Ivermectin on Twitter: Investigating Early Advocacy for COVID-19 Vaccine Alternatives

Daniel Gabriel
University of Central Florida

Recommended Citation
https://stars.library.ucf.edu/honorstheses/1347
IVERMECTIN ON TWITTER:
INVESTIGATING EARLY ADVOCACY FOR COVID-19 VACCINE
ALTERNATIVES

by

DANIEL GABRIEL

A thesis submitted in partial fulfillment of the requirements
for the degree of Bachelor of Science
in the Department of Sociology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Spring Term
2023
ABSTRACT

An emerging pattern of public doubt in scientific and political authorities has been seen during the COVID-19 pandemic, where numerous alternatives to vaccinations have gone viral. Ivermectin’s growth from a relatively known specialist drug to a political controversy is a striking example of the amplification that social media can provide. Doubt in the dangers of illness has occurred in regard to previous diseases with limited impact, including the Zika virus, Ebola, and H1N1. However, the COVID-19 pandemic’s impact in the United States is a much larger example of the gaps in current risk assessments and methods of public health authorities. Publicly available Twitter data was mined to identify tweets discussing ivermectin and vaccination during the first year of COVID-19, before public discussion of ivermectin took off. Those tweets were coded using textual analysis and examined through the use of statistical tools. I examine existing sociological studies about trust in medical authority, vaccine rejection, diffusion of new information, and risk analysis to provide context for my results. Attitudes towards vaccination influenced attitudes towards ivermectin inversely. Negative attitudes towards COVID-19 vaccination were associated with more positive attitudes towards ivermectin. Mentions of pharmaceuticals, deaths during the vaccine wait, or a vaccine conspiracy were additionally significant, all of which led to more positive attitudes towards ivermectin.
ACKNOWLEDGMENTS

This thesis wouldn’t have been possible without the help of my thesis chair, Dr. Park. I’m incredibly grateful for your feedback, motivation, and guidance. I also want to thank Erin and Kinsey for their reviews and suggestions.
**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF FIGURES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>6</td>
</tr>
<tr>
<td>Public Perceptions of Risk</td>
<td>6</td>
</tr>
<tr>
<td>Trust in Medical and Political Authorities</td>
<td>8</td>
</tr>
<tr>
<td>Rejection of Vaccination</td>
<td>11</td>
</tr>
<tr>
<td>Demedicalization</td>
<td>13</td>
</tr>
<tr>
<td>Diffusion of New Treatments</td>
<td>14</td>
</tr>
<tr>
<td>METHODS</td>
<td>16</td>
</tr>
<tr>
<td>RESULTS</td>
<td>21</td>
</tr>
<tr>
<td>FINDINGS</td>
<td>32</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>37</td>
</tr>
<tr>
<td>CONCLUSION</td>
<td>39</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>40</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1: Histogram showing tweet frequency per day, April 2020-June 2021...................... 17
Figure 2: Bar graph showing tweet frequency by month..................................................... 21
Figure 3: Bar graph displaying the breakdown of users and their tweets in the study period..... 22
Figure 4: Bar graph of ivermectin attitude frequencies. ...................................................... 23
Figure 5: Bar graph of vaccine attitude frequencies. ............................................................ 24
Figure 6: Bar graph showing frequency of alternative drug recommendations.................... 25
Figure 7: Bar graph showing frequency of topics referenced by users................................. 26
Figure 8: Overlaid line graphs of ivermectin and vaccine’s percentage shares by attitude.... 29
Figure 9: Overlaid line graph of the most significant references and their percentage of total tweets by month. ......................................................................................... 30
Figure 10: Overlaid line graph of the alternative drug recommendations’ percentage share by month. .............................................................................................................. 31
LIST OF TABLES

Table 1: Crosstabulation of ivermectin and vaccine attitude frequencies. .................................. 27
Table 2: Chi-squared significance results for Table 1’s crosstabulation. ..................................... 27
INTRODUCTION

The COVID-19 pandemic upended daily life around the world when it began to spread in 2020, but it hit the United States particularly hard. As of March 2023, in the U.S. alone, over 100 million cases have been contracted, with over 1.1 million deaths (CDC 2023). America makes up about a sixth of the world’s total deaths and cases, while representing only a twentieth of the world’s population. Even before the pandemic, public health in the United States was generally poor given its resources. American healthcare spending exceeded any other high-income country, but the nation had a lower life expectancy, higher obesity rates, and fewer visits to doctors (Tikkansen and Abrams 2020).

In addition, the United States made early mistakes at nearly every turn: the CDC initially downplayed the effects of the virus, testing was limited because of using our own proprietary tests, contact tracing measures were too slow, mask confusion, and the Trump White House response was generally limited (Lewis 2021). While masks were recommended by the CDC, mandates were left up to states despite the absence of a vaccine or any viable treatments for COVID-19. Even when state governments followed CDC guidance, public adherence often did not reach the levels for measures to reach full efficacy. Mask advisories, for example, required wide use of masks for containment to work as intended (Fischer et al. 2021).

The lack of adherence to public health advisories had multiple underlying factors. American has strong cultural ideals of freedom, which often translates into a preference for limited government involvement in one’s personal lives and private businesses. Practically speaking, institutional forces in America lack the power to enforce broad measures without approval from states. On top of limited abilities to enforce mandates, mixed messaging from the
government throughout COVID-19, but particularly in the integral early stages, confused and divided people. Scientific authorities encouraged caution as the disease spread throughout Asia and Europe, even as the dangers of COVID-19 were denied or downplayed by politicians and media sources, making measures to contain it seem unnecessary or authoritarian.

When COVID-19 hit the United States and health regulations were enacted, public fears grew. Lockdown measures often meant losing their livelihoods as businesses were closed, losing the ability to practice their religion when services were moved online, or losing opportunities for their children as their education moved into untested online classrooms. Often, however, hesitancy towards government measures was influenced by distrust in the scientific organizations behind them: the World Health Organization (WHO), the National Institutes of Health (NIH), and the Center for Disease Control (CDC). The motivations of these health agencies and their tactics became the object of concern rather than the dangers of coronavirus. In addition, medical authorities were often confronted with roadblocks within the government itself.

One of the first examples this division came in mid-March 2020 with then-President Donald Trump’s public advocacy on Twitter for the use of hydroxychloroquine, an anti-malaria drug, as a measure to treat COVID-19 (Niburski and Niburski 2020). Throughout that month, Trump’s arguments for it were tempered by medical agencies, citing a lack of evidence for its efficacy (Cathey 2020). Later in the year, Trump claimed that hospitals were marking patient deaths as resulting from COVID-19 in cases when the death occurred from other causes. Based on Medicare rules established during the pandemic, this alleged miscounting of deaths would have been done to earn higher federal payouts to hospitals (Appleby and Knight 2020). Trump’s claim directly accused doctors and the medical community of profiting from the virus.
The wait for vaccines and discomfort with lockdown measures led some Americans to search for alternative solutions. The antiparasitic drug ivermectin was a prominent example. Ivermectin is a drug designed to fight heartworms and other infestations. Originally used for livestock and animals, in the eighties it was approved for human usage at different dosages and formulations (Crump and Ōmura 2011). However, ivermectin, if taken over recommended limits can potentially lead to serious side effects, including seizures and death (FDA 2022).

In March 2020, it was found that ivermectin killed COVID-19 in vitro (Caly et al. 2020). Some media sources picked up on this and further studies were undertaken to investigate if this effect would work in the human body. Results were inconclusive, and the few studies that produced positive results were later shown to have critical research flaws (Marcolino et al. 2022). These studies, including the original in vitro study, were enough proof for many to begin taking ivermectin as a preventive measure against COVID-19. Individual doctors also capitalized on interest in alternative treatments, advocating for specialized combinations of medications, usually containing ivermectin or hydroxychloroquine (HCQ).

In the face of regulatory and medical agencies warning of side effects from misuse, advocates responded with claims that ivermectin was being hidden from the public as a viable treatment since it was not profitable for the pharmaceutical industry (Jarry 2021). To this day, ivermectin use is still promoted on the political right, which has engaged with antivaccination rhetoric and alternative medication at alarming rates. Organizations like the Frontline COVID-19 Critical Care Alliance (FLCCC) still advocate for its use, rather than vaccination. As a result of this promotion and discussion, ivermectin prescriptions for human use were twenty-four times higher in August 2021 than they were before the pandemic (Temple et al. 2021).
Public attention for inconclusive papers like the original ivermectin study is rare. Why were alternative cures advocated despite warnings from scientific authorities? Did attitudes towards vaccination affect attitudes towards alternative treatments? What cultural beliefs, if any, were advocated by those who promoted vaccine-alternatives-and why?

The online advocacy for ivermectin during the pandemic represents an opportunity to answer these questions. Ivermectin was not an established political debate before the pandemic. It was not a medicine most people had heard of or talked about, making it a useful microcosm of broader attitudes during the pandemic. Examining the attitudes of “early adopters” of ivermectin may shed light on the most appealing aspects of ivermectin, especially regarding vaccination (Rogers 2002).

I believe a broad analysis of the range of reactions to ivermectin and vaccine developments will yield useful information about the reasons given for alternative medicine use. My objective is to analyze online discussions surrounding ivermectin. Public perception of ivermectin may shed light on what aspects of it drew attention. I hope to understand which ivermectin information was perceived as trustworthy. Ivermectin use is a highly politicized issue, and examining advocates may show commonalities in their reasoning and discussion.

The benefits of scientific innovation are diminished without responsible and deliberate implementation. Limits in public understanding and interaction often cloud scientific research. In the case of COVID-19, hundreds of thousands of deaths in the United States could have been avoided with appropriate use of the containment measures available. I believe that doubts in authority will be reflected in discussions about ivermectin. Despite decades to learn from the concerns of the anti-vaccination movement and to improve communication between the medical
industry and the public, COVID-19 showed that little has gotten better. Addressing this gap between technology and its application is critical. Through this research I hope to gain a better understanding of what causes authoritative messages to be doubted and for alternatives to be sought after.
LITERATURE REVIEW

This study examines attitudes towards ivermectin during COVID-19 vaccine development. The expert guidance towards both differed completely: ivermectin was dismissed and vaccines were the treatment expected to end the pandemic. Analyzing ivermectin’s advocacy means examining the context surrounding it: perceptions of risk from COVID-19 and vaccination, trust in medical and political authorities, differences in the messaging around the treatments based on status, and the attributes of ivermectin that made it more desirable than a vaccine. Finally, I examine recent literature produced during the pandemic.

Public Perceptions of Risk

Public rejection of health advisories is not a phenomenon that began during the COVID-19 pandemic. Several sociological theories examine previous outbreaks and the public reaction to them. Beck’s “risk society” argues that modern society has shifted from “power structures based in capitalism to structures concerned with the definition of risk (Beck 1992). With the massive influx of personal risks from industrial development, the ability to be aware of risks is dependent on one’s resources: a CEO has much more knowledge of water pollutants in their area than a working family, for example. Laurent-Simpson and Lo (2019) used risk society as a framework to analyze public responses to CDC advisories about Zika on Facebook. Commenters regularly believed in corruption within these expert sources, a phenomenon that held true during COVID-19.

Because of this and other dynamics of online communication, modern infectious diseases are increasingly defined by their social construction rather than their medical facts. Conrad and
Barker (2010) find that social constructions of illness are practical, grounded experiences, not independent from the conditions they are created within. They warn that the medicalization of conditions often ignores these realities; that is, medicalization is a social construction of illness dominated by authorities and medical forces. Joffe (2011) discusses the influence of the risk society perspective on public perceptions of those health authorities: “[the] stigma pattern that occurs with regard to [Emerging Infectious Diseases] shifts ‘upwards’ – the blame and stigma here were placed on public health and scientific entities” (Joffe 2011:453). The dynamics of a society in which risks must be evaluated by each individual mean that disagreements over risk assessment by authoritative sources are common. When authoritative assessments frame diseases inaccurately, public trust decreases (Sherlaw and Raude 2013).

While it may seem that overemphasizing the potential dangers of an illness might “scare” the public into following health advisories, recent outbreaks have shown that the disparities between how diseases are presented and their actual effects can cause distrust in media sources and health authorities (Nerlich and Koteyko 2012, Joffe 2011, Sherlaw and Raude 2013). Perceptions of disease frame their reality in the minds of the public. Douglas and Wildavsky (1983) argue that individuals order their perceptions of risk based on biases shaped through social forces.

Another sociological theory regarding risk perceptions explores the idea that diseases originating abroad are perceived as less dangerous from the public perspective. Joffe and Haarhoff (2002) examine how the British public’s perception of Ebola was shaped by elite presentations of the illness (in this case, news media and political leaders). Media imagery led to public interpretation of Ebola as an exotic, almost science-fiction, disease. This distance from the
material reality of the dangers of illness is another social reality expanded upon during COVID-19. They also note how Ebola was “othered” through its portrayal as a foreign, African illness. In the case of COVID-19, the relative danger represented by the illness was often compared to the common flu and [downplayed]. Due to COVID-19’s origin in China, similar reactions could occur.

Trust in Medical and Political Authorities

Throughout COVID-19, various aspects of the pandemic became politically charged. Sociological examination of polarization has investigated similar cases involving political affiliation and trust in authority. American political polarization has led to increased doubt in public institutions, particularly from the right. Mooney (2005) argues that the rise of the New Right (a movement back towards conservative and religious tradition) in the 1970s led to lessening trust from the right in scientific institutions, particularly higher education and regulatory bodies.

Gauchat (2012) examined social statistics from the period of 1974 to 2010 for trust in scientific authority by political viewpoint. He found that “group differences in trust in science are largely stable over the period, except for respondents identifying as conservative. Conservatives began the period with the highest trust in science, relative to liberals and moderates, and ended the period with the lowest.” (Gauchat 2012:167) An opposition to regulation stemming from science may be a reason for this decline in trust (Jacques et al. 2008). To conservative groups, regulations may be “getting in the way of progress”, a mindset seen in the decrying of business closures during the pandemic’s early stages. Many users feared the
economic consequences of lockdown and preferred the distribution of ivermectin and other therapeutics instead.

The general perception of the medical profession as a faultless system to be listened to and trusted was shown to be challenged during the rise of neoliberalism. Reeder (1972) explores how the “professionalism” of medical authorities hampers trust with their patients. Importantly, he also points to the different dynamics of doctor-patient relationships depending on the medical situation; when patients have emergencies, doctors have power and the patients are forced to seek them out, but when doctors want patients to take preventive treatments, they must convince patients that it is in their own interests. Haug and Lavin (1981) expand on this and argue that the traditional power dynamic between doctors and patients has changed, with consumerist ideas becoming more mainstream.

Later in the century, after some of the impacts of these changes have been felt, Mechanic (1996) examines the decline of trust in the medical profession and argues that the changing landscape of medical practice has influenced it. As medicine becomes more commercialized, it is perceived differently. Social trust, or trust in the institution, decreases. As Mechanic puts it:

> “Increasingly, individuals making major social decisions about health and medical care are managers whose background in medicine is limited. When corporations that deliver medical care are primarily motivated to bring generous returns to their stockholders, and when a significant proportion of the medical care dollar goes to investors rather than patient care, then people are inclined to question the motives and decisions of these organizers and providers of care” (Mechanic 1996:178).

The other component of trust, interpersonal, (the trust between the patient and the doctor) is built up over time. Managed care, essentially the economization of physicians’ time and treatments,
threatens that trust. Adherence to a doctor's advice depends on the belief that the advice is in a patient’s best interests. Mechanic proposes that social and interpersonal trust need to be rebuilt.

During this shift to consumers, patients have become more likely to research their symptoms and have feedback and questions for their doctors (McKinley and Middleton 1999). When meeting with their doctors, having their concerns addressed is critical to their views of the interaction. The consequences of ignoring patient concerns overlap with the antivaccination literature I reviewed, particularly Blume (2006). This shift from patient to consumer is also explored by Cockerham (2000) through the ideas of health lifestyles: the ways people live and treat themselves in regard to illness. He discusses the two potential avenues of action by the public, split between individual agency and structural conditions. The American health system could be understood as becoming more individualistic and choice-based, thus weakening messaging from health authorities and the bond of trust that was critical to the doctor-patient relationship.

Recent studies have explored politicization’s effect during the pandemic. Attitudes in tweets regarding ivermectin were shown to differ based upon geographic location (Diaz et al. 2022). Using sentiment analysis on Twitter data, Diaz found that tweets geolocated within Republican states (based on 2020 presidential votes) had less negative average attitudes towards ivermectin than Democratic states.

In some cases, distrust in authority may result in a desire to engage in “corrective practices” to mitigate the effects of authoritative policies (Pirkkalainen, Näre, and Lyytinen 2022:5). A study of asylum advocates in Finland found that they responded to what they saw as mistakes or outright harm being done by their government by taking social roles that would
allow them to reduce those issues. For example, by taking up advocacy positions or social work, they could respond to policies they disagreed with. In a similar sense, advocating for ivermectin online may be a corrective practice against what some see as governmental overreach in recommending against ivermectin, or pushing for vaccination.

In a recent case, belief in misinformation and a lack of faith in government overlapped through social media engagement and discussion in Nigeria (Akingbade 2021). Social media access was essential to the young respondents, particularly during the pandemic, to communicate and access information about COVID-19. The increased use of social media during the pandemic is an important point to consider when examining online discussions; for many, it represented the only outlet for human interaction.

Rejection of Vaccination

Anti-vaccination movements and ideology have grown in recent decades. Sociological analysis has taken different angles to attempt to understand this rise. Blume (2006) examines anti-vaccination protests and concerns as well as preexisting sociological literature on social movements, concluding that approaching vaccine hesitancy as a social movement may legitimate their claims. Blume argues that the unifying approach of the medical industry to focus on anti-vaccination arguments as a new movement misses the “serious, complex and potentially disruptive questions regarding the ways in which medical professionals behave” (Blume 2006:639). One of the most important questions to address is the conflict between the individual
patient’s right to choose and the expert’s idea of the common good. With patients now viewed as “consumers”, their desire for informed consent and choice is often ignored by vaccination approaches. These questions are often the concerns of the vaccine hesitan, and failing to address them does little to change perceptions of vaccines as intended (Blume 2006).

Analyzing the reasoning given for vaccine hesitancy is a relevant research strategy, as it may help future messaging address existing concerns. Bean (2011) used content analysis to examine anti-vaccination websites following the H1N1 pandemic. She found four main categories of themes present on the sites: safety and effectiveness, civil liberties, alternative treatments, and conspiracy theories or search for truth. Bean noted the new theme of a “manufactured threat” describing the H1N1 outbreak and argues that persuasion is a more effective tool of vaccine advocacy than fear (Bean 2011:77).

Ward (2016) argues that the different proportions of vaccine arguments made online constitute different groups with different levels of vaccine rejection and that studying them as a whole is limited: exploring the boundaries between the levels is more useful. In essence: the anti-vaccine movement is not a monolith. Ward used thematic analysis to examine the public discourse of anti-vaccine groups and interviewed representatives of those organizations. Ward describes three levels of vaccine hesitancy, beginning with Group 1 (“Anti-vaccine”), who are against vaccination in all forms. Next is Group 2 (“Marginally anti-vaccine”), groups who reject vaccination in general, but do not make it their central focus as an organization. Finally, Group 3 (“Occasionally Vaccine Critical”) represents groups that are sometimes opposed to vaccination in particular cases but are more accurately described as “vaccine hesitant”. Groups 1 and 2 often interact, while Group 3 views them as fringe skeptics rather than allies. Given these differences,
Ward believes that more context is required when discussing people or groups opposed to vaccination (Ward 2016). Is it their central cause? How do they view themselves? Using this model of analysis allows for more accurate conclusions to be drawn.

**Demedicalization**

The “demedicalization” of illness refers to the treatment of illness becoming centered in areas other than traditional medicine. This can have consequences in cases where these treatments outside of the established medical system are not as effective, or when they threaten public health. This phenomenon has been noted by public health authorities in previous cases but was thought to be manageable by public health sources through the application of science (Dingwall 2013). However, pure scientific evidence was insufficient during COVID-19 to convince enough Americans to be vaccinated, and previous studies show that public perception can easily be swayed away from purely logical points of view. “Prescriptive communications are likely to be met with skepticism … further[ing] the gap between public health systems and the public” (Davis 2014:514). As seen with vaccination messaging, while the science behind vaccine use may be ironclad, public concerns need to be addressed for messages to stick (Blume 2006).

Medicalization and demedicalization is understood as a spectrum in later analysis, and issues can become both medicalized and demedicalized at the same time. Analyzing it from “multiple dimensions – discourses, practices and identities – and to the multiple levels of analysis at which it occurs – macro, meso and micro” is critical to a deeper understanding of how issues are changing (Halfmann 2012:186). My examination of the medicalization of COVID-19 likely will find differences at these levels.
Diffusion of New Treatments

Understanding the spread of new treatments is essential to understanding both the spread of ivermectin online as well as the reactions to the vaccine. Sociological exploration of this concept is exemplified through the diffusion of innovations model, which explores how ideas and inventions spread. If individuals perceive the innovations as possessing some advantage to existing ones, being consistent with their values and needs, easily understandable, able to be tested out, and with visible effects, they are more likely to use the innovation (Rogers 2002).

Rogers (2002) explores this process of adoption through five groups of consumers, in chronological order and following a normal distribution curve. Most relevant to my study period are innovators, making up the first 2.5% of users, and early adopters, the next 13.5%. Early adopters influence the remaining population, and existing studies have shown the effect of these “opinion leaders” on their peers in increasing uptake of innovation and ideas (Ellerbeck 1991, Lomas 1991, Puska et al. 1986). Initial advocates for ivermectin may resemble the opinion leaders found in other contexts. If so, what qualities of ivermectin convinced them to support its use?

Other theorists have examined the spread of information in a medical context. Freed (1998) creates a framework describing the process of vaccination strategies from “Awareness” to “Adherence”, building on Rogers’ earlier diffusion model. Becker’s (1984) health belief model is another framework that explores the likelihood of taking preventive action. In this model, one’s demographics and perceived danger from the disease threat affect their perception of the threat’s danger. From there, cues to action and beliefs in the benefits of the preventive action affect their likelihood of taking the action (Janz and Becker 1984).
In a practical examination of ivermectin advocacy on Twitter, Berdahl (2022) found three main avenues of discussion that promoted ivermectin: users interacting with the “COVID-19 Critical Care Alliance”, users opposed to lockdowns in India, and users favoring hydroxychloroquine in opposition to Dr. Anthony Fauci. They also found spikes in mentions in March, August, and December. Viewing Pierre Kory as an “opinion leader” helps explain the effect on ivermectin tweets.
METHODS

Twitter is a popular social media site centered around a character limit on posts and a dynamic reply system that spurs user interaction. Twitter increasingly became a hotbed of political messaging and discussion in part due to Donald Trump’s frequent use of his personal account on the site throughout his presidency. During COVID-19, his views on the pandemic were posted there and in turn, discussed, challenged, supported, and joked about. While Trump was removed from the site in early 2021, the website’s political discussions continued in full force. Twitter’s central focus of textual expression makes it a useful source for research on people’s opinions and views.

To elaborate, Twitter’s simple posting and sharing design, coupled with its short-form nature, made it an ideal subject for data scraping. Posts on the site are simple to download and store, and the open discussion forum of the site means that users rarely censor their beliefs. Users often use the site to express themselves, often addressing their peers and their leaders. Because of the character limit and the openness of posts on the site, the main throughlines of users’ arguments are typically very clear; the format of Twitter leaves little room to obfuscate.

I examined Twitter posts through quantitative analysis. The SNS library for Python, a Twitter scraping tool, was used to gather all English language tweets containing the terms “ivermectin” and “vaccine” from the period of March to December 8th, 2020. This period covers a time where ivermectin was not broadly discussed online, capturing initial reactions to the first studies showing its potential in vitro.
While vaccines had not been approved for use during this time, they were in development, and discussion around the manufacturing process often included ivermectin as an alternative. Our data is ideally a representation of viewpoints from opinion leaders of ivermectin advocacy. The period studied represents this well because the discussion around ivermectin during this time had not been politicized through mainstream media sources or public figures. As a result, the data sample should be representative of people likely to recommend alternative drug use; understood through diffusion theory, these would be innovators and early adopters (Rogers 2002). The time period ends before the massive increase in tweets containing the search criteria in December 2020, shown in Figure 1. These coincide with a Senate hearing involving ivermectin, after which discussion enters the mainstream, which will be excluded from analysis.
Initial Twitter scraping with SNS returned 726 users and 1373 tweets. After coding, the dataset was filtered to 620 users (and 1221 tweets). The attitudes within a user’s tweets were summarized in one output, with each user only coded once, regardless of their number of tweets. Posts from hospitals, medical organizations, and politicians were not included, to limit the sample to the general public. From there, users were removed if their tweets were not in English, if they were not referring to COVID-19, or if they did not express an attitude towards ivermectin or the future COVID-19 vaccine.

Each user’s relevant data was coded into variables for analysis. I used a standardized Qualtrics form to record my analysis. I recorded the username, number of tweets, and dates of tweets first, and then analyzed their tone towards four COVID-19 issues that I believed would be most relevant to understanding ivermectin use. First was tone, the tweet’s general opinion towards ivermectin, vaccines, federal health authorities, and masks; these were recorded as positive, negative, or neutral. Users with no tone towards ivermectin or the COVID-19 vaccine were removed. I also added a marker variable that recorded if there were any citations or influences present in the user’s tweets: primarily links to studies or articles, or political messaging.

Several other variables were included based on what is mentioned by users. The use of words referencing pharmaceuticals, government, freedom, ventilators, or masks was marked when mentioned. In addition, the reasoning behind vaccine reluctance was also coded, with the main options being belief in a vaccine conspiracy (microchips, mRNA theories, and so on), reluctance due to the perceived “rushed” or “untested” nature of the vaccine, mentions of an alleged profit motive behind vaccine promotion, the potential waste of financial resources or
studies on vaccines that could be spent elsewhere, a feeling of a lack of danger from COVID-19, and/or the belief that deaths during the vaccine wait could be prevented with other treatments. These mentions echo heavily the concerns of previous antivaccination movements (Bean 2011).

As coding progressed, it became increasingly clear that attitudes towards a vaccine were focused on the idea of vaccines in general, in addition to the burgeoning vaccines under development during the time period. The coding options around vaccine reluctance were added to account for this. In addition, other treatments advocated by users were coded. Almost a dozen alternative drugs were proposed or used by the sample users.

In some cases, the tone of the tweet was not clear without the context of the tweet the user was replying to or the images within the tweet. When this happened, the original tweet timeline was found so that the user’s tone could be recorded correctly. Some tweets consisted of just a link to articles or YouTube lectures on COVID-19; if the tweet text did not contain overt opinions about ivermectin or vaccination, they were marked in the coding scheme and excluded from analysis.

From there, the dataset produced by this coding was examined through statistical data exploration in R and SPSS. R was primarily used for data visualization; SPSS was used for statistical analysis, primarily cross-tabulation and significance testing. Most of the data analysis focused on analyzing the dynamic between ivermectin and vaccine attitudes. The references users made were essential to understanding that relationship. A chi-squared analysis was the primary test of potential differences.

After a broad quantitative examination, some tweet examples were examined during analysis and discussion, to provide examples of tweet attitudes. Coding results will be discussed
with tweets as an example. This will provide context for the data analysis results and exemplify the types of variables explored.
RESULTS

Tweets generally increased as the year went on, with a peak in August and September. This same peak is present in the general trend of ivermectin searches in 2020 found in prior studies of the time period (Berdahl et al. 2022).

Figure 2: Bar graph showing tweet frequency by month.

It’s important to note that December tweets were limited to the first 8 days of the month, as discussed in Methods. Around December 9th, tweets fitting the research criteria spiked to over 100 per day and higher.
Figure 3: Bar graph displaying the breakdown of users and their tweets in the study period.

The majority of users only tweeted once, and very few more than 10 times. 581 users tweeted less than five times. Only 15 users tweeted more than 10 times, with a maximum of 58 tweets coming from one user.
The overwhelming majority of responses held a positive tone towards ivermectin and a negative tone towards the vaccine. 558 (90%) users were positive towards ivermectin, 40 (6.5%) were neutral towards ivermectin, and 22 (3.5%) were negative towards it.
Attitudes towards the future COVID-19 vaccine were the opposite of ivermectin attitudes, with the most frequent response being negative, at 419 responses (67.6%). There were 110 responses with a neutral tone towards the vaccine (17.7%). 91 responses were positive towards the future vaccine (14.7%). There were not enough responses with an attitude towards health authorities (230 responses) or masks (41 responses) for data analysis. Likewise, political affiliation was only present in 89 responses. Cited materials informed my analysis but were not analyzed quantitatively.
Examining mentions of alternative medicines showed nearly half of users also advocating the use of hydroxychloroquine, with 291 mentioning it in their tweets (46.9%). Vitamin supplements were mentioned 84 times, or 13.5% of the time. Other frequent mentions were zinc and doxycycline, the other two parts of “Ivermectin Triple Therapy”, at 156 and 66 mentions, respectively (25.2% and 10.6%). Although HCQ mentions declined in the later half of the time period, they were a common feature earlier, likely boosted by Trump’s mentions of it.
I also recorded any references or reasoning that seemed relevant to understanding the user’s perspective. The counts here show the high amount of references to government (206) and profit motives behind the COVID-19 vaccine (178). Additionally, concern over deaths during the vaccine wait (166) and negative attitudes towards pharmaceuticals (149) ranked as frequent, with around a quarter of all users mentioning them.
Table 1: Crosstabulation of ivermectin and vaccine attitude frequencies.

<table>
<thead>
<tr>
<th>Tone towards Ivermectin Use</th>
<th>Count</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>70</td>
<td>558</td>
</tr>
<tr>
<td>Neutral</td>
<td>81</td>
<td>519</td>
</tr>
<tr>
<td>Negative</td>
<td>407</td>
<td>500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Count</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivermectin</td>
<td>70</td>
<td>558</td>
</tr>
<tr>
<td>Vaccine</td>
<td>81</td>
<td>519</td>
</tr>
<tr>
<td>Total</td>
<td>407</td>
<td>500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Count</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>70</td>
<td>558</td>
</tr>
<tr>
<td>Neutral</td>
<td>81</td>
<td>519</td>
</tr>
<tr>
<td>Negative</td>
<td>407</td>
<td>500</td>
</tr>
</tbody>
</table>

Table 2: Chi-squared significance results for Table 1’s crosstabulation.

Positive attitudes towards ivermectin and a negative tone towards vaccination were the most frequent pairing, occurring 407 times, and making up 65.6% of total responses. 97.1% of users with a negative tone towards vaccination had a positive attitude towards ivermectin. Users who disliked vaccines overwhelmingly had positive feelings towards ivermectin.

From there, the other most frequent pairings also were positive towards ivermectin, roughly split evenly between neutral and positive attitudes towards the vaccine. Interestingly, those who discussed the vaccine with a neutral tone had a smaller frequency of positivity.
towards ivermectin than those who discussed the vaccine positively. This is likely due to initial optimism towards both vaccination and ivermectin that was common in earlier months of the timeframe.

There were very few users that were negative both towards the vaccine and ivermectin; most either liked both or only one. Only 3 users (0.5%) had a negative tone towards both. Very few responses were negative towards ivermectin, regardless of vaccine attitude, with only 22 total users that held a negative tone towards ivermectin (3.5% of all responses).

I tested the relationship between attitudes with a chi-squared test, which came back with a p-value much below the traditional target value of 0.05. This indicates that the attitudes recorded towards ivermectin and vaccination are not independent; there is likely a relationship between the two, in this case, an inverse one. As attitudes toward vaccines become more negative, attitudes towards ivermectin are more positive. Some cell counts were below the minimum expected amount, which may have biased the results in the favor of rejecting H₀.
Examining the percentage share of mentions in Figure 8 shows that the attitudes towards ivermectin remained relatively stable throughout the sample period. After April, ivermectin’s positive attitude share remained near 100%. Vaccine attitudes fluctuated to a higher extent, particularly in October, with an increase in neutral attitudes and a corresponding decrease in negative attitudes dropping to 56%, which only rebounds to the 70% mark in November and December. Positive attitudes toward vaccination are highest in April, at nearly 40%, but drop below 20% for the remainder of the timeframe.

Only three of the referenced topics had a statistically significant effect on ivermectin attitudes that could not already be explained through vaccine attitudes. These are mentions of
pharmaceuticals (0.191), deaths during the vaccine wait (0.308), and conspiracy theories surrounding the vaccine (0.960).

Figure 9: Overlaid line graph of the most significant references and their percentage of total tweets by month. Examining the references percentage share by month in Figure 9 shows a spike in mentions of pharmaceuticals in June. A similar spike in references to deaths during the vaccine wait and vaccine conspiracies occurs in July. Concern over deaths during the wait for the vaccine rises again with a peak in October, declining thereafter. Mentions of a conspiracy around vaccination remain between 10 and 40 percent of tweets throughout the time period. The most interesting month is October, where vaccine conspiracy theory mentions decline, concerns over vaccine wait deaths increase, and mentions of pharmaceuticals stay constant. I associate this with decreased
vaccine concerns leading up to the 2020 presidential election, where Trump’s vaccine acceleration program was mentioned in positive tones.

Figure 10 shows a similar trend throughout the five most common alternative medicines. They rise in early summer, with a plateau thereafter. Hydroxychloroquine and zinc both drop in October, rise in November, and decline again in December. All drugs’ mentions drop in December, with most reaching five-month lows. However, none of the drugs provided additional statistical significance in predicting ivermectin attitudes that vaccine attitudes could not.
FINDINGS

Initial findings from the data sample show a nearly universal positivity towards ivermectin, as well as a mindset of skepticism around a future vaccine. The primary concerns being the organizations behind the vaccine (government and the pharmaceutical industry) and the reasons for the vaccine’s creation (usually thought to be for profit or for conspiratorial reasons). Another main concern came from the deaths from COVID-19 during the vaccine wait.

The link between ivermectin and vaccine attitudes was shown particularly in the most common pairing of attitudes: negative towards the vaccine and positive towards ivermectin. Ivermectin’s identity shifted from being a stop-gap measure until a vaccine was approved in earlier months before becoming an alternative to vaccination as vaccine development progressed and fears around it grew. Beliefs that vaccination as unsafe, as well as fears of government control, shaped attitudes positively towards ivermectin, which was seen as free from pharmaceutical scheming due to its older patent and low cost. In some cases, the perception of the institution of medicine superseded actual evidence. For example, during the later part of the time period, the lack of approval for ivermectin was seen as evidence that it threatened pharmaceuticals’ and the government’s plans for vaccines. When studies emerged contradicting the original results, they were thought (if even discussed) to be planned by the industry or tampered with. In the end, the in-vitro study alone was enough evidence of ivermectin efficacy for many users. Existing fears about vaccination and new ones involving the mRNA technology used to develop them shaped attitude towards ivermectin, often in the face of established evidence.
Earlier tweets in the time period sometimes expressed optimism that ivermectin could be used towards vaccine development: that it represented a cure all of its own. Vaccine fears intensified over the course of COVID-19, and changed how ivermectin was viewed. Ivermectin discussion tends to be positive, with most tweets either excited about its potential (earlier period):

"Is there a fund raising for developing Ivermectin into the COVID-19 vaccine?"

(user @Vincelaurenz, April 4th)

or critical of authorities for not recommending its use (later):

"Then you will think that have to take a untried DNA altering vaccine. IVERMECTIN could have prevented all this. Why did the government ignore this? Why did the government not tell you to up your Vit C and D? Think!!!"

(user @GumshoeNews, November 9th)

"Why isn’t more focus being put on treatment options? Everyone is so damn focused on the silver bullet vaccine, it may never come. If we all got on board with Ivermectin/HCQ + Zinc + VitD and Az don’t you think we could re-start the world economy?"

(user @AussieDad3boys, September 24th)

Alternative cures presented were often peers of ivermectin or supplements to it. Hydroxychloroquine was another early treatment that also was viewed as “silenced” by many users. Doxycycline and zinc were proposed as part of an ivermectin “triple therapy” that became a more prevalent mention as time passed. In many cases, users presented a full dosing strategy for other users to follow. In a sense, this sharing of information echoes the ideas of “corrective
practices” (Pirkkalainen, Näre, and Lyytinen 2022: ). Users felt that these drugs were being hidden from the public, and that they were fighting back to share information on their own.

The loss of economic opportunities during lockdown was lamented by many users, echoing the reasoning behind conservative opposition to regulation in previous studies (Jacques et al. 2008, Mooney 2005). The shutdown of physical businesses was seen as a negative side effect of regulatory inaction: while people lost their livelihoods, ivermectin and hydroxychloroquine were not used to treat people. The lack of approval for those medicines was often seen as limiting the American economy.

On top of concerns over the losses during the wait for vaccines, many held skepticism towards the vaccine itself. The main concerns were a) lack of safety in the vaccine b) profit motives behind vaccine development c) broader vaccine conspiracies (typically involving Bill Gates, microchips, and the new mRNA technology used in vaccine development). These echo previous findings around common anti-vaccination themes, as well as the relatively new phenomenon of vaccine conspiracies (Bean 2011).

While some users pointed to a lack of danger from COVID-19, the disease’s origins in China seemed mostly not to play a role in this characterization, unlike in previous cases (Joffe and Haarhoff 2002). Diseases like Ebola were presented as less of a threat by media sources “othering” the outbreak, which was largely centered in Africa. China’s position as a global rival to the United States may have amplified conspiratorial ideas about COVID-19, seen particularly in the theories around its origins. In addition, the rapid spread of COVID-19 throughout Western Europe, and ultimately the United States, may have diminished the amount of “othering”
possible for Americans to justify. Unlike Ebola, the portrayal of COVID-19 as posing little
danger seemed motivated by a desire to “return to normal”, rather than the illness itself.

Analyzing ivermectin advocacy through diffusion theory is intriguing. Its relative
advantage over lockdown and masks was a “return to normalcy” and a boosting of the economy.
It featured less perceived downsides than the vaccine: it had been in use for decades in other
applications, cost little, and was not being promoted by mainstream sources. Ivermectin was
compatible with the skepticism around vaccination, particularly those around safety and
pharmaceutical meddling. Ivermectin’s use was not complex, with simple programs being
distributed throughout the Internet. Ivermectin’s trialability largely took place in the sharing of
headlines around miraculous results from its use, as well as personal anecdotes by peers. Lastly,
ivermectin’s effects were not particularly observable. Its effect was discussed in some cases, but
often it was a self-fulfilling prophecy. Both ivermectin users who avoided COVID-19 and those
who made it through infection alike attributed it to the drug. From a diffusion theory perspective,
ivermectin’s use among vaccine skeptics is completely logical.

Interestingly, its relative obscurity gave ivermectin credibility. Trust in the medical
establishment, especially by conservatives, has diminished enough to the point that any solutions
promoted by it are doomed to suspicion. To me, blame for this deficit is both on the shoulders of
conservative political thought and the tactics used by medicine to engage with patients.
Conservative beliefs have been associated with decreased trust in authority in previous cases
(Gauchat 2012). However, the medical profession and its governing bodies need to re-examine
their approach to preventive treatment promotion (Blume 2006, Mechanic 1996, Rogers 2002).
No number of studies will shape public thought as much as a restoration of trust in the medical institution.
DISCUSSION

There are several aspects of this research that could be improved. First, dataset size and coding. My data is a small sample of a much larger discussion taking place over years. I focus on the initial stages of discourse, but a longitudinal study of attitudes could also yield promising results. Coding methods examined frequency and general attitudes but not the rhetorical strategies or language used to express those attitudes. As a quantitative exploration of this data, the depth of a content analysis will not be reached. Qualitative work building upon this study would likely yield more in-depth results, but this research provides a useful context for future work.

The incredible amount of data available online about ivermectin attitudes made this research something of a challenge-particularly to limit the sample to a manageable amount while retaining validity. One limitation that stands out is the requirement that tweets contain both the words “ivermectin” and “vaccine”. The focus of my research is specifically on ivermectin but searching for “ivermectin” alone yielded around 14,000 tweets in the selected time period, with hundreds of thousands of results during the entire span of the pandemic. As a result, my sample may be biased towards responses contrasting ivermectin and vaccination, rather than discussing ivermectin alone. While the relationship found here between the two is compelling, a larger examination of ivermectin attitudes may find that attitudes towards vaccination had a smaller effect than found in this research.

In addition, the overwhelming favor towards ivermectin in the sample meant that some values in the chi-squared analysis were below expected values. These values can be seen in the cross-tabulation and the subsequent warning. The chi-squared independence test is likely biased
for the data due to this, in favor of our conclusion to reject $H_0$. While the data reflects the actual attitudes found in the sample, the low number of values in those pairings inflates the p-value.
CONCLUSION

People advocated for ivermectin because it solved concerns about vaccination and authority while also “treating” COVID-19. Taking ivermectin alleviated feelings of helplessness that many felt as the pandemic spread. Ivermectin was seen as safe due to decades of use in its intended application, as well as free from pharmaceutical tampering due to its low cost and expired patent. Even in cases where some users viewed COVID-19 as relatively harmless, the ease of access and use for ivermectin made it appealing. These users’ high level of distrust in authority, both medical and political, made disproving the initial ivermectin studies difficult.

As the pandemic and the physical response grew (mask mandates, quarantine, social distancing), ivermectin was viewed as an escape. Even though the original study had no evidence that ivermectin could help within the human body, for many users it was enough. When the death toll increased, the fact that ivermectin’s use was not supported by Western governments seemed to validate the distrust many users felt towards them. Given the context of ongoing vaccine development during this period, users returned to familiar ground: suspicion.

Ivermectin advocacy ultimately comes down to trust in institutions. Without it, people will turn to whatever they can, even if its effects are unproven. Medical messaging failed to address the specific concerns and contexts surrounding vaccination and the lockdown measures put into place. While preexisting attitudes towards medical authorities and treatments carried through COVID-19, lessons learned from previous communication failures were not applied, with devastating results.
REFERENCES


FDA. 2022. “Why You Should Not Use Ivermectin to Treat or Prevent COVID-19.” FDA.


