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The Relationship Between Social Media and Conspiracist Thinking on COVID-19 Vaccine Uptake

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Abstract

Previous research has found a relationship between COVID-19 vaccine conspiracist beliefs, social media use, and COVID-19 vaccine uptake. The current study aimed to expand on previous findings to investigate the potential moderating effect of social media on the relationships between conspiracist beliefs, trust in experts, and political conservatism on vaccine uptake. Additionally, the current study examined two age groups (20-30 year olds and 50-60 year olds). Trust was measured using a Trust Scale (developed by researchers); Vaccine conspiracy beliefs were measured using an expanded version of the Vaccine Conspiracy Belief Questions (Shapiro et al., 2016); Frequency of social media use was measured using an adapted version of the Social Networking Activity Intensity Scale by Li et al. (2016); Social media literacy was measured using an abridged version of the Social Media Information Literacy Scale by Heiss et al. (2023). Results of the study indicated that more frequent use of Snapchat and TikTok is associated with less COVID-19 vaccine uptake and greater COVID-19 conspiracist beliefs. Additionally, the effect size of the relationships between trust in experts & vaccine uptake and trust in experts & conspiracist beliefs is dependent on the frequency of Snapchat and TikTok use. Future research should further investigate the factors that contribute to the impact of Snapchat and TikTok on vaccination to inform interventions to encourage vaccination. Researchers may also want to explore whether this effect is true for vaccines other than that for COVID-19.

Keywords: Conspiracy beliefs, COVID-19 Vaccine Uptake, Trust, Political Conservatism, Social Media, Snapchat, TikTok, Age

Introduction: COVID-19 in '24

Since 2020, the vaccine availability and safety protocols for SARS-CoV-2, or COVID-19, have changed dramatically. Following the initial rollout of the Pfizer and Moderna vaccines in December 2020, the Centers for Disease Control and Prevention (CDC) recommended both doses of the mRNA vaccine to prevent severe infections as well as a booster dose. Two years later, Moderna and Pfizer rolled out a new, bivalent vaccine that targeted the original strain of COVID-19 and the Omicron variant. After many rounds of injections, especially for immunocompromised patients, as of 2023 the vaccine options include the 2023-2024 formula of Pfizer-BioNTech, Moderna, or Novavax, the latter being a protein based vaccine opposed to an mRNA vaccine (Yale Medicine, 2024). Thus, the current recommendation from the CDC is that individuals receive one of these new vaccines to protect themselves from the COVID-19 virus, regardless of vaccination history. These options are the beginning of a shift in the culture of COVID-19 immunization. After four years, this vaccine is on track to assume its position with other routine immunizations, such as the annual Flu Shot. So, why is it still the case that 65.3% of Americans have not received the most updated vaccine as of February 16th, 2024 (CDC, 2024)? Recent studies suggest that information on social media might be at play.

With the prevalence of social networks as a source of entertainment, interpersonal connection, and information, it is no wonder that websites like Facebook, Instagram, and TikTok can act as echo chambers especially for information related to vaccines. Since the beginning of the pandemic, social media use increased by 20% (Dixon et al., 2023) likely due to a widespread disruption to individuals' regular routines and the easy accessibility of social media platforms. Past studies have shown that users are more likely to interact with content that matches their opinions, which can cause confirmation bias (Sun et al., 2022). For this reason, conspiracy tends

to spread like a virus of its own on social media sites, which can be detrimental to legitimate health recommendations by experts about the COVID-19 vaccines. Even with moderation across platforms, certain posts still slip through the cracks. Despite Twitter/X's efforts to restrict misinformation on the site, 54.8% of tweets posted between January 2020 and March 2022 had negative sentiments about the vaccine (Melton et al. 2022). The current study aimed to discover the relationships between vaccination status, conspiracist thinking, and social media usage.

The Influence of Social Media on Vaccine Uptake

A study of 985 Canadian individuals by Chen et al. (2022) examined predictors of vaccine hesitancy; data collection occurred on an online survey platform in May of 2021. This study found that individuals who use social media as their main source of information about the COVID-19 vaccine were 50% more hesitant to receive the vaccine. The relationship of hesitancy compared to acceptance for the 18-24 age group was not significant, compared to the over 54 group for which respondents were 60% less likely to be hesitant to receive the vaccine. Interestingly, this study found that participants were more hesitant regardless of how much they trusted social media as a source of information, as measured by the question "How much do you trust the information you got so far about the COVID-19 vaccine?"

Another study of 515 undergraduate students from a large, northeastern university found that what these participants' friends posted on social media about the vaccine directly impacted their COVID-19 vaccination intentions (Lin et al., 2021). This could be due to many factors, including the intensity at which an individual uses social media and the amount of social media misinformation they consume.

Additionally, in China, parents with children under the age of 6 were significantly less likely to vaccinate their children for COVID-19 if their information came from social media platforms rather than verified sources, according to a cross-sectional study (Du et al., 2021). The same was found in a cross-sectional study of mothers in Japan (Horiuchi et al., 2021). In general, American mothers also tended to be more hesitant to vaccinate their children or themselves when they obtained their information on immunizations from online sources (Salmon et al., 2005). This concern is likely heightened for these parents because the safety of their children is questioned by the information available on social media.

Dambadarjaa et al. (2021) also found that, of a Mongolian sample, those who preferred social media as a source of COVID-19 vaccine information were the most likely to reject the vaccine compared to those who used brochures, infographics, or posters. Similarly, a review of 14 research publications by Rodrigues et al. (2023) found similar results regarding vaccine sentiment in Asian countries. Individuals who received vaccine information on social media were less likely to receive any form of the vaccine, overall. This study suggests that this region in particular is influenced by cultural values that favor natural remedies and traditional medicine over immunizations. These findings indicate that in non-western countries, the focus of anti-vaccination content that can be found on social media is more focused on the risks of the vaccine compared to other options for protection against COVID compared to the conspiracist thinking found on western social media. Alternative research has explored such variables to better understand the relationship between social media and vaccine uptake.

The Influence of Social Media on Conspiracist Beliefs

The term “infodemic,” coined by David Rothkopf in 2003 after the original SARS outbreak, has made a comeback during the current pandemic, including use by the World Health

Organization (WHO). Since then, many people have found themselves interacting with media online related to COVID-19 vaccine information, especially during times of isolation due to the pandemic. Conspiracy theories, or beliefs that a covert organization is responsible for a particular phenomenon, thrive in online spaces, where like-minded people can easily access each other. Preceding the COVID-19 pandemic, 40% of posts containing information on common diseases such as diabetes, cancer, and HIV/AIDS contained false information (Waszak et al., 2018). Additionally, these posts were shared hundreds of thousands of times across various social media platforms, which only broadened their reach. Since 2020, social media use in general has increased in widespread use with 8% more use in 2024 than in the past year alone (Datareportal, 2024). This significant increase is likely due to increased reliance on social media for interpersonal connection during the pandemic on top of the increased prevalence due to evolving access to technologies.

In two other studies using online surveys of Romanian and British individuals, respectively, Allington et al. (2020) and Buturoui et al. (2021) found that people who obtain information about the COVID-19 disease on social media are more likely to believe conspiracy theories in posts. These users are also more likely to share misinformation with others on social media platforms (Ahmed & Rasul, 2022). Not only do they show higher rates of addictive social media use, but these users are also less likely to follow public health recommendations (Islam et al., 2020; Nicholls & Yitbarek, 2022). These relationships are compounded by the fact that individuals are more likely to interact with content that reflects their ideals on social media, creating an echo chamber effect where their content is curated to match their beliefs (Puri et al., 2020). This effect can be seen on platforms like TikTok, where the more users interact with a certain type of content, the more their page will present them with similar content.

In their 2023 study, Theocharis et al. investigated the impact of belief in conspiracy theories across different platforms in 17 European countries. Unlike other studies examining the impact of social media as a whole, this study focused on Messenger, WhatsApp, Youtube, Twitter, and Facebook. They examined the difference between interpersonal messaging applications such as Facebook and Twitter, where individuals are more likely to be exposed to other individuals' beliefs. This study also claimed that YouTube is a unique social media platform in its audio-visual delivery of content and the division into specific communities that occurs when influencers develop online communities of people through their YouTube channels. The results of this study indicate that Twitter reduced conspiracist beliefs by 4%, whereas Facebook and the other platforms studied increased conspiracist beliefs by around 4% across all countries studied. This finding might suggest that the greater moderation of COVID-19 conspiracy on Twitter is significant compared to the lesser content moderation on Facebook. It is important to note that in 2023, Twitter was bought out by Elon Musk and became X, a platform that now lacks moderation, so the effects of what is essentially a new social media remain to be seen in past studies. Additionally, it is important to note that Facebook was the most frequently used social media source in every country studied compared to the other four. Perhaps not all social media platforms are created equal when considering the dissemination of conspiracist beliefs related to the COVID-19 vaccine.

Furthermore, there are specific strategies through which misinformation is rapidly disseminated on social media platforms, such as writing style. A common tone employed in posts containing misinformation is similar to that of mainstream news media or scientific findings, which leads more people to believe these posts without checking for accuracy. For example, using medical jargon, quoting public figures, and using statistics makes a post seem more

credible to mainstream audiences. Additionally, proper capitalization of the first word of each sentence and all words in headings add to this effect. Posts containing conspiracy content on Facebook between September 2019 and August 2021 with these qualities positively predicted more likes (Ngai et al., 2022). These posts containing fabricated information are 70% more likely to be retweeted, due to their unconventional messages (Thorakkattil et al., 2022). Vosoughi et al. (2018) estimate that this effect is due to the human interest in the novelty of these ideas as they are presented on social media compared to factual news. The virality of these posts only makes them more accessible to the public, especially considering the broad use of social media and technology in America, today.

Social Media Literacy & Conspiracist Beliefs

Not all content on social media is easily interpreted by every consumer. Certain posts dealing with complicated subjects or unfamiliar language might confuse social media users. Alternatively, some users might take the information shared in a post at face value despite inaccurate statements or false information. This is where the concept of media literacy becomes crucial for the examination of social media behaviors. Media literacy is the concept that it is important to think critically about the production and content of media messages (Arke, 2023). This has been adapted to pertain more to digital platforms such as Facebook and Twitter/X and is commonly referred to as social media literacy. In the context of COVID-19, those who have greater social media literacy or critical thinking were found to have fewer conspiracy beliefs regarding the vaccine (Scandurra et al., 2022). Therefore, social media literacy is crucial for people to decipher credible information, and what needs to be confirmed by searching other, verifiable sources.

An interesting finding by Borah et al. (2022) is that the impact of media literacy on conspiracist thinking could be contingent on political orientation; liberals with higher levels of media literacy showed lower levels of conspiratorial thinking, whereas conservative people showed more conspiracist beliefs despite self-reported media literacy, according to a cross-sectional survey of adults in the U.S. Individuals with lower levels of education also tended to have lower analytical thinking skills, as well as greater distrust in institutions, which lead to lower media literacy (Scandurra et al., 2022). This is particularly relevant to the conspiracy information circulating social media pertaining to the COVID-19 vaccine.

The Influence of Conspiracist Beliefs on Vaccine Uptake

Conspiracy beliefs have long preceded the COVID-19 virus. People who are male, who perceive themselves as having lower social standing than others, and who are part of an ethnic minority group tend to exhibit more conspiratorial beliefs in general. These individuals also show less reliance on personal social networks such as family and friends for support (Freeman & Bentall, 2016; Douglas et al., 2019), which could explain the current links between frequent social media use and conspiracy of COVID-19 vaccination.

As more recent studies have shown, conspiracy theories have a detrimental impact on COVID-19 vaccine uptake (Abu-Odah et al., 2022; Scandurra et al., 2022; Fadhel, 2023). In their qualitative study of Palestinian citizens and policy makers, Abu-Odah et al. (2022) found that many individuals were operating with misinformation about the COVID-19 vaccines. During interviews, Palestinian individuals voiced concerns such as “I heard that this vaccine is connected with an electronic chip and will inject it into our bodies to monitor us in the future” and “I think the quality of vaccines supplied to the Palestinian Authority is not good... many of these vaccines are about to be expired” (54). Additionally, political conflicts have permeated the

vaccine discussion in Palestine, where some individuals were concerned about the quality of vaccines to be received from Israel in a proposed 2021 “vaccine swap.” As can be seen in the United States, political conflicts and conspiracy beliefs are closely related.

A survey of 1050 adults from the United States in March 2020 and again in July 2020 showed that at the beginning of the lockdown and in the months following, conspiracy theories about the virus itself and the vaccine were consistently present. Of the participants in the first survey and a follow-up study, 67.4% endorsed getting information related to the pandemic from social media platforms. Between the first and second questionnaires, the rate of vaccine hesitancy increased by 11.3%, in line with the influx of conspiracy theories circulating on social networks (Romer & Jamieson, 2020).

Similarly, a Canadian analysis of the content of social media posts by Tang et al. (2022) found that many Facebook and Twitter posts described a concern about being “microchipped” by Bill Gates or having their DNA altered by the COVID-19 vaccine. Others in a Lebanese study of 1052 randomly sampled participants endorsed theories that the virus itself was made in a laboratory, that it is a tool by the pharmaceutical industry to sell vaccines, or that the virus was created as a means to control the population. Of these participants, 33% were uncertain about their vaccine intentions, and 14.7% had no intention to vaccinate (Ghaddar et al., 2022).

The belief that the virus is a hoax contributed to significantly fewer COVID containment behaviors at the beginning of the pandemic, such as hand washing and social distancing as discovered in a 2020 online survey of individuals from the U.S. and the U.K. (Imhoff & Lambrey, 2020). With this extreme belief before the availability of vaccines, especially for those who already have low trust in government experts and pharmacological advancements. It is not

difficult to imagine the potential impacts of statements such as these on individuals' plans to get vaccinated, as Freeman et al. (2022) found in their study of 2501 English adults.

Trust in Experts & Vaccine Uptake

One of the greatest contributing factors to vaccine uptake is trust in government, according to a cross-national study including 120,000 participants conducted by Jennings et al. (2022), representing 90% of the world population. In 75 of the 105 countries involved in the survey, there was a positive relationship between willingness to be vaccinated and trust in government. For participants in France, Germany, Spain, Croatia, Argentina, Brazil, and India, trust in health institutions along with trust in government had a significant effect on vaccine intentions. This relationship was also found in other studies surveying vaccine uptake including those by Jennings et al. (2021), Carrieri et al. (2023), and Mousoulidou et al. (2023) where individuals who endorsed trust in science showed lower rates of vaccine hesitancy. Conversely, individuals who endorsed low trust in government and the vaccine approval process showed higher rates of conspiratorial thinking regarding the COVID-19 vaccine.

In terms of social media, a study of South African adults found that those who simply used social media as a source of information did not have riskier behaviors (e.g., social distancing, hand washing, mask wearing); however, those who trusted social media *more* than scientists and experts tended to show less uptake of the vaccine, despite the availability in their country (Nicholls & Yitbarek, 2022). These results would suggest that the sources that individuals trust determine much of decision-making about the COVID-19 vaccine.

Trust & Conspiracist Beliefs

Conspiracist worldviews in general have been found to be related to a refusal to trust experts and scientists (Imhoff & Lamberty, 2020). Conspiracy stems from attributing cause to a covert organization rather than the cause validated by the government. In the case of the COVID-19 vaccine, those who do not plan to receive it could be placing feelings of fear into conspiracy rather than trusting the scientists who developed the vaccine. In a landmark study of correlates of conspiracist thinking, Goertzel (1994) found that low levels of interpersonal trust and high levels of anomie, or a lack of moral connection to societal systems, are the greatest correlates of conspiracist thinking. The resulting feelings of fear and powerlessness can contribute to conspiracy theories as a means of coping with the harsher realities of the world.

Many popular conspiracy theories about the COVID-19 vaccine stem from misinformation about the government's approval process or its underlying scientific basis. Freeman et al. (2020) found that in their survey of 2,501 English adults, 50% of participants showed some level of conspiracy beliefs about the vaccine, endorsing statements such as "I don't trust the information about the virus from scientific experts." and "The coronavirus is bait to scare the whole globe into accepting a vaccine that will introduce the 'real' deadly virus." Extreme beliefs such as these contribute to vaccine hesitancy across the world. Blackburn et al. (2023) found that in their study, individuals with higher trust in government and science had significantly fewer hesitations about receiving the vaccine. These studies all show that increased trust in validated sources of information works to increase vaccine uptake.

The Influence of Political Conservatism on Conspiracy & Vaccine Uptake

Another indicator of conspiracy beliefs across social media is political conservatism. According to an online survey of 840 Americans, consuming conservative media was positively associated with conspiracy beliefs in general and about the COVID-19 vaccine (Lobato et al., 2020; Romer & Jamieson, 2021). These studies also found that conservative individuals showed less intent to receive the vaccine. Considering that conservative ideals place more emphasis on individual freedoms and less government interference, it is reasonable to assume that politically conservative people may subscribe to more conspiracy beliefs than politically moderate or liberal individuals. However, according to a study by Enders et al. (2022), conservative individuals believed most in the conspiracy that the COVID-19 threat had been exaggerated, whereas liberal individuals endorsed conspiracy theories about Trump to the same degree. This study suggests that while people with conservative ideals are more likely to have conspiracist beliefs about the COVID-19 pandemic, this is not necessarily the case for all conspiracy theories.

Especially at the beginning of the pandemic when President Trump was active on social media sites such as Twitter/X, politically conservative individuals were far more likely to consume conservative media, which was found to increase concern about vaccination among Trump voters (Hornsey et al., 2020). This effect might not only be related to the spread of conservative media but also because Donald Trump amassed a large social media following, including 87.4 million followers on Twitter/X as of February 2024. In 2014, before Trump became president, he Tweeted “Healthy young child goes to doctor, gets pumped with massive shot of many vaccines, doesn’t feel good and changes- AUTISM. Many such cases!” (@realDonaldTrump, 2014). Tweets such as this only exacerbate conspiracy beliefs in individuals who support Trump.

In terms of conservatism's direct impact on conspiracy, Stecula & Pickup (2021) explored populism, or the political ideology that separates ordinary people from the elite, as a correlate of conspiracist thinking. This relationship was examined due to populism's inherent similarities with conspiracy. The study found that not only is conservative news media more likely to disseminate conspiracist beliefs, but this effect is greater in those with populist attitudes. Due to the fact that populist ideals appeal to the everyday citizen as opposed to those who are more privileged, it is logical that these conservative individuals would have less trust in the government to take care of their needs, as will be discussed in the next section.

Political Conservatism and Trust

Another aspect of political conservatism and vaccine uptake is trust. According to surveys from the Pew Research Center Republicans' trust in scientists has dropped 20% between 2019 and 2023 (Pew Research Center, 2023). In the most recent survey of US adults, 38% of respondents who identify as Republican have little to no trust in scientists. This is contrasted by the responses of Democrats; while these individuals' trust in scientists also decreased between 2019 and 2023, this was only by 4%. Non-republican individuals showed far less change in trust compared to conservative individuals. This effect has been steadily increasing over time as can be observed in earlier studies by McCright et al. (2013). and Campbell & Kay (2014). These two studies examined potential motivations for conservatives' lack of trust in the scientific community; they found that this relationship is likely due to the economic impacts of certain scientific findings such as the need to limit interpersonal contact. In the case of the COVID-19 pandemic, the epidemiological findings that led to the closure of many businesses and schools were hypothesized to be a reason for the decrease in trust in science by Kerr et al. (2021). In other words, the implications of scientific discovery regarding the pandemic could be why many

politically conservative individuals have endorsed less trust in science from the outset of the pandemic.

The Effect of Celebrity Admiration on Vaccine Uptake

Some of the most popular accounts on social media belong to influencers and celebrities. Because of this, celebrity admiration, or trust in celebrities, may be a contributing factor to vaccine uptake. Berman et al. (2019) investigated the impact of celebrity vaccine attitudes on individuals' vaccine attitudes through an online survey of participants 18 years of age or older. They found a significant positive association between anti-vaccine attitudes in celebrities and anti-vaccine attitudes in those who follow them on social media. During the pandemic, a new concept has gained popularity; Medical experts who become internet celebrities are crucial for sharing accurate information with users of social media, especially since many users trust their advice and opinions. Of these internet medical professionals, consumers will trust those whom they perceive to be "down to earth," and professional, with high-quality information (Wei et al., 2022). These findings highlight the importance of positively reinforcing vaccine information from experts in mainstream media.

Research Gaps

Though past research has investigated many of the issues described in this review, most studies were conducted earlier in the pandemic, before vaccines rolled out, or within the year after. What is less clear is if the COVID-19 vaccine has a different outlook in 2024. The prior research did not take into account the new recommendations for the 2023-2024 Moderna vaccine, because it did not yet exist; and in a world four years post-lockdown, it is important to

recognize that public opinion might have changed and the factors influencing vaccine uptake may have shifted, especially the specific conspiracies regarding the vaccine.

Additionally, social media use and prevalence have only increased since the pandemic began, so it is important to revisit some of the impacts of using these platforms for information gathering about current vaccine opinions and risks.

Research Questions & Current Study

The current study aimed to discover how conspiracist thinking, trust, political conservatism, and social media use impact vaccine uptake.

RQ1: What is the relationship between social media use and individuals' COVID-19 conspiracist beliefs and vaccine uptake?

RQ2: How does this relationship interact with political conservatism and trust in experts?

The current study also proposed a new model for social media interaction with conspiracist thinking, political conservatism, trust, and vaccine uptake in which social media is a moderator for the other, preexisting relationships.

H1: Conspiracy and Vaccine Uptake

1A: Conspiracist thinking would decrease vaccine uptake, moderated by social media.

1B: Participants aged 20-30 would demonstrate higher levels of conspiracist thinking than those aged 50-60.

1C: Participants who endorse higher social media literacy would demonstrate lower levels of conspiracist thinking.

H2: Political Conservatism, Social Media, and Vaccine Uptake

2A: Political conservatism would decrease vaccine uptake, moderated by social media

2B: Politically conservative individuals would demonstrate higher levels of conspiracy.

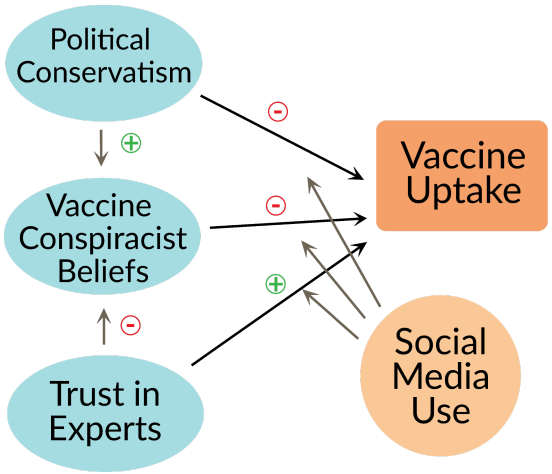
H3: Trust in Experts, Social Media, and Vaccine Uptake

3A: Low trust in experts would decrease vaccine uptake, moderated by social media.

3B: Individuals who demonstrate low trust in experts would show higher levels of conspiracy.

3C: High trust in celebrity figures (e.g. social media influencers) would decrease vaccine uptake.

Social media was hypothesized to be a moderator to each of the relationships above, not causing them but instead augmenting them. That is to say, these relationships would likely exist without social media, but they are amplified by the accessibility and prevalence of this technology. See a depiction of the study model below.



Method

Participants

Participants were recruited using Prime Panel, an online crowd sourcing platform through Cloud Research to recruit individuals to complete surveys. Prime panel allows researchers to filter for various characteristics of a sample and offers compensation to those who take the survey. Some participants were excluded for failing to meet the survey and study criteria. Participants received financial compensation for completing the study that depended on the platform used to access the survey. Ultimately, 810 participants' responses were included; 382 participants' responses were recorded in the 20-30 year old group and 418 participants' responses were recorded in the 50-60 year old group.

We determined our target sample size by conducting an *a priori* power analysis using G*Power version 3.1.9.7 (Faul et al., 2007) to determine the required sample size needed to test our first aim. The required sample size to achieve 80% power for detecting a small effect in a bivariate correlation ($r = .10$) with two tails and an error probability of $\alpha = .05$ was $N = 800$. Study inclusion criteria were being either 20-30 years old or 50-60 years old and fluent in English.

Procedures

The current study was approved by the Institutional Review Board at Trinity College. After the completion of a consent form at the beginning of the survey, participants were sorted into either the 20-30 year old age group or the 50-60 year old age group. Data collection occurred between March 6, 2024, and March 8, 2024, after which the survey was closed.

Measures

Informed consent was obtained before participants began the survey which included the purpose, procedure, compensation, duration of the study, and the associated risks and benefits. The informed consent section also detailed that participation is voluntary, and that participants were free to stop taking the survey at any time. Confidentiality was outlined as well as the contact information for the Principal Investigators in the event of any questions or concerns. Participants consented to participation by selecting "Yes" or "No" when prompted at the end of the consent form. If "No" was selected, the participant would be brought to a thank you page at the end of the survey. If "Yes" was selected, then participants were presented with the questionnaire (See Appendix A).

Demographic characteristics were also collected at the beginning of the survey following informed consent asking participants' age (years), gender (male, female, non-binary, transgender, other, prefer not to say), race (American Indian/Alaskan Native, Asian or Asian American, Black or African American, Caucasian (white), Middle Eastern, Native Hawaiian or Pacific Islander, other, prefer not to say), ethnicity (Hispanic/Latino or Not Hispanic/Latino), geographical location (U.S. state), relationship status, political orientation (very liberal, liberal, moderate, conservative, very conservative), religious orientation (Agnostic, Atheist, Buddhist, Christian, Hindu, Jewish, Muslim, other, not religious), annual household income (less than $35,000, $35,000-$75,000, $75,000-$150,000, more than $150,000), and educational attainment (less than high school, high school diploma or equivalent, some college and no degree, Associate's degree, Bachelor's degree, more than Bachelor's degree) (See Table 1 and Appendix B).

COVID-19 vaccination status was measured with a series of questions assessing how many vaccines participants had already received at the time of taking the questionnaire and their

reasons for doing so and intentions to receive the most current vaccine. We also assessed the participants' partner's vaccination status, whether they tested positive for COVID-19 and how severe their infection was. We used these questions to create a dichotomous measure of COVID-19 vaccination that reflected whether participants were fully vaccinated (i.e., if they had received the initial COVID-19 vaccination and at least one booster) (See Appendix C).

Social Media Usage

Frequency of social media use was measured using an adapted version of the **Social Networking Activity Intensity Scale by Li et al. (2016)**. This scale asked participants how often they used social media (Facebook, Instagram, Snapchat, TikTok, Twitter/(X), Reddit, YouTube) in the past week with the following five-point scale: 0 (never), 1 (1-2 days), 2 (3-4 days), 3 (5-6 days), and 4 (everyday). We calculated a composite variable representing the overall frequency of social media use by averaging participants' responses to these seven items ($\alpha = .66$).

Next, participants rated how many hours per day they spend performing specific actions on social media, such as "Commented on friends' status, logs, and photos" and "Shared/Reposted content" on a five-point scale with the following options: (0-1), (2-3), (4-5), (6-7), (8-9), (10+). We calculated a composite variable representing the frequency of social media activity by averaging participants' responses to these ten items ($\alpha = .91$) (See Appendix D).

Social media literacy was measured using an abridged version of the **Social Media Information Literacy scale by Heiss et al. (2023)** which asked participants to rate their ability to perform actions such as "Critically reviewing post content for accuracy" or "Understanding

complex content that people post on my network" on a scale from 1 (easy) to 7 (difficult). We calculated a composite measure of social media literacy by averaging participants' responses to the ten scale items (α = .94) (See Appendix E).

Vaccine Conspiracy Beliefs

Vaccine conspiracy beliefs were measured using the **Vaccine Conspiracy Beliefs Questions Scale by Shapiro et al. (2016)** which asked participants to rate how much they agree with statements such as "Vaccine safety data is often fabricated" and "The government is trying to cover up the link between vaccines and autism" using a scale from 1 (very strongly disagree) to 7 (very strongly agree). We added the following three questions to the preexisting scale to account for covid-specific beliefs: "The existence of the Covid-19 virus is fabricated by the government," "COVID-19 vaccine safety data is often fabricated," and "COVID-19 vaccine efficacy data is often fabricated," all of which were rated on the same seven-point scale. We averaged these 10 items to create a composite measure of vaccine conspiracy beliefs (α = .96) (See Appendix F).

Trust in various sources of information was tested using a **Trust Scale** composed of original questions developed for this study. This scale asks how much trust participants have in specific sources of information regarding the COVID-19 vaccine, such as: Public Health Institutions (e.g., Local health department, CDC), Acquaintances (e.g., coworkers, classmates, peers), Social media personalities, (e.g., Facebook, Instagram, TikTok, Twitter/X), and Pharmaceutical companies (e.g., Pfizer, Moderna). The response choices include Not at all, Very little, Somewhat, A great deal, Completely, or I do not get information from here. We calculated two-item composite measures that represented trust in expert sources (i.e., my doctor and public

health institutions; $\alpha = .62$) and trust in social media sources (i.e., social media personalities and social media news; $\alpha = .75$) (See Appendix G).

Data Analysis

We conducted our analyses using SPSS software (Version 29.0, IBM, Armonk, NY, USA). We tested Hypothesis 1A by conducting a logistic regression to test whether vaccine conspiracy beliefs were associated with COVID-19 vaccine uptake and whether there was an interaction of vaccine conspiracy beliefs and frequency of social media use on COVID-19 vaccine uptake. We tested Aim 1B by using an independent samples t-test to examine whether emerging adults and middle-aged adults differed in their endorsement of vaccine conspiracy beliefs. We tested Aim 1c by using a bivariate correlation to test the association of social media literacy and vaccine conspiracy beliefs.

We tested Hypothesis 2A by using a logistic regression to test whether political orientation was associated with COVID-19 vaccine uptake and whether there was an interaction of political orientation and frequency of social media use on COVID-19 vaccine uptake. We tested Aim 2b by using a bivariate correlation to test the association of political orientation and vaccine conspiracy beliefs.

We tested Hypothesis 3A by using a logistic regression to test whether trust in expert sources or trust in social media sources was associated with COVID-19 vaccine uptake. We tested Hypothesis 3B by using a bivariate correlation to test the associations of trust in expert sources, trust in social media sources, and vaccine conspiracy beliefs.

Results

Descriptive Statistics

We used independent samples t-tests to examine whether emerging adults and middle-aged adults differed in how frequently they used specific social media platforms. Middle-aged adults reported more frequent use of Facebook, $t(808) = -6.25$, $p < .001$, whereas emerging adults reported more frequent use of Instagram, $t(808) = 9.60$, $p < .001$, Snapchat, $t(808)=14.08$, $p<.001$, TikTok, $t(808)=12.34$, Twitter/X, $t(808)=7.28$, $p<.001$, Reddit, $t(808)=9.12$, $p<.001$, and YouTube, $t(808)=6.21$, $p<.001$.

H1A: Social Media, Conspiracy Beliefs, and COVID-19 Vaccine Uptake

We used a logistic regression to test whether vaccine conspiracy beliefs were associated with COVID-19 vaccine uptake (vaccinated and boosted vs other). Consistent with Hypothesis 1A, we observed a statistically significant effect of vaccine conspiracy beliefs on COVID-19 vaccine uptake, OR = 0.96, 95CI = 0.95, 0.96, $p < .001$.

We used a logistic regression to test whether there was an interaction of vaccine conspiracy beliefs and frequency of social media use on COVID-19 vaccine uptake (vaccinated and boosted vs other). We observed an interaction of vaccine conspiracy beliefs and frequency of social media use on COVID-19 vaccine uptake ($p \leq .005$). Vaccine conspiracy beliefs were more strongly associated with COVID-19 vaccine status among people with low social media use frequency ($b = -.05$, $SE = .01$, $p \leq .001$) than among people with high social media use frequency ($b = -.03$, $SE = .01$, $p \leq .001$).

Next, we conducted separate logistic regressions to test whether the frequency of using each type of social media platform (Facebook, Instagram, Snapchat, TikTok, Twitter/X, Reddit,

and YouTube) was associated with COVID-19 vaccine status. We found that individuals who reported more frequent use of Snapchat, *OR* = 0.83, *95CI* = 0.75, 0.91, $p \leq .001$, and TikTok, *OR* = 0.90, *95CI* = 0.83, 0.98, $p = .018$, were less likely to be vaccinated against COVID-19. Frequency of using Facebook, Instagram, Twitter/X, Reddit, and YouTube was not associated with COVID-19 vaccine uptake.

We conducted bivariate correlations to test whether the frequency of using each type of social media platform (Facebook, Instagram, Snapchat, TikTok, Twitter/X, Reddit, and YouTube) was associated with vaccine conspiracy beliefs. We found that endorsement of vaccine conspiracy beliefs was negatively associated with frequency of using Reddit, r = -.08, p = .026. We also observed marginally significant positive associations of vaccine conspiracy beliefs with frequency of using TikTok, r = .07, p = .057, and Snapchat, r = .06, $p = .076$. Frequency of using Facebook, Instagram, Twitter/X, and YouTube was not associated with vaccine conspiracy beliefs.

H1B: Conspiracy Beliefs and Age Cohort

We used an independent samples t-test to examine whether emerging adults and middle-aged adults differed in their endorsement of vaccine conspiracy beliefs. Contrary to Hypothesis 1B, emerging adults (M = 38.4, SD = 15.3) and middle-aged adults (M = 37.6, SD = 19.0) did not differ in their vaccine conspiracy beliefs, t(808) = 0.67, p = .50.

H1C: Social Media Literacy and Conspiracy Beliefs

We used a bivariate correlation to test the association of social media literacy and vaccine conspiracy beliefs. Contrary to Hypothesis 1C, social media literacy and vaccine conspiracy beliefs were positively correlated, $r = .10$, $p = .004$.

H2A: COVID-19 Vaccine Uptake and Political Conservatism

We used a logistic regression to test whether political conservatism was associated with COVID-19 vaccine uptake (vaccinated and boosted vs other). Consistent with Hypothesis 2A, we observed that greater conservatism was associated with lower COVID-19 vaccine uptake, OR = 0.68, 95CI = 0.59, 0.78, $p \leq .001$.

We observed an interaction of political orientation x social media use frequency on COVID-19 vaccine uptake ($p = .039$). But contrary to Hypothesis 2A, we found that conservatism was more strongly associated with COVID-19 vaccine status among people with low social media use frequency ($b = -.70$, $SE = .10$, $p \leq .001$) than among people with high social media use frequency ($b = -.43$, $SE = .11$, $p \leq .001$).

H2B: Conspiracy Beliefs and Political Orientation

We used a bivariate correlation to test the association of political orientation and vaccine conspiracy beliefs. Consistent with Hypothesis 2B, vaccine conspiracy beliefs and political conservatism were positively correlated, $r = .37$, $p \leq .001$.

H3A: COVID-19 Vaccine Uptake and Trust

We used a logistic regression to test whether trust in expert sources or trust in social media sources was associated with COVID-19 vaccine uptake (vaccinated and boosted vs other). Consistent with Hypothesis 3A, we observed that greater trust in expert sources was associated with higher COVID-19 vaccine uptake, OR = 1.82, 95CI = 1.51, 2.21, $p \leq .001$. However, trust in social media sources was not associated with COVID-19 vaccine uptake, OR = 0.90, 95CI = 0.77, 1.04, $p = .16$.

Next, we used the PROCESS macro for SPSS to test whether there was an interaction of trust in experts x frequency of TikTok and Snapchat use predicting COVID-19 vaccine uptake. We found a significant interaction of trust in experts x TikTok and Snapchat use frequency ($p = .027$). Next, we examined the conditional effects of trust in experts on COVID-19 vaccine uptake in people with low (-1 SD), average (M), and high (+1 SD) levels of TikTok and Snapchat use. There was a stronger association of trust in experts and COVID-19 vaccine uptake in people with low use ($b = 0.84$, $SE = 0.13$, $p < .001$) and average use ($b = 0.75$, $SE = 0.11$, $p < .001$) than for people with high use ($b = 0.40$, $SE = .15$, $p = .007$).

H3B: Vaccine Conspiracy Beliefs and Trust

We used a bivariate correlation to test the associations of trust in expert sources, trust in social media sources, and vaccine conspiracy beliefs. Consistent with Hypothesis 3B, vaccine conspiracy beliefs were negatively correlated with trust in expert sources, $r = -.39$, $p \leq .001$, and positively correlated with trust in social media sources, $r = .14$, $p \leq .001$.

Next, we used the PROCESS macro for SPSS to test whether there was an interaction of trust in experts x frequency of TikTok and Snapchat use predicting vaccine conspiracy beliefs. We found a significant interaction of trust in experts x TikTok and Snapchat use frequency on vaccine conspiracy beliefs ($p = .010$). Next, we examined the conditional effects of trust in experts on vaccine conspiracy beliefs in people with low (-1 SD), average (M), and high (+1 SD) levels of TikTok and Snapchat use. There was a stronger association of trust in experts and vaccine conspiracy beliefs in people with low use ($b = -9.81$, $SE = 0.91$, $p \leq .001$) and average use ($b = -9.07$, $SE = 0.76$, $p < .001$) than for people with high use ($b = -6.12$, $SE = 1.11$, $p \leq .001$).

Discussion

As previously mentioned, this study found that individuals with COVID-19 conspiracy beliefs (H1A) and politically conservative individuals (H2A), respectively, were less likely to be vaccinated. Politically conservative individuals were also more likely to have COVID-19 conspiracy beliefs (H2B). Greater trust in expert sources was positively correlated with COVID-19 vaccine uptake, whereas trust in social media sources was not correlated with vaccine uptake. Additionally, those who endorsed TikTok and Snapchat use had lower levels of trust in experts. There was also a stronger association between trust in experts and COVID-19 vaccine uptake in individuals with lower TikTok and Snapchat use (H3A). Finally, there was a significant negative correlation between trust in expert sources and COVID-19 vaccine conspiracy beliefs. This relationship was stronger in those who had low TikTok and Snapchat use (H3B).

Past research supports the findings for hypothesis 1A regarding conspiracy beliefs negatively predicting vaccine uptake (Sallam et al., 2021; Abu-Odah et al., 2022; Scandurra et al., 2022; Fadhel, 2023). This is a sensible finding when considering that conspiracy theories about the COVID-19 vaccine tend to pertain to its safety, efficacy, and effectiveness. Interestingly, our finding that this relationship is stronger among individuals with low social media use contradicts past findings. A former survey based study similar to the current one found that social media moderated the relationship between emotion regulation and COVID-19 vaccine conspiracy beliefs in the study by Scandurra et al. (2021). Ahmed & Rasul (2022) found that individuals who use social media more are more likely to believe the conspiracy theories they encounter on these platforms. Perhaps the difference in results in the current study is due to the changing landscape of social media platforms such as Twitter and TikTok as well as the changes to COVID-19 vaccine and pandemic protocols in general. That is to say, the behaviors observed

two years ago may greatly contrast the current behaviors on social media, since there is more factual information widely available which has been circulating for a longer period of time, making it more believable to some. Additionally, after four years, some of the fear factor of conspiracy theories posted to social media platforms might not be as relevant to the general public.

In an additional analysis examining the use of different social media platforms on conspiracist beliefs and vaccine uptake, respectively revealed a novel finding regarding the moderating impact of social media on the relationship between conspiracy and vaccine uptake. While overall use of social media platforms had no significant effect, TikTok and Snapchat use in particular proved to have an effect on these relationships. Individuals with any TikTok and Snapchat use endorsed significantly more conspiracy beliefs, whereas individuals with no TikTok and Snapchat use had significantly less conspiracy beliefs (See Figure 1). Conversely, any TikTok and Snapchat use was associated with lower COVID-19 vaccine uptake, whereas not using TikTok and Snapchat at all was associated with greater vaccine uptake (See Figure 2). These findings are likely due to the exposure to short form content and conspiracy beliefs on these platforms in particular, with a lack of moderation. Where Facebook and Instagram do utilize moderation on their platforms both operating under the “Meta” umbrella.

Interestingly, Reddit use negatively predicted COVID-19 vaccine conspiracy beliefs, which might speak to its forum based format and lack of moderation. This result is not in line with what the lack of moderation on reddit might suggest. However, as many reddit users have posted, the content of Reddit seems to be more liberal than it is conservative, especially with epidemiological issues.

Furthermore, past studies support the findings for hypothesis 2A regarding political conservatism negatively predicting vaccine uptake. Romer & Jamieson (2021) found this relationship to be true in their study of factors that lead to COVID-19 vaccine opposition. However, once again, contrary to past findings, the moderating effect of social media on this relationship is in the opposite direction of former studies such as that by Hornsey et al. (2020) where this relationship is stronger in individuals who use social media less. Similarly to the former postulation, this result may be due to a difference in the impact of social media at the current stage of the pandemic. It is also important to remember that in March of 2020, the president of the United States was Donald Trump, who has been known to use social media to share his ideals about the pandemic and vaccination. Perhaps since he left office in 2021, the impact and frequency of his statements has lessened with the changing dynamics of the pandemic and social media platforms.

The findings of the current study regarding hypothesis 2B were also supported by Motta et al. (2020) and Stecula & Pickup (2021), suggesting that politically conservative individuals endorse greater conspiracy beliefs about the pandemic. This could be due to an echo chamber type effect on right wing media platforms, as suggested by Motta et al. (2020). However, Enders et al. (2022) found that conservative conspiracy beliefs pertain to vaccines over other topics, likely due to concerns about individual freedoms and government control. More information on reliable sources and media literacy is necessary to prevent COVID-19 conspiracy beliefs moving forward.

Hypotheses 3A and 3B regarding the relationships between trust in experts and COVID-19 vaccine uptake and COVID-19 conspiracy beliefs, respectively were both supported by past research by Imhoff & Lamberty (2020), Jennings et al. (2021), Carrieri et al. (2023), and

Mousoulidou et al. (2023). However, the moderating effect of TikTok and Snapchat use in particular has yet to be examined by other studies. In both of these relationships, the effects of TikTok and Snapchat use change the effect size of vaccine uptake and conspiracist beliefs about the COVID-19 vaccine (See Figure 3 and Figure 4). As previously mentioned, this may be attributed to the abundance of short form content on these platforms in particular, as well as the lack of moderation allowing individuals to make videos claiming facts about the pandemic without fact checking.

Surprisingly, contrary to hypothesis 1B, vaccine conspiracy beliefs did not differ from the 20-30 year old age group and the 50-60 year old age group. This result suggests that exposure to conspiracist beliefs is not solely limited to social media platforms such as TikTok and Snapchat, where the majority of users belong to the 20-30 year old cohort of our study. Perhaps individuals also receive conspiracy about the COVID-19 vaccine from other places such as news networks and word of mouth through loved ones.

Another interesting finding that contradicted hypothesis 3C was that conspiracist beliefs were positively correlated with social media literacy. This result was unexpected, but it is likely due to the self report style of the questions regarding social media literacy. Individuals with higher conspiracy beliefs likely believe that they are capable of comprehending the content of social media posts even if they objectively are not as skilled at these interactions.

Limitations and Future Directions

As mentioned above, the social media literacy scale was not as effective as we had anticipated in that it measured individuals' perceived ability to interact with posts and

information on social media platforms rather than objective ability, which led to responses that were not in line with past findings.

Additionally, we attempted to use another measure of social media adapted from the Facebook Intensity Scale (Ellison et al., 2017) to examine the magnitude of specific social media platform use such as "I spend time on _____ at the expense of my obligations" or "I feel out of touch when I haven't logged onto _____ for a while." However, the scale was not effective in capturing the intensity of each of the actions for each social media, because the scale was "broken" so to speak in Qualtrics. When participants endorsed each behavior, the social media platforms did not accurately match up with the format we used. A future study might find a more effective way to measure the intensity of specific social media behaviors and platforms; this would be particularly useful in understanding what distinguishes TikTok and Snapchat from Instagram, Reddit, Youtube, and Twitter/X.

Another future study might investigate the amount of misinformation circulating on each social media platform regarding the newest COVID-19 vaccine and regulations. It is critical to understand the factors that cause TikTok and Snapchat to be significant in vaccine uptake and conspiracy beliefs where other platforms are not. The current study may be the first to discover that TikTok and Snapchat in particular contribute to the misinformation and hesitancy to receive the COVID-19 vaccine. Going forward, it will continue to be imperative that policy makers, medical professionals, and educators understand these factors which contribute to COVID-19 vaccine hesitancy to encourage individuals to protect themselves against the virus. Despite the fact that it has been four years since the beginning of the pandemic, it is still crucial to public health that people "get the shot!"

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Tables

Table 1.

Demographic characteristics of the full study sample (N = 810)

	%	*n*
Age Cohort		
20-30 years old	48.4	392
50-60 years old	51.6	418
Gender		
Female	48.9	396
Male	49.5	401
Non-binary	1.3	11
Prefer not to say	0.2	2
Race		
White	64.6	523
Black or African American	18.0	146
Asian or Asian American	4.1	33
American Indian or Alaska Native	2.1	17
Native Hawaiian or Pacific Islander	0.4	3

Middle Eastern	0.4	3
Multiple Races	5.1	41
Other Race	3.8	31
Prefer not to say	1.6	13
Ethnicity		
Hispanic or Latino	13.7	111
Not Hispanic or Latino	86.2	698
Prefer not to say	0.1	1
Relationship Status		
Married	31.2	253
In a relationship but unmarried	15.2	123
Single	41.0	332
Divorced or separated	10.4	84
Widowed	2.2	18
Parental Status		
Has children	43.2	350
Does not have children	56.8	460

Political Orientation		
Very conservative	10.1	82
Conservative	17.9	145
Moderate	45.1	365
Liberal	18.1	147
Very liberal	8.8	71
Religion		
Agnostic	6.0	49
Atheist	4.7	38
Buddhist	0.9	7
Christian	58.9	477
Hindu	0.7	6
Jewish	1.6	13
Muslim	1.4	11
Not religious	19.8	160
Other religion	6.0	49

Household Income		
Less than 35,000 USD	37.9	307
35,000-75,000 USD	32.3	262
75,000-150,000 USD	23.8	193
More than 150,000 USD	5.9	48
Vaccination Status		
Not vaccinated	29.9	242
Vaccinated but not boosted	22.2	180
Vaccinated and boosted at least once	47.9	388

Table 2.

Descriptive statistics for main study variables

	M	*SD*
Adverse childhood experiences	2.5	2.7
Childhood trauma	58.2	19.5
Vaccine conspiracy beliefs	38.0	17.3
Social media use (frequency of activities)	0.7	0.9
Social media use (frequency of use)	1.5	0.9
Social media literacy	4.7	1.4
Trust in expert sources	3.9	0.8
Trust in social media sources	2.7	1.0

Figures

Figure 1.

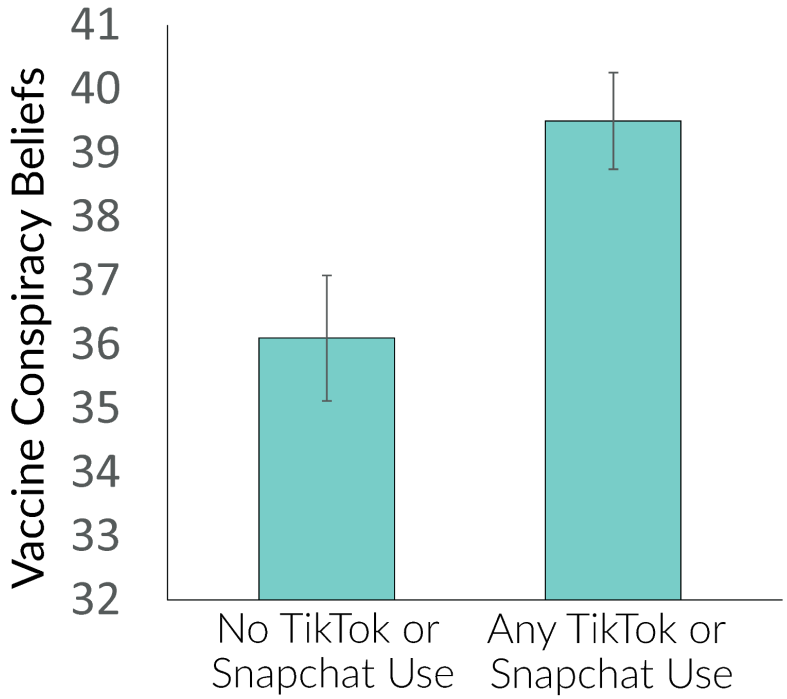


Figure 2.

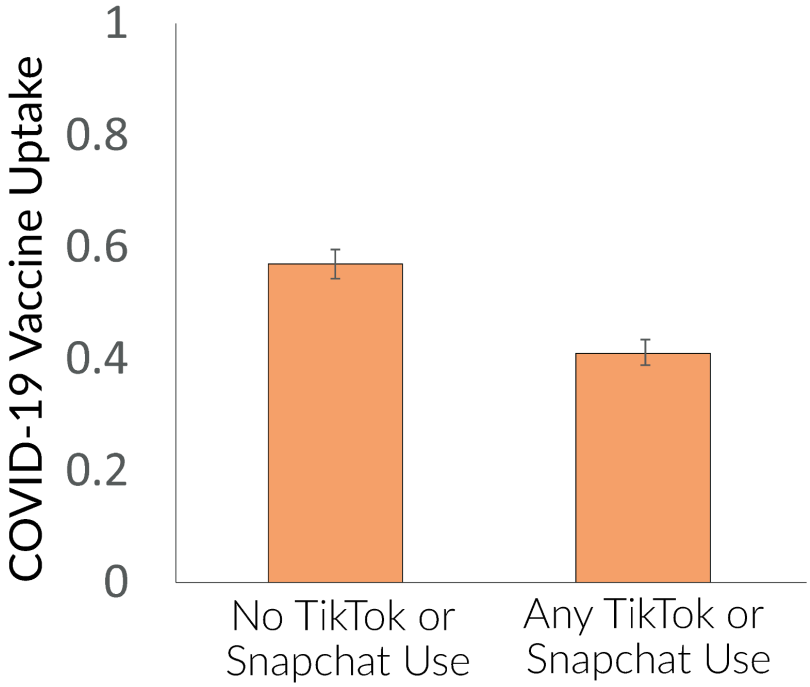


Figure 3.

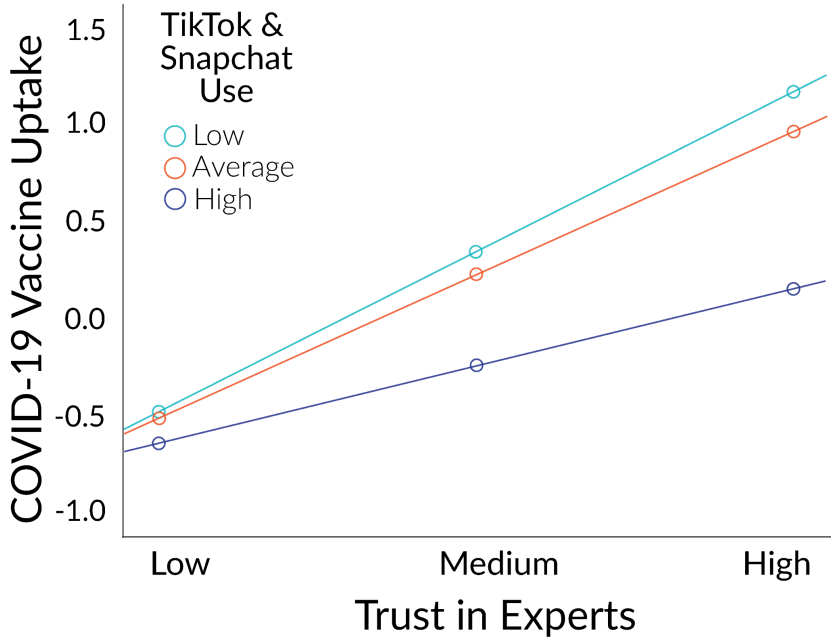
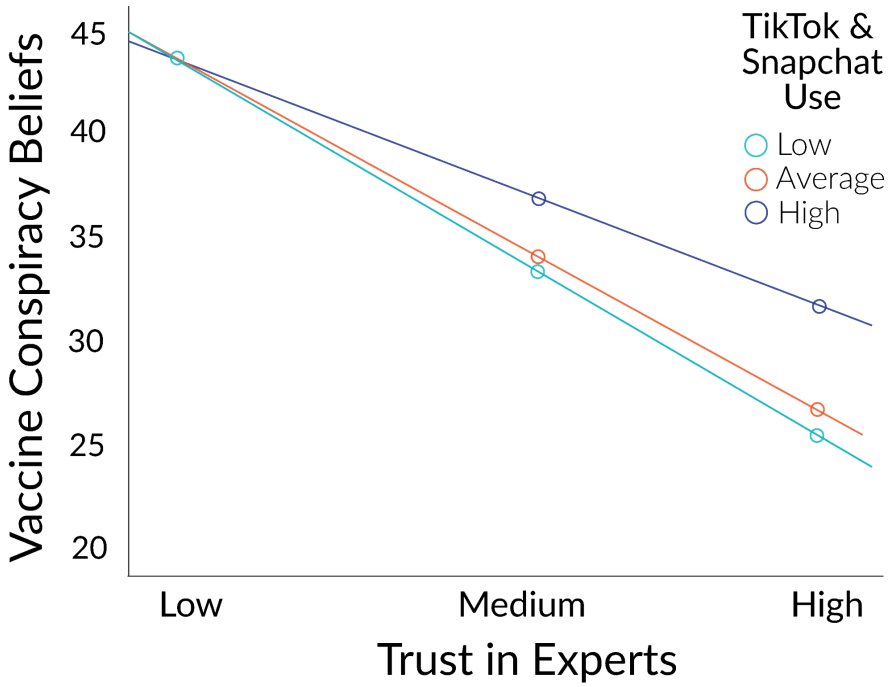


Figure 4.



Appendices

Appendix A

Informed Consent

Request to Participate in Research

We invite you to participate in a web-based survey about your Covid-19 vaccination status. Approximately 800 (400 males and 400 females) adults in the United States will take part in this study. You DO NOT need to be vaccinated to participate in this study. To complete the survey, however, you must meet the following criterion:

(1) Must be in one of the following two age ranges: 20-30 or 50-60

Purpose of this Research

This study is designed to better understand the reasons why a person may or may not be vaccinated for COVID-19.

Procedure

This study involves completing a one-time, web-based survey. It should take 20-25 minutes. You will be asked to complete a series of validated scales or model scales used by other researchers along with general demographic questions about yourself, and then some specific questions about the Covid-19 vaccine and disease status. The last section contains different questions about your attitudes and beliefs.

Risks or Discomfort

Because this survey is anonymous, the risks involved in completing it are minimal. Although we inquire about you and your family's health status there is no way for your responses to be linked back to your specific identity. Some questions may also be sensitive and or painful regarding your personal life including questions about emotional, verbal, physical, and or sexual abuse/trauma. This content may be upsetting to you, so it should be noted again that all information collected will be anonymous. If you are uncomfortable answering any of the questions, you may choose not to answer that question and move on in the survey. If you find yourself experiencing any form of distress please see provided resources below:

National Suicide Prevention Lifeline: 1-800-273-8255 or 988

National Domestic Violence Hotline: 1-800-799-7233

National Sexual Assault Hotline: 1-800-656-4673

Confidentiality

All information obtained in this survey will be treated confidentially. The survey is completely anonymous, meaning no identifiable information will be attached to your survey responses. Information from the survey will be kept on password-protected computers and only the research team will have access to these records to preserve confidentiality. Records will be kept in our laboratory for a minimum of 3 years.

Compensation

Upon completion of the study, you will receive compensation in the amount you have agreed to with the platform (Prime Panels) through which you entered this survey.

Voluntary Participation

The decision to complete this survey is voluntary. You may refuse to answer any question asked in the survey. Even if you begin the online survey, you may stop at any time by closing your web browser. Please note, however, if your survey is not almost entirely complete, you will not be compensated.

Questions/Concerns

If you have any questions or concerns, please contact the following personnel:

Co-Principal Investigator Lauren Bessette at lauren.bessette@trincoll.edu or Gillianne Nugent at gillianne.nugent@trincoll.edu or Research Supervisor Dina Anselmi, Ph.D. (faculty at Trinity College, CT) at dina.anselmi@trincoll.edu or Brian Chin (faculty at Trinity College at Trinity College, CT) at brian.chin@trincoll.edu

By clicking "yes" below, you are indicating you are 18 years of age and that you consent to participate in this study. Please print out a copy of this consent form for your records.

- Yes
- No

Appendix B

Demographic Questions

Age

1. How old are you? (in years) _____

Gender

2. What do you identify as? (Drop-down menu for: Other specification)
   a. Male
   b. Female
   c. Non-binary
   d. Transgender
   e. Other (please specify)
   f. Prefer not to say

Race/Ethnicity

3. Check the box(es) of the racial group(s) that best describes you:
   a. American Indian/Alaskan Native
   b. Asian or Asian American
   c. Black or African American
   d. Caucasian (white)
   e. Middle Eastern
   f. Native Hawaiian or Pacific Islander
   g. Other (Please specify) _____
   h. Prefer not to say

4. Check the box of the ethnicity that best describes you
   a. Hispanic or Latino
   b. Not Hispanic or Latino

Geographic Location

5. What state in the U.S. are you from? (drop down menu with all states)

Relationship Status

6. What is your current relationship status?
    a. Single
    b. In a relationship but not married
    c. Married
    d. Divorced or separated
    e. Widowed

7. If you are presently in a relationship or married how long have you been in this relationship?
    a. Less than a year
    b. 1-3 years
    c. 3-8 years
    d. 8 years or more

Children Status

1. Do you have children?
    a. Yes (if yes, there is a drop down menu for how many children individual has)
        i. How many children do you have
    b. No
2. Are your children vaccinated
    a. Yes
    b. No

Political ideology/orientation

8. How would you describe your political orientation?
    a. Very liberal
    b. Liberal
    c. Moderate
    d. Conservative
    e. Very conservative

Religious Ideology

9. What is your religious background?
    a. Agnostic
    b. Atheist
    c. Buddhist
    d. Christian (sub-question)
        Catholic
        Eastern Orthodox
        Protestant (please specify)_____
        Non Denominational
    e. Hindu
    f. Jewish
    g. Muslim
    h. Other, please specify
    i. Not religious

10. How religious are you currently?
    a. Not religious
    b. Slightly religious
    c. Moderately religious
    d. Very religious

Household/Earned Income

11. What is your family's household income?
    a. Less than 35,000 per year
    b. $35,000-$75,000
    c. $75,001-$150,000
    d. More than $150,000

Educational Level

12. What is the highest level of education you've completed?
    a. Less than High School
    b. High School Diploma or Equivalent
    c. Some College, No Degree
    d. Associate's Degree
    e. Bachelor's Degree
    f. More than a Bachelor's Degree (e.g., Master's, JD, PhD)

Appendix C

Vaccine Status

1. . What is your Covid-19 vaccination status?

   a. Not vaccinated

   b. Vaccinated, but not boosted

   c. Vaccinated and boosted at least once

2.. Were you required to get the Covid-19 vaccine for work or another reason?

   a. Yes

   If so, why were you required to get the vaccine? _____

   b. No

3. If you answered "Yes" to the previous question, would you have gotten the Covid-19 vaccine if it wasn't required?

   a. Yes

   b. No

   c. Unsure

Vaccination status of partner/spouse

4.. What is your partner/spouse's Covid-19 vaccination status?

   a. Not vaccinated

   b. Vaccinated, but not boosted

   c. Vaccinated and boosted at least once

   d. I don't have a partner/spouse

5. . Have you gotten the newest Covid-19 hybrid vaccine (released in September of 2023)?

a. Yes

b. No (with drop-down menu for answers below)

i. I plan to get it
ii. I am unsure of my plans to get it
iii. I never plan on getting it

6. . Have you ever tested positive for Covid-19?

a. No
b. Yes
    i. How many times?
        1. (Drop down w numbers)
    ii. How serious was your most severe infection?
        1. (Asymptomatic) (Mild) (Moderate) (Severe) (Required Hospitalization)
    iii. Was your first infection before December 2020, when the vaccine became available?
        1. Yes
        2. No
    iv. Have you ever taken Paxlovid (a drug that reduces symptoms, chances of hospitalization, and long covid)?
        1. Yes
        2. No
            a. Would you ever take Paxlovid (a drug that reduces symptoms, chances of hospitalization, and long COVID) if you tested positive for COVID-19 and your doctor recommended it?
                i. Yes
                ii. No
                    1. If no, why not?
                        a. _____

Appendix D

Social Media Frequency

Adapted Social Networking Activity Intensity Scale by Li et al. (2016)

How often have you used any of the following social media (Facebook, Instagram, Snapchat, TikTok, Twitter/(X), Reddit, Youtube) in the past week?:

(never), (1-2 days), (3-4 days), (5-6 days), (everyday)

How many hours per day do you spend on the following actions?

(0-1), (2-3), (4-5), (6-7), (8-9), (10+)

1. Sent messages to friends on message board
2. Chatted with friends via instant messaging function
3. Replied to comments made by social networking friends
4. Commented on friends' status, logs, and photos
5. Shared/Reposted content
6. Browsed others' logs/photos/statuses/albums
7. Posted photos/videos on personal web profile
8. Shopped on social media platforms
9. Surfed entertainment
10. Surfed current news

Appendix E

Social Media Literacy Scale

Adapted Social Media Information Literacy Scale by Heiss et al. (2023)

Rate the following on a scale from 1 (difficult) to 7 (easy)

Navigation

Browsing social media platforms in a way that helps me find new information quickly.

Appraisal

Critically reviewing post content for accuracy.

Critically examining the content of posts for their truthfulness.

Critically examining the credibility of post sources.

Critically evaluating the trustworthiness of post sources.

Comprehension

Understanding complex content that people post on my network.

Understanding posts on more difficult topics.

Understanding complicated relationships addressed in posts.

Understanding complex issues conveyed in posts.

Curation

Customizing or Influencing the content displayed in my newsfeed to match my interests.

Interaction

Interacting with others on social media.

Appendix F

Vaccine Conspiracy Belief Questions (Shapiro et al.)

Rate how much you agree with each statement on a 1-7 scale. 1= Being very strongly disagree and 7= being very strongly agree.

1. Vaccine safety data is often fabricated.
2. Immunizing children is harmful, and this fact is covered up.
3. Pharmaceutical companies cover up the dangers of vaccines.
4. People are deceived about vaccine efficacy.
5. Vaccine efficacy data is often fabricated.
6. People are deceived about vaccine safety.
7. The government is trying to cover up the link between vaccines and autism.
8. The existence of the Covid-19 virus is fabricated by the government.*
9. Covid 19 vaccine safety data is often fabricated.*
10. Covid 19 vaccine efficacy data is often fabricated.*

* = added by researchers for this study

Appendix G

Trust Scale (Original Questions Developed by Researchers)

How much trust do you have in the following sources of information about the COVID-19 vaccine?

	Not at all	Very little	Somewhat	A great deal	Completely	I do not get information from here
My doctor	□	□	□	□	□	□
Public Health Institutions (e.g., Local health department, CDC)	□	□	□	□	□	□
Acquaintances (e.g., coworkers, classmates, peers)	□	□	□	□	□	□
Loved ones (e.g., family, friends)	□	□	□	□	□	□
Social media personalities, (e.g., Facebook, Instagram, TikTok, Twitter/X)	□	□	□	□	□	□
Social media news (e.g., Facebook,	□	□	□	□	□	□

Instagram, TikTok Twitter/X)						
Government approval process for Covid 19 vaccine	□	□	□	□	□	□
The Covid-19 Vaccine development process in general	□	□	□	□	□	□
Pharmaceutical companies (e.g., Pfizer, Moderna)	□	□	□	□	□	□