Causes and Origins of COVID-19 Vaccine Hesitancy in the United States

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Despite over 3 million total deaths from Covid-19, two-thirds of voters say they will not try to get a Covid vaccine when it first becomes available, and one-fourth of voters don't plan to receive the vaccine at all. While this statistic is troubling, it may not be surprising given the apparent growing sentiments of mistrust toward the scientific community, and those who report scientific information, from the American public. This sentiment is not limited to the topic of vaccinations, and it manifests in topics such as climate change denial (More U.S. citizens are skeptics of climate change than in any other western nation (Fagan, 2019)) and disbelief in the efficacy of mask use to prevent the spread of disease (37% of Americans report not wearing masks during "close contact with non-household members" (Key, 2021)). While scientific discovery is crucial to determine courses of action that are best in times of crisis, it is equally, and perhaps more, important to relay that information in a way that is most compelling and convincing.

While the disconnect between scientific consensus and public opinion is well documented in many areas, the persistence of distrust in the COVID vaccine is as recent as the vaccine itself, and has yet to be studied extensively. Part of what has turned public opinion against trusting scientific research is the prevalence of biased research, funded by companies with a stake in the outcome. For decades research funded by the tobacco industry hid the potential harm of smoking cigarettes (Bero, 2003), and likewise oil corporations have been attempting to discredit studies describing climate change for years (Collomb, 2014). For these (and most) issues, there are clear groups that benefit from misleading research, however it is unclear who would benefit from perpetuating doubt in vaccines. Additionally, aspects of

American culture, including general skepticism and mistrust of governmental organizations, make communication of scientific information more difficult than in other nations.

In order to identify potential strategies to convince the American public that the Covid vaccine is beneficial, I believe it is important to determine the unique cultural objections to "consensus" science in the United States, the social groups that are most inclined toward these beliefs, and the political forces that are at play, or even the political forces that are *perceived* to be at play. The decision to receive a vaccination is an important one, and there are legitimate reasons why an individual would want to be as informed as possible when making it. The goal of this research is to determine what sources would be viewed as most trustworthy when disseminating information about the vaccine. I have studied this using a survey administered to members of my home community in Fauquier County, VA, about their attitudes toward groups such as scientific researchers, doctors and other healthcare professionals, government agencies such as the FDA, and media outlets that report relevant information, and their tendency toward vaccine hesitancy. The results from this survey would hopefully give some predictive capability based on trust in these organizations, giving insight into the root causes of vaccine hesitancy.

Literature Review

Vaccine hesitancy is more difficult to define than simply identifying which individuals will not take a vaccine and which individuals will. In fact, while it is generally accepted that levels of vaccine skepticism and hesitancy exist on a spectrum, there is much debate on how to most effectively group individual's attitudes towards vaccines. Keane (2005) identified four groups of attitudes toward vaccination, the "vaccine believers" that are wholly convinced of

vaccines, the "cautious parents" that believe vaccine science but don't like to watch their children being vaccination and are uncomfortable with the method, "relaxed parents" that have skepticism of vaccines, and "unconvinced parents" that are entirely skeptical of vaccinations. This approach was critiqued by Gust (2005) who identified through survey 5 attitudes toward vaccine adoption, labeled as "immunization advocates", "go along to get alongs", "health advocates", "fence-sitters", and "worrieds". These categories allow for broader types of reasoning to result in an individual's placement in each group. Yet another framework devised by Benin (2006) identified a group called "late vaccinators", or parents that are worried about the pace of vaccinations but believe in overall efficacy.

In an attempt to draw statistical relationships between individual attitudes toward vaccination and likelihood of child vaccination, Opel (2011) designed a survey to determine an individual's attitudes in four domains linked to vaccine hesitancy: vaccination behavior, beliefs about vaccine safety and efficacy, attitudes about vaccine mandates and exemptions and trust. They used the results from this survey to determine an associative model to predict vaccination status of children. This indicates that there is credibility to the model they devised.

Another challenge to identifying groups of attitudes toward vaccines is the degree to which these groups, and individuals within these groups, shift with the political and social climate. Streefland (1999) points to the existence of "local vaccination cultures" that influence individual's beliefs differently in different areas of the country and even world. This would indicate a study of vaccine hesitancy could yield different results not just by region, but by community, underscoring the need for random and varied samples for study. Other studies site recent controversies regarding health impacts and vaccines, such as MS and the hepatitis B vaccine (Francois, 2005) and autism and the MMR vaccine (Poland, 2010), despite the evidence

for these linkages being missing. It is unclear if fears based on these connections could be assuaged through communication of contradictory data.

A central focus of research in this area is into the major players in the social framework, and their interactions. The first major player is the media, including not only people and media outlets, but technologies for communication. A study from Mason (2000) demonstrated media influence in stoking flames of vaccination hesitancy. This is exacerbated by the opportunities for individuals that are vaccine hesitant to amplify their opinions through internet social media sites (Wolfe, 2002). The shifting of public health policies has also contributed to vaccine hesitancy. Another crucial actor in this system is healthcare providers and professionals. Studies from Connors (1998) and Jellyman (2004) indicate that hesitancy can initiate with an individual's healthcare provider, indicating that nurses and doctors in many western countries show significant degrees of vaccine hesitancy. This hesitancy could prevent these healthcare workers from fully advocating for complete and timely vaccines to patients.

Another interesting factor in vaccine hesitancy is the role of an individual's knowledge level of vaccine science. Studies from Streefland (1999), Bond (1998), and Evans (2001) all indicate that vaccine hesitancy actually increases with increased knowledge of vaccine science, and parents that choose to vaccinate their children have the least knowledge of vaccination. However, a study from Guay (2009) contends this relationship may be causal in the opposite direction, that parents who are already planning to vaccinate their children have no reason to research vaccine science, while parents that are already skeptical of vaccines will be more motivated to seek information to confirm their belief. I am yet to find any studies on the effect of increased levels of knowledge on individuals who are already skeptical of vaccine science, and this appears to be a potential gap in literature.

In general, much of the theory surrounding vaccine adoption is focused on parental attitudes toward vaccination of their children. While this would be a component of COVID vaccine adoption, there are many groups of non-parental individuals that may choose not to adopt the vaccine for other reasons, which may be a gap in current research as there has not been motivation for this type of research in recent history, as vaccinations typically occur in childhood.

STS Framework and Method

Several STS frameworks were useful in analyzing this research topic. Winner's approach was used to analyze structures of power involved in vaccine development and distribution. Typically, these vaccines are required by government agencies as a prerequisite for public schooling, which does remove the decision making from individuals somewhat, but this could be more acceptable for technologies that affect populations in the way vaccines do. Vaccines are typically deployed through medical professionals like primary care physicians, but in the case of incredibly common vaccines, like the flu shot, they can be obtained from local pharmacies in community hubs like grocery stores. This is helpful as it does not result in too much power of any one agency over the possession of these technologies. There are few barriers to this technology, and often the true cause of non-adoption are political oppositions and skepticism of the industries that produce and advocate for the technology.

Latour's ANT framework was used to analyze the role of all actors, including nonhuman actors, in the system. The development of a vaccine requires many human and non-human actors and actants. The process requires laboratory scientists to design an effective vaccine, manufacturing engineers to produce it in large quantities, medical professionals to administer the vaccine, and, especially in the case of Covid-19, government administrators to promote its use.

Even within these broad categories, additional resources are required for these processes; laboratory and manufacturing work requires extensive infrastructure, making these tasks impossible outside of major city centers with reliable power grids. Many of the raw materials for development must be harvested, either from grown cell cultures or larger organisms. Government agencies, especially in the United States with limited state-sponsored media, rely on independent media outlets to spread the information they provide. Additionally, technologies like the internet and social networking sites influence the way this information is spread, who can make claims regarding these new technologies, and who decides what they or others should interact with.

Currently there is a model for forming an effective actant network, but it does not function to the capacity necessary. Government agencies will fund vaccine development and promote the results, although this financial link can create skepticism from observers. Then officials from these government agencies, or even scientists they have chosen to represent them, utilize media agencies to spread the information they want released. Again, this relationship can draw criticism of bias.

A critical component of this issue is the way in which the technologies of today, namely social media services, can shape the messages that are being delivered regardless of the intent of the individuals involved. I think the structure of sites like Twitter or Facebook result in short form information that lacks the ability to provide relevant context and information, and becomes ripe for individuals to criticize claims as a result. I think this could be an interesting component of the societal network surrounding vaccine development to explore with my research question.

For this research project I have chosen to gather data via the survey research method. The questionnaire attached in Appendix A was distributed via social media, primarily to

members of my home community in Fauquier County, Virginia. Fauquier County

demographically is fairly rural, with a population density of 100.7 people per square mile (the

average in Virginia is 202.6 people per square mile) and majority white. This community was

chosen for ease of data collection, as I am already in contact with many members of the

community there, and due to the comparatively broad range of ages and backgrounds than can be

expected at a University such as the University of Virginia, which would be the most likely

alternative location for data collection.

Results and Discussion

The survey was distributed via social media and was primarily filled out by residents of

Fauquier County, VA. The self-reported demographic data showed a fairly homogenous

population of survey takers, confirming that the results of this survey should not be generalized

to the American population as a whole, and much better describe the attitudes and feelings of a
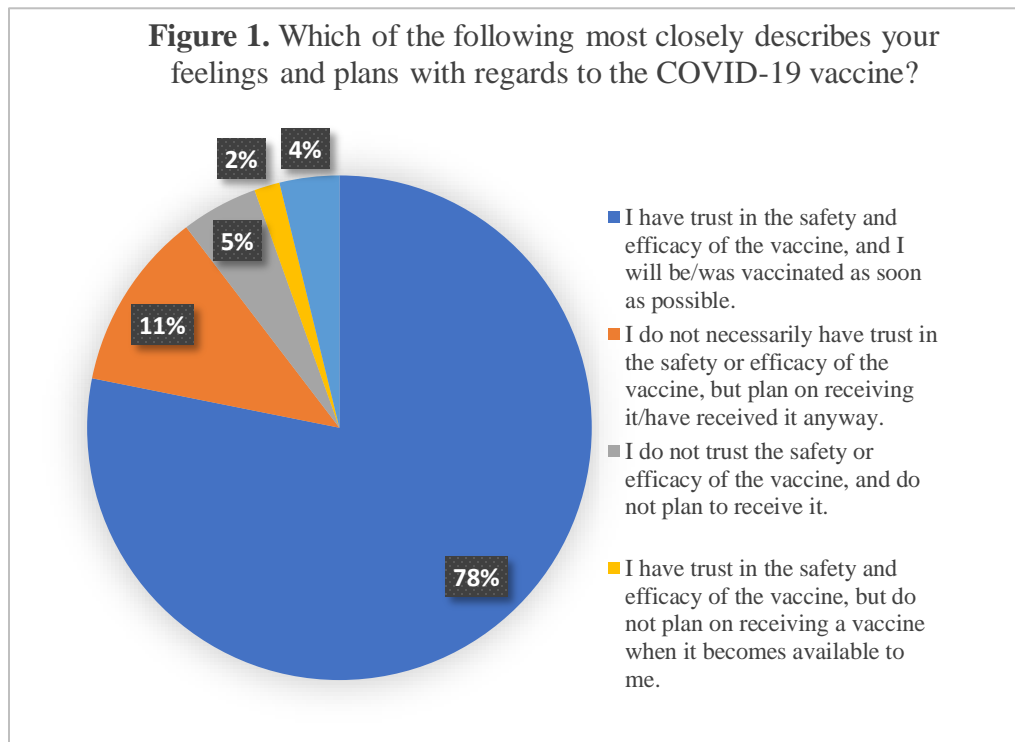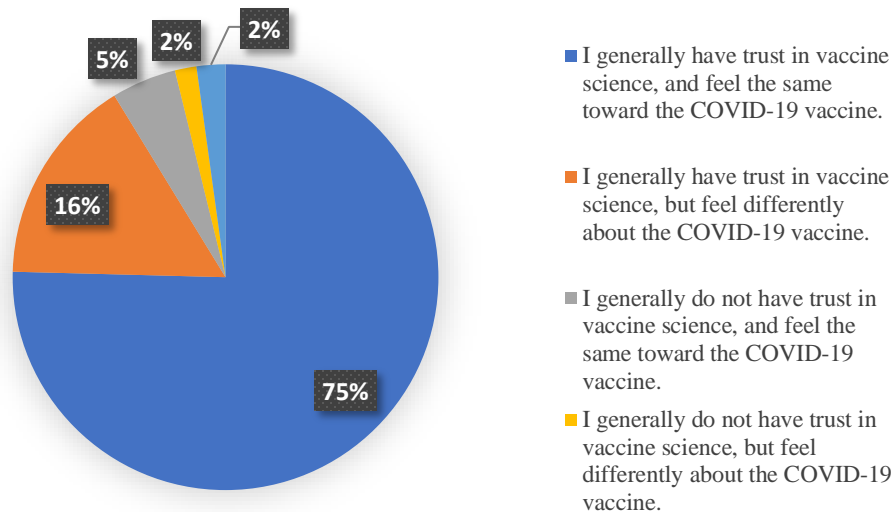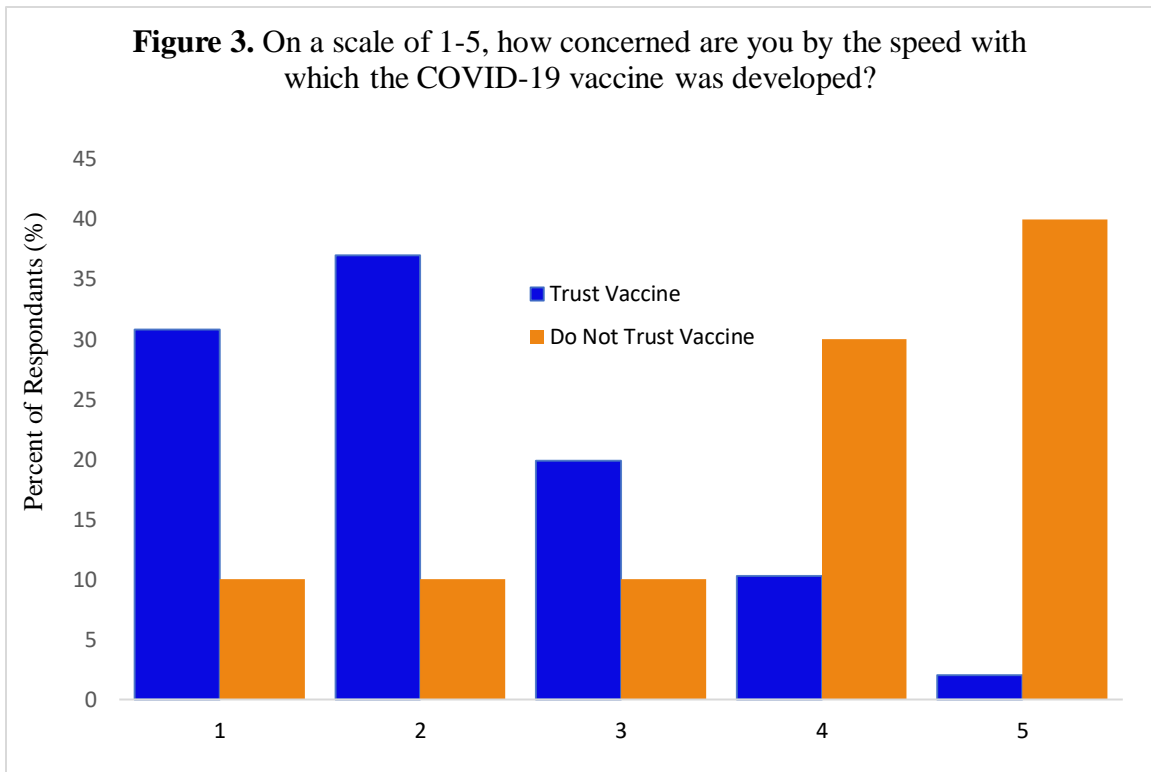
few nearby towns and communities in rural Virginia.

Figure 1. Which of the following most closely describes your feelings and plans with regards to the COVID-19 vaccine?

- I have trust in the safety and efficacy of the vaccine, and I will be/was vaccinated as soon as possible.
- I do not necessarily have trust in the safety or efficacy of the vaccine, but plan on receiving it/have received it anyway.
- I do not trust the safety or efficacy of the vaccine, and do not plan to receive it.
- I have trust in the safety and efficacy of the vaccine, but do not plan on receiving a vaccine when it becomes available to me.

Figure 2. How does your attitude toward the COVID-19 vaccine compare to your attitude toward broader vaccine science?

- ■ I generally have trust in vaccine science, and feel the same toward the COVID-19 vaccine.
- ■ I generally have trust in vaccine science, but feel differently about the COVID-19 vaccine.
- ■ I generally do not have trust in vaccine science, and feel the same toward the COVID-19 vaccine.
- ■ I generally do not have trust in vaccine science, but feel differently about the COVID-19 vaccine.

As seen in **figure 1**, 78% of respondents indicated trust in the vaccine and willingness to be vaccinated. Only 16% of respondents indicated a lack of trust in the vaccine, but among this group over two thirds of respondents indicated they would likely receive the vaccination anyway. However, as seen in **figure 2**, the following question revealed that about 21% of respondents had some degree of hesitancy surrounding the COVID-19 vaccine. 16% of respondents indicated that, while they generally trust vaccine science, they felt differently about the COVID-19 vaccine, and an additional 5% indicated they typically do not trust vaccine science and feel the same toward the COVID-19 vaccine.
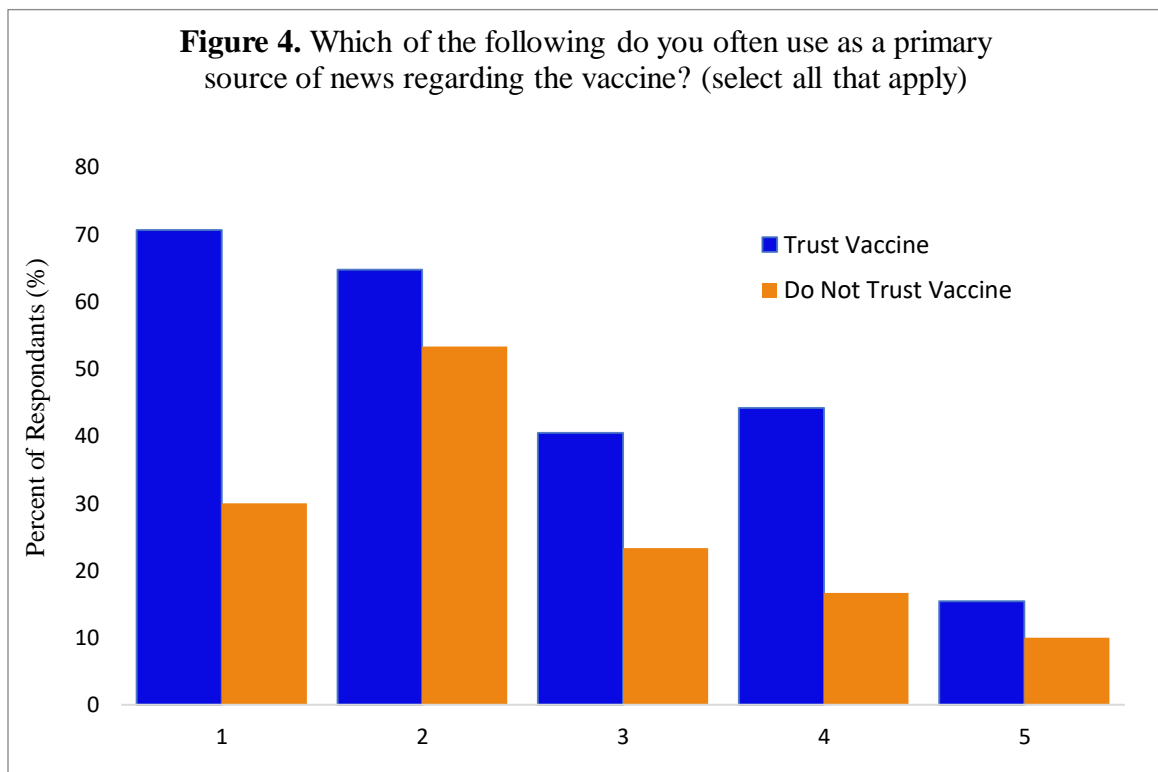
Using the reported trust in the COVID-19 vaccine, two cohorts were created for further data analysis: A group that responded with trust to the COVID-19 vaccine that consisted of 136 respondents, and a group that responded with lack of trust to the vaccine that consisted of 30 respondents. It is important to note the size of the "no-trust" cohort is sufficient to typically be considered representative of a population to a degree, but is still fairly small.

Figure 3. On a scale of 1-5, how concerned are you by the speed with which the COVID-19 vaccine was developed?

When asked to rate the degree to which the speed of the vaccines development and approval was worrying to respondents, a clear difference can be seen between the cohorts, and nearly opposite trends are observed **(Figure 3)**. Individuals who trusted the vaccine were more likely low levels of worry, while individuals with no trust in the vaccine were much more likely to indicate worry in the speed of development.

The respondents were asked to identify the groups or people they routinely use as primary sources of news **(Figure 4)**. The respondents in the "trust" cohort were more likely to use each source of news than the respondents in the "no-trust" cohort. It is important to note that respondents were encouraged to select multiple answers if applicable, so this does not necessarily mean the "no-trust" cohort consumed news less frequently, but does mean that members of the "no-trust" cohort receive news from fewer sources on average. Both cohorts

listed "Social media posts shared by friends or relatives" as the least used source of news, however the "trust" cohort identified "Government health agencies/organizations" as the most used source, while the "no-trust" cohort listed "Published scientific journals or press releases from scientific organizations/groups not affiliated with the government" as the most used source of news. The greatest disparity between the cohorts was in the use of "In print or online newspapers", where the "trust" cohort reported using it as a primary news source nearly three times as often as the "no-trust" cohort, and in the use of "Government health agencies/originations, where slightly more than two times the percentage of "no-trust" cohort members in the "trust" cohort utilized it as a primary source of news.

Figure 4. Which of the following do you often use as a primary source of news regarding the vaccine? (select all that apply)

The respondents were then asked to rate their level of trust in several institutions related to the COVID-19 vaccine, and the responses were sorted by the cohorts.

Figure 5. In general, how much trust would you say you have in the information reported by medical researchers and professionals, such as doctors, nurses, and other healthcare workers.
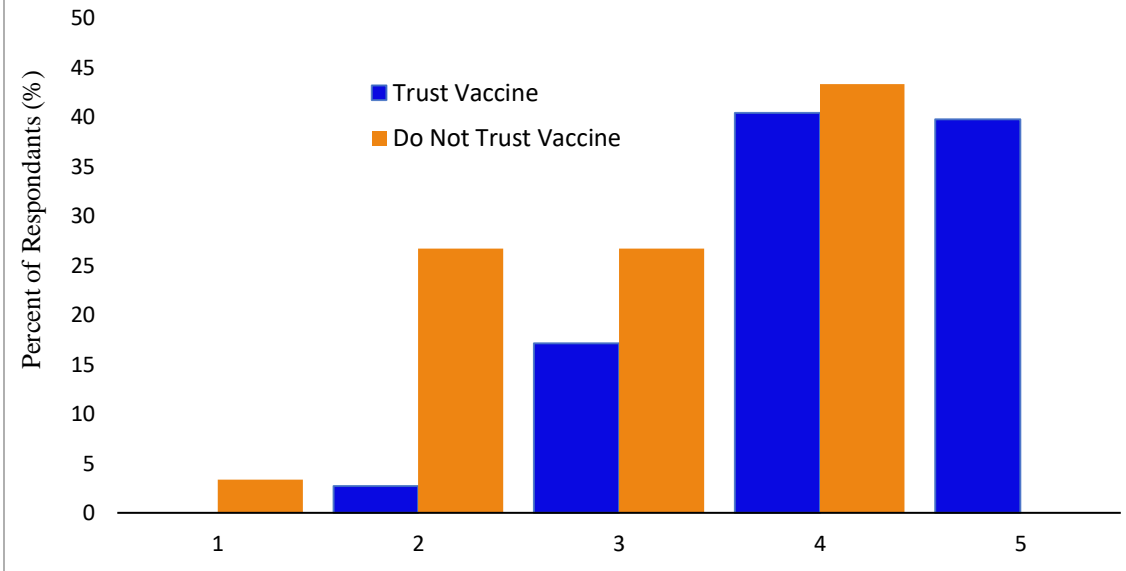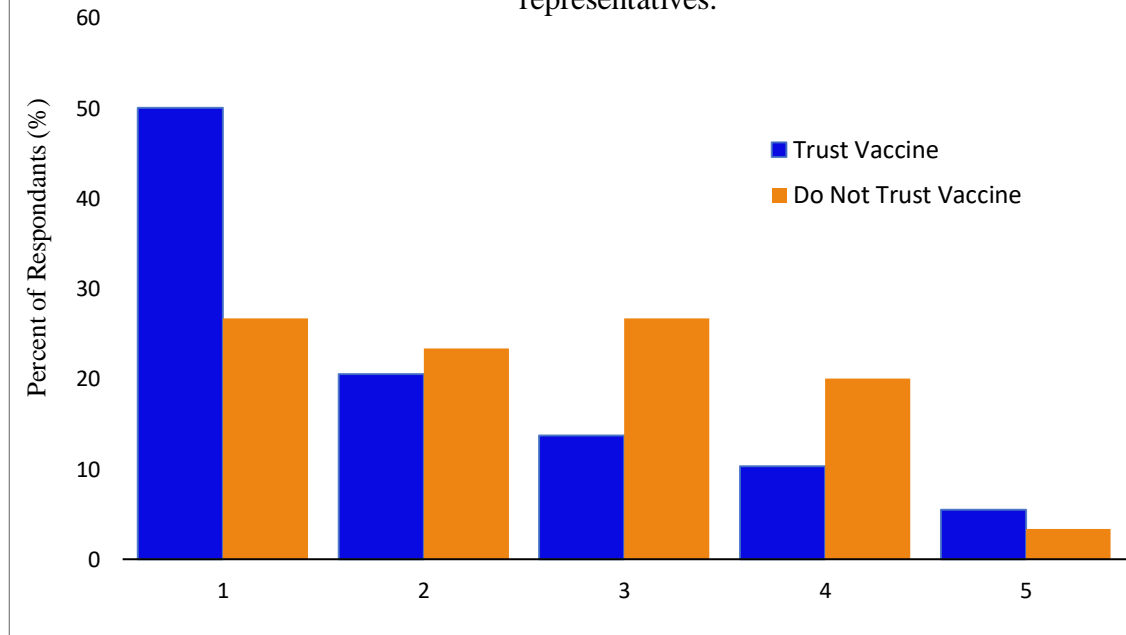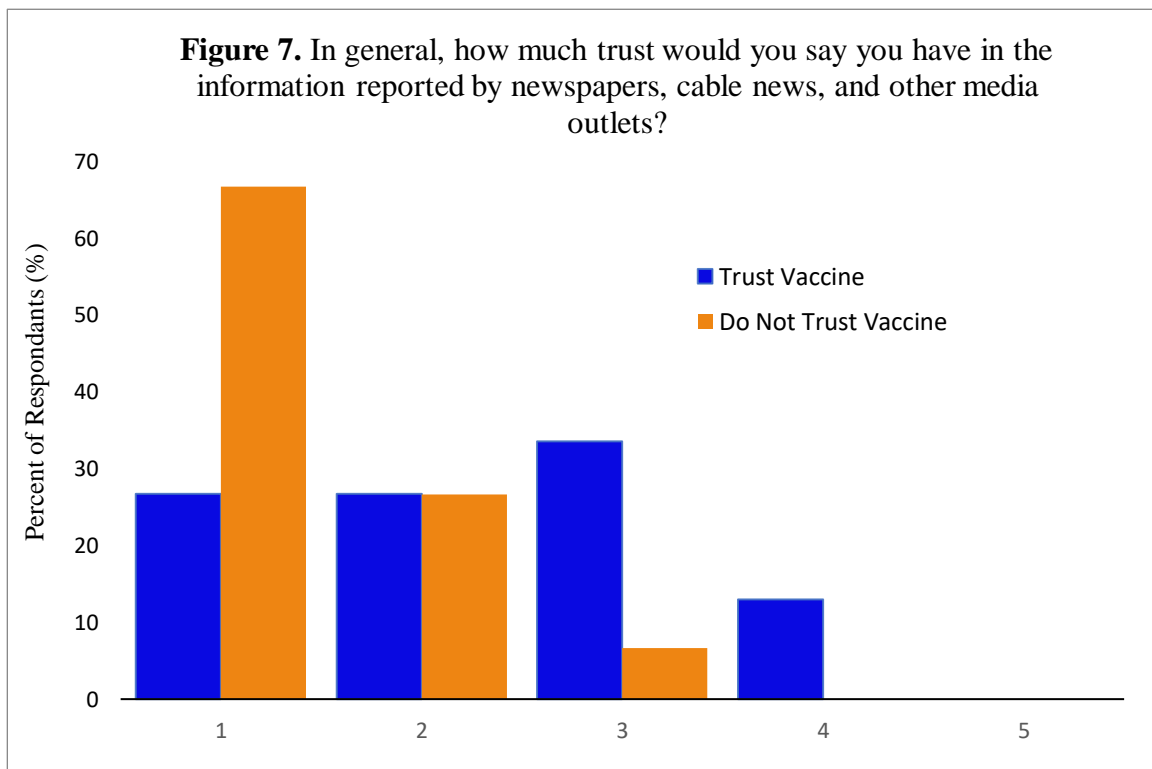

Figure 6. In general, how much trust would you say you have in the information reported by the Trump administration and its representatives.
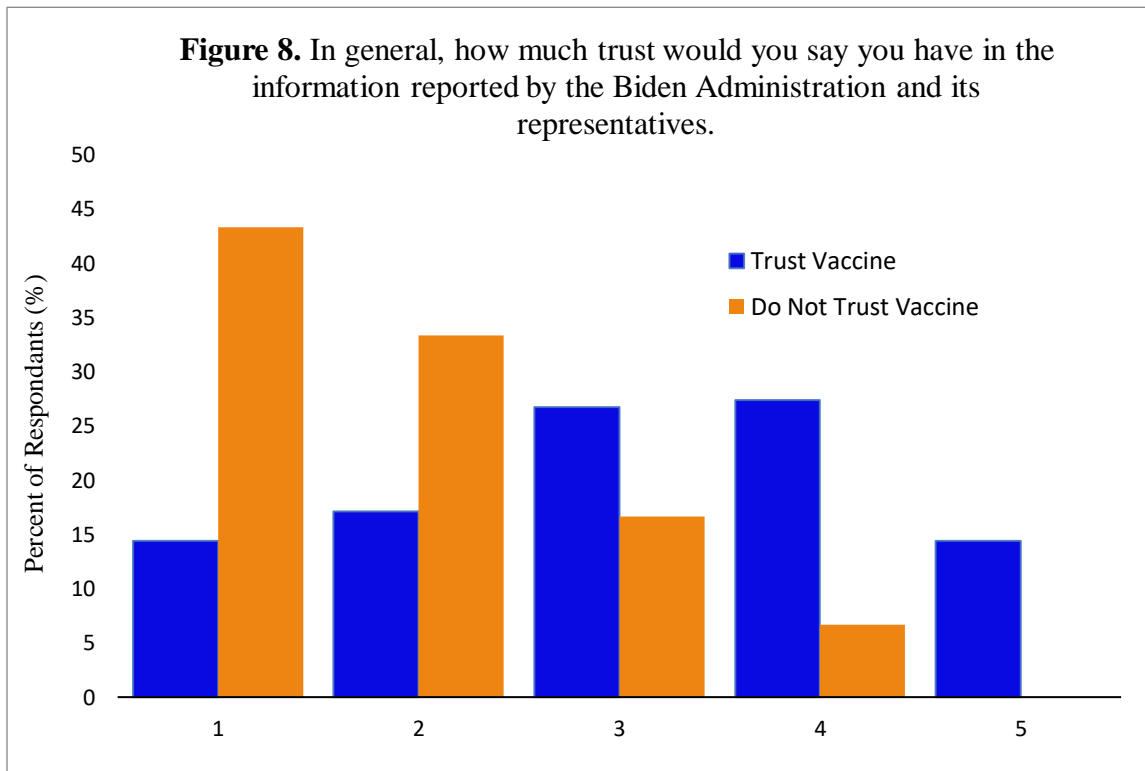
The cohorts were most similar in their responses to questions about medical researchers and professionals **(Figure 5)**, and the Trump administration **(Figure 6)**. Both cohorts responded with relatively high trust toward healthcare professionals, with a notable difference in that the "no-trust" cohort did not have a single respondent claim the highest level of trust, despite the plurality of respondents indicating the second highest level of trust. In contrast, both cohorts indicated relatively low trust in the Trump administration, however the "no-trust" cohort did indicate a slightly higher overall level of trust.

The least trusted organization across both cohorts was "newspapers, cable news, and other media outlets" **(Figure 7)**. Nearly 70% of respondents in the "no-trust" cohort gave these originations the lowest possible rating of trust, and no members of this cohort gave higher than a three of five rating. While the "trust" cohort rating was slightly higher on average, only about 12% of respondents in this group gave higher than a three of five rating, with no respondents giving a five in this group.

Figure 7. In general, how much trust would you say you have in the information reported by newspapers, cable news, and other media outlets?

The participant's reported trust in the Biden administration was fairly dependent on the cohort the respondent was in **(Figure 8)**. Members of the "no-trust" cohort responded with lower average trust in the Biden administration, with a clear negative trend. Members of the "trust" cohort responded with the opposite trend; however, it is much less strong, and fewer respondents gave a five rating than any other rating.

Figure 8. In general, how much trust would you say you have in the information reported by the Biden Administration and its representatives.

The remaining organizations, BioPharma companies involved in the development and manufacturing of the vaccine **(Figure 9)** and government health agencies **(Figure 10)**, yielded similar response trends from the cohorts. In each, members of the "trust" cohort answered in a negatively tailed distribution centered around four out of five, and members of the "no-trust" cohort answered in a positively tailed distribution centered around two out of five.

Figure 9. In general, how much trust would you say you have in the information reported by BioPharma Companies (Moderna, Pfizer, etc.) involved in the development or manufacturing of the COVID-19 vaccine.
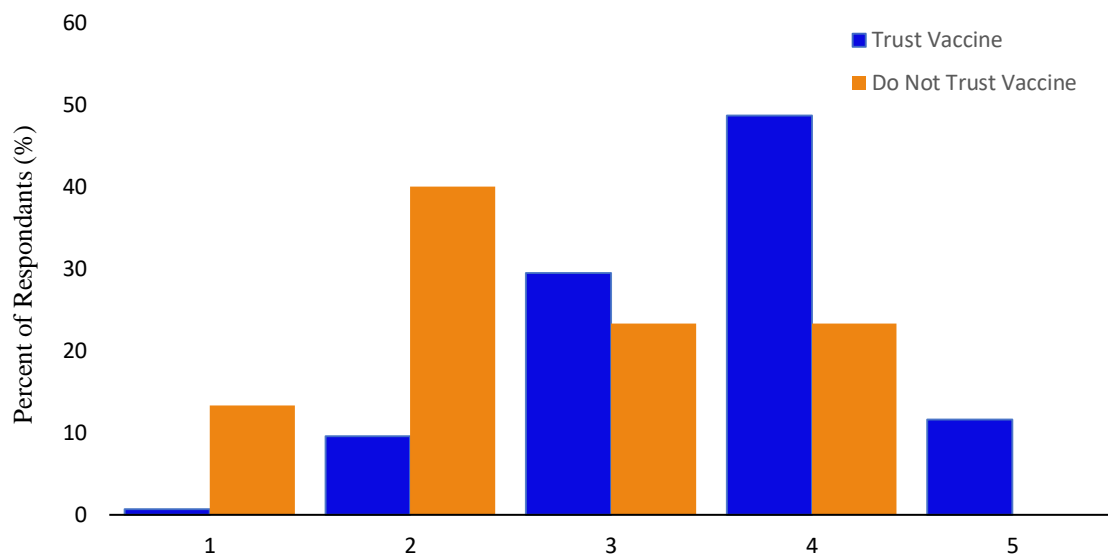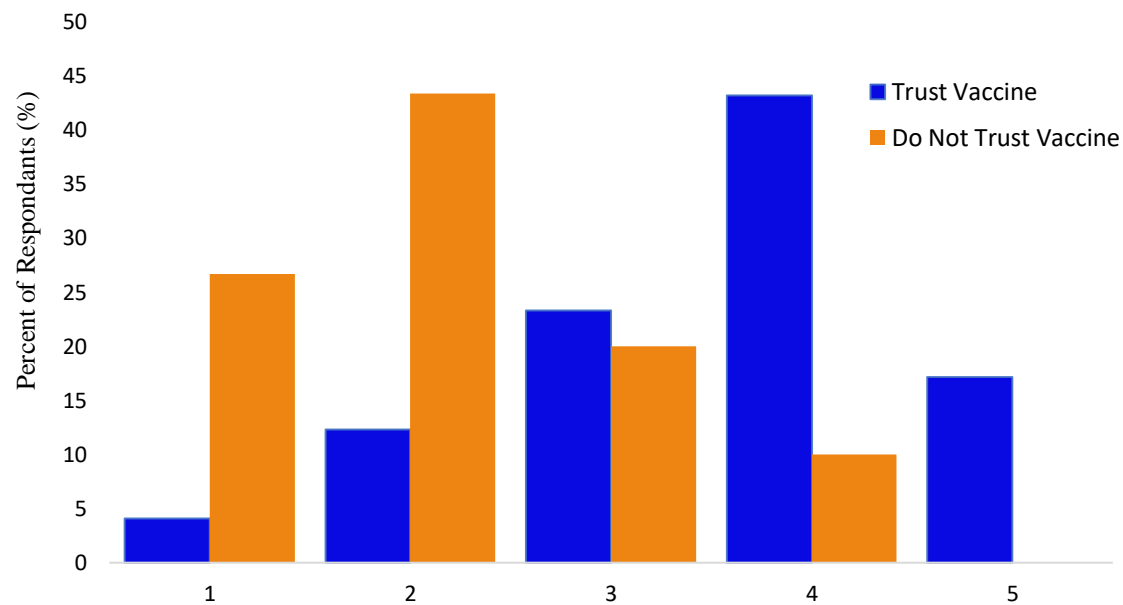

Figure 10. In general, how much trust would you say you have in the information reported by government health agencies (NIH, NIAID, etc.).

Using Winner's approach to analyze the structures of power that are at play amongst these organizations, a slight pattern seems to emerge in the responses from the "no trust" cohort. It appears that, with the exception of media organizations that are highly distrusted by both cohorts, there is a loose negative correlation between the amount of societal power an organization has and the degree to which it is trusted by the "no trust" cohort. These respondents tend to have greater levels of trust in relationships they see as more equal, such as between a person and their individual doctor, than in relationships where they are governed over by an organization with authority.

Using the ANT, it can be seen that respondents tend to take notice of non-human actants in the dissemination of information. Internet and cable news sources tend not to be trusted by either cohort, and social media services tend not to be used as a source of news. This indicates that the respondents tended to be at least somewhat aware of ways that mediums for news distribution can affect the message, and they take this into account when consuming the news.

Conclusions and Recommendations

While the responses of the "trust" and "no-trust" cohorts differed in most areas, the differences were most stark in their concerns at the pace of the vaccine's development, attitudes and level of trust in news outlets (both television and in print), trust in government health agencies, and trust in BioPharma companies related to the vaccine development. The "no-trust" cohort had by far the most trust in healthcare professionals compared to any other group, indicating that a change in attitude toward vaccine science may be best affected through direct interactions between individuals and their doctors, and not through advertising or public service campaigns, as those who have little trust in the vaccine are likely to have little trust in the organizations that report such information.

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Appendix

Appendix A. Survey Questions

1. Your Name (Optional)
2. Your Age (Optional)
   a. 19 or younger
   b. 20-39
   c. 40-59
   d. 60-79
   e. 80+
3. Your Ethnicity (Optional, Select All That Apply):
   a. White
   b. Black
   c. Hispanic
   d. Asian
   e. Native American
   f. Other:
4. Which of the following most closely describes your feelings and plans with regards to the COVID-19 vaccine:
   a. I have trust in the safety and efficacy of the vaccine, and I will be/was vaccinated as soon as possible.
   b. I have trust in the safety and efficacy of the vaccine, but do not plan on receiving a vaccine when it becomes available to me.
   c. I do not necessarily have trust in the safety or efficacy of the vaccine, but plan on receiving it/have received it anyway.
   d. I do not trust the safety or efficacy of the vaccine, and do not plan to receive it.
   e. Other:
5. How does your attitude toward the COVID-19 vaccine compare to your attitude toward broader vaccine science?
   a. I generally have trust in vaccine science, and feel the same toward the COVID-19 vaccine.
   b. I generally have trust in vaccine science, but feel differently about the COVID-19 vaccine.
   c. I generally do not have trust in vaccine science, and feel the same toward the COVID-19 vaccine.
   d. I generally do not have trust in vaccine science, but feel differently about the COVID-19 vaccine.
   e. Other:
6. On a scale of 1-5, how concerned are you by the speed with which the COVID19 vaccine was developed? If you wish, you may explain your response or add information in the text field below.
7. In general, how much trust would you say you have in the information reported by the following groups/organizations (scale of 1-5)?
   a. BioPharma Companies (Moderna, Pfizer, etc.) involved in the development or manufacturing of the COVID-19 vaccine.

b. Medical researchers and professionals, such as doctors, nurses, and other healthcare workers.
c. Government health agencies (NIH, NIAID, etc.).
d. The Trump administration and its representatives.
e. The Biden Administration and its representatives.
f. Newspapers, cable news, and other media outlets.

8. Which of the following do you often use as a primary source of news regarding the vaccine (select all that apply)?
a. Government health agencies/organizations.
b. Published scientific journals or press releases from scientific organizations/groups not affiliated with the government.
c. Cable news. In print or online newspapers.
d. Social media posts shared by friends or relatives.
e. Other: