before	207 Black American participants in RAND American Life Panel Nationally representative	Overall, 35% agreed or strongly agreed that they would not get a COVID-19 vaccine, 40% agreed or strongly agreed that they would get vaccinated, and 25% reported "don't know." Significant multivariable predictors of not wanting to get vaccinated included high mistrust of the vaccine itself (e.g., concerns about harm and side effects), OR (95% CI) = 2.2 (1.2-3.9), p = .007, and weak subjective norms for vaccination in one's close social network, OR (95% CI) = 0.6 (0.4-0.7), p < .001.
Latkin, et al. (2021). Mask usage, social distancing, racial, and gender correlates of COVID-19 vaccine intentions among adults in the US[32]	Assess vaccine intentions and hesitancy among American adults	National panel survey, online & telephone in May 2020	Before	1,056 respondents, nationally representative	53.6% yes, 16.7% no, 29.7% unsure A sub-analysis among respondents who did not plan to obtain a COVID-19 vaccine (16.7%) indicated that the Black population, compared to White, were almost twice as likely to report concerns about becoming infected from the vaccine. In contrast, Whites, compared to

					other racial/ethnic groups, were more than twice as likely to report that one of the reasons for not intending to get a vaccine was that "the coronavirus outbreak is not as serious as some people say it is." These findings are from a subsample and highlight the importance of studies examining racial/ethnic differences in vaccine intentions.
Gatwood, et al. (2021). Factors influencing likelihood of COVID-19 vaccination: a survey of Tennessee adults[33]	To examine the vaccine-related beliefs and behaviors associated with likely hesitancy toward vaccination against coronavirus disease 2019 (COVID-19) among nonelderly adults.	Online cross-sectional survey in June 2020	Before	TN adults 18-64 who were not healthcare providers 1,000 completed responses (62.9% response rate)	54.1% had some hesitancy Three leading reasons for being hesitant toward COVID-19 vaccination emerged: lack of sufficient effectiveness evidence (32.1%), perceived lack of disease risk (24.6%), and vaccine safety concerns (23.2%). Approximately one-third (34.4%) of respondents indicated some historical vaccine hesitancy, and only 21.4% indicated always getting a seasonal influenza vaccination.
Rodriguez, et al. (2021). The rapid evaluation of COVID-19 vaccination in emergency departments for underserved patients study[34]	Emergency departments (EDs) often serve vulnerable populations who may lack primary care and have suffered disproportiona te COVID-19	In-person cross-sectional survey Dec 2020 to March 2021	After	ED patients during their visits to 15 safety net EDs in 14 US cities 2,301 participants (89.4% response rate)	61% stated they would accept vaccine, rest are hesitant 3 primary reasons for vaccine hesitancy were similar for those with and without a source of regular medical care: concerns about side effects and safety (65%), need for more

	pandemic effects. Comparing patients having and lacking a regular source of medical care and other ED patient characteristics, we assessed COVID-19 vaccine hesitancy, reasons for not wanting the vaccine, perceived access to vaccine sites, and willingness to get the vaccine as part of ED care.				information (47%), and having heard stories in the media or online (24%). The fourth most common reason for respondents who had primary care was "don't believe the vaccine will work"; in respondents who lacked primary care, the fourth most common reason was "not worried about getting COVID-19 infection" Differences between those who had primary care and those who did not
Stern, et al. (2021). Willingness to receive a COVID-19 vaccination among incarcerated or detained persons in correctional and detention facilities[35]	To assess vaccination willingness and intent among incarcerated populations in the US	Sept to Dec 2020 Interviews	Before	3 prisons and 13 jails in 4 states (Washington, Florida, California, Texas) 5,110 participants (64.2% response rate)	45.4% would refuse, 9.8% would hesitate Common reasons reported for COVID-19 vaccine hesitancy were waiting for more information (54.8%) and efficacy or safety concerns (31.0%). The most common reason for COVID-19 vaccination refusal was distrust of health care, correctional, or government personnel or institutions (20.1%).
Dalal, et al. (2021). COVID-19 vaccination intent and perceptions	To assess vaccine uptake and hesitancy among IBD population	Dec to Jan 2021 Anonymous survey online	After	906 participants with IBS in Boston, MA & from social media 8.1% response rate	Rates of COVID-19 vaccination intent were 80.9% for local and 60.0% for SM participants.

among patients with inflammatory bowel disease[36]				Not representative of national IBD population	The hesitant participants most commonly selected "concern that long-term safety of vaccines is unknown" (64.4% local, 70.1% SM) and "prefer to see how others tolerate vaccine first" (62.2% local, 55.6% SM). Approximately 70% desire data regarding vaccine safety/efficacy among patients with IBD
Dorman, et al. (2021). Factors associated with willingness to be vaccinated against COVID-19 in a large convenience sample[37]	To assess factors of hesitancy and receipt of vaccination among Californian adults	Internet survey, face to face and telephone interviews Oct and Nov 2020	Before	26,324 respondents Large convenience sample in California Response rate unknown	Measures from 5C scale: confidence, complacency, convenience, calculates risks and benefits, concern for others For the sample as a whole, confidence in the safety of the vaccine was the strongest predictor of willingness to be vaccinated, followed by concern for protecting others and whether or not one believed that COVID-19 was serious enough to warrant vaccination Not sure exact percentages
Allen, et al. (2021). Why are some people reluctant to be vaccinated for COVID-19? A cross-sectional survey among U.S. adults in	To assess cognitive, attitudinal and normative beliefs associated with not intending to get a COVID-19 vaccine among	Online cross-sectional survey of US adults May-June 2020	Before	1219 respondents Nationally representative sample of US adults 64% response rate	17.7% no & 24.2% unsure Those who strongly disagreed with statements that most vaccines are very safe and/or effective were more likely to say they would not get the vaccine, compared with those who strongly

May-June 2020[38]	American adults				believed most vaccines are very safe/effective (78.1% vs. 5.0%) Those who strongly disagreed with statements that they themselves and everyone else in society has a responsibility to be vaccinated were more likely to indicate they would not get a COVID-19 vaccine, compared with those who strongly agreed with these statements (77.2% vs 4.8%) When asked about not needing to be vaccinated if everyone else were vaccinated, results were mixed. Those who strongly opposed this statement were most likely to report an intention to vaccinate (74%), while those who strongly agreed were most likely to indicate they would *not* get the vaccine (45.3%). Those who were neutral about this statement were the most likely to report that they were unsure about vaccination (42.4%). Regarding trust of public authorities, half (49%) of those who strongly disagreed that public authorities decide about which vaccines to recommend based on the best interests of the

					community and that public authorities should be able to mandate vaccination reported that they did not intend to be vaccinated.
Teasdale, et al. (2021). Parental plans to vaccinate children for COVID-19 in New York city[39]	To assess intent among caregivers in NYC to vaccinate their young children, and assess reasons for hesitancy	Online survey from March 9-April 11, 2021	After	1,119 parents and caregivers of children under 12 (no response rate given) Representative of NYC population of parents	61.9% planned to vaccinate, 14.8% no, 23.3% unsure Reasons for hesitancy: safety & effectiveness (81.2%), believe children are at low-risk for COVID-19 and don't need vaccination (21.7%), medical reasons (16.6%), religious or philosophical reasons (9.5%)
Teasdale, et al. (2021). Plans to Vaccinate Children for Coronavirus Disease 2019: A Survey of United States Parents[40]	To assess intent among caregivers in the U.S. to vaccinate their young children, and assess reasons for hesitancy	Online, Community-based, nonprobability survey March 2021	After	2074 parents of children under 12 Representative of US population	49.4% plan to vaccinate child, 25.6% no, 25.0% unsure Reasons: potential safety or effectiveness concerns (78.2%), believe children are at low-risk of infection and do not need to be vaccinated (23.0%), medical reasons (11.2%), religious reasons (8.5%)
Teherani, et al. (2021). Intent to Vaccinate SARS-CoV-2 Infected Children in US Households: A Survey[41]	To assess vaccination intent among caregivers in the U.S. with children who had previously been infected with COVID-19	2 phone interviews of 19-question survey April-Nov 2020 & Dec-Jan 2021	1 before & 1 after	102 in April-Nov 2020 (initial survey) & 45 in Dec-Jan 2021 (follow-up survey) 51% initial response rate, 44% for follow-up Guardians of children who had a laboratory-confirmed	Initial: 45% endorsed vaccination for child, 43% not, 12% might 24 respondents from follow-up survey listed reasons for vaccine hesitancy: safety and side effect concerns (50%), lack of information (37.5%), can give you COVID-19 illness (16.67%)

				diagnosis of COVID-19 (not nationally representative)	

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