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Choosing COVID-19 treatment over prevention through vaccination: A U.S. social media case study

Stuart Williams¹

Megan McFarlane¹

Mary Giammarino¹

Emily Acker¹

NAME OF DEPARTMENTS AND INSTITUTIONS:

¹ MITRE Health, USA

CORRESPONDING AUTHOR:

Stuart Williams. E-mail: shwilliams@mitre.org

ABSTRACT

Background: This study examined anti-vaccination social media posts that favored COVID-19 treatment (monoclonal antibodies (mAbs)) rather than prevention through vaccination, both of which were under Emergency Use Authorization rather than full approval from the U.S. Food and Drug Administration at the time of this study. Our research stemmed from participation in a U.S. public health education campaign led by a coalition of government agencies to expand provider and health system use of mAbs with high-risk COVID-19 positive patients. **Aim:** Inform real world communication strategies for treatment over prevention therapies. **Methods:** We analyzed the most-engaged tweets that mentioned mAbs and vaccines from March 1 to August 31, 2021. **Results:** Our qualitative analysis identified the following themes: distrust in science, individualism, and politically oriented or partisan sentiment. **Discussion:** Countering anti-vaccine messages and reducing the susceptibility of vaccine-hesitant individuals to these messages must involve message design that considers the individualism and distrust revealed in this study. We recommend two approaches: (1) unmasking anti-vaccine messaging techniques; (2) using colloquial and values-driven language. **Conclusions:** Our findings reinforce the need for public health practitioners to monitor public and social media discourse, adopt messaging that navigates anti-vaccine sentiment, and engage with the preference for treatment over prevention.

KEYWORDS

COVID-19, prevention, social media, treatment, Twitter, vaccine

BIOGRAPHIES

Stuart Williams is a biomedical innovation researcher at MITRE, which operates federally funded research and development centers for the U.S. government. He holds a D.Sc. in information systems and communication and focuses his research on applied health communication, public health strategy, and health policy.

E-mail: shwilliams@mitre.org. ORCID: 0000-0001-9122-5309.

Megan McFarlane is a health communication researcher at MITRE, which operates federally funded research and development centers for the U.S. government. She holds a Ph.D. in communication studies, and her primary

research areas include health communication, women's reproductive health, and the U.S. military. She is the author of three books, the most recent of which is *Militarized Maternity: Experiencing Pregnancy in the U.S. Military* (2021, University of California Press).

E-mail: mmcfarlane@mitre.org. ORCID: 0000-0002-2354-564X.

Mary Giammarino has led award-winning public health and advocacy campaigns in the U.S. and globally. She is a health communication lead at MITRE and holds a master's degree in public policy from Harvard University. She has published articles and guest blogs related to her research and practice in health promotion and health policy.

E-mail: mgiammarino@mitre.org. ORCID: 0000-0003-0306-9559.

Emily Acker is a policy analyst and researcher at MITRE, which operates federally funded research and development centers for the U.S. government. She holds a master's degree in global policy studies from the Lyndon B. Johnson School of Public Affairs at the University of Texas at Austin. She studies mis/disinformation and its implications for U.S. policy.

E-mail: eacker@mitre.org. ORCID: 0000-0002-3593-2559.

Introduction

Monoclonal antibody (mAb) treatment for people infected with COVID-19 received U.S. Food and Drug Administration (FDA) Emergency Use Authorization (EUA) in November 2020, based on evidence that mAb treatment could reduce the relative risk of progression to severe disease and hospitalization by 70% (U.S. Food and Drug Administration, 2020) in certain high-risk patients. As use of authorized mAb treatments increased, discourse emerged on social media that their availability as a COVID-19 treatment precluded the need for vaccination (Mueller, 2021a).

In this study, we explore the preference for mAbs over vaccines, or treatment over prevention, that we observed through social media posts during our participation in a national public health campaign conducted between March and August 2021 to educate U.S. providers and health systems about the availability of COVID-19 treatments. The campaign included activities to monitor public and social media discourse and inform a national messaging strategy led by a coalition of government agencies to influence treatment adoption. Throughout the campaign, both the vaccines and mAb treatments were administered under EUA—the vaccine approval occurred after the end of the therapeutic campaign—establishing comparable contexts between available prevention and treatment options. Vaccines were both cheaper and easier to access than mAbs (the EUA for mAbs restricted administration to high-risk people, whereas vaccines were available to adults, regardless of risk status). The narrow eligibility, expense, and potential shortages of mAb treatment meant that unvaccinated individuals might become dangerously ill and unable to access treatment when needed (Jewett et al., 2021; Mueller, 2021b). The impact of choosing treatment over prevention is profound because an estimated 234,000 deaths could have been prevented from June 2021–March 2022 through increased vaccination (Amin et al., 2022). Understanding and addressing the preference for treatment over prevention is one part of an overall effort to reduce anti-vaccine sentiment and improve health communication. Therefore, a primary goal in our research is to inform real world health communication strategies.

To be clear, we are not measuring anti-vaccine pervasiveness or causality of anti-vaccine sentiment in this study. Instead, this study aims to understand the pro-mAbs anti-vaccine messaging strategies that were shared on Twitter. To do this, we explored the following research question: What messaging themes were present among the most-engaged Twitter posts mentioning monoclonal antibodies that also expressed anti-vaccination beliefs during an education campaign conducted between March and August 2021 targeting U.S. healthcare providers and health systems? Our findings have implications for designing messages that counter anti-vaccine sentiment and increase vaccine acceptance.

Definition of terms

This paper uses the term anti-vaccine to refer to “strong-willed and committed” opposition to vaccination (Dubé et al., 2021). In contrast, vaccine hesitancy refers to doubts and concerns

about vaccination (Dubé et al., 2021). Exposure to anti-vaccine content is associated with increased vaccine hesitancy (Jolley & Douglas, 2014) and the influence of anti-vaccine content is higher among individuals with low confidence in vaccination compared to individuals with high confidence (Schmid & Betsch, 2019). Message design that counters anti-vaccine sentiment, discussed later in this paper, is an area that warrants further attention given the susceptibility of vaccine hesitant individuals to anti-vaccine content.

Culture-based preference for treatment over prevention

Twitter, like other forms of social media, had increasingly become one of the primary communication channels used to express vaccine sentiments at the time of our study and has been the focus of many studies regarding messages of vaccine uptake and hesitancy (Küçükali et al., 2022; Radzikowski et al., 2016; Scannell et al., 2021a; Yuan et al., 2019). Unlike formal health campaigns (which must come from an authoritative organization) or one-on-one interpersonal interactions, Twitter allows for one-to-many communication without regard to the credibility or authority of the tweet's author. In fact, Radzikowski et al. (2016) found that on Twitter, bottom-up, grassroots users tend to be more influential than public health authorities (Radzikowski et al., 2016). Therefore, although research has shown that social media can both encourage and discourage vaccine uptake, scholars have noted an upsurge in anti-vaccine sentiment being shared on social media, and this increased during the COVID-19 pandemic (Betsch et al., 2012; Küçükali et al., 2022; Radzikowski et al., 2016; Scannell et al., 2021b; Wilson & Keelan, 2013). Prior to the pandemic, researchers examined increased anti-vaccine sentiments on Twitter regarding the measles, mumps, and rubella (MMR) vaccine after the 2015 Disneyland measles outbreak in California (Kang et al., 2017; Radzikowski et al., 2016; Yuan et al., 2019). Yuan, et. al, (2019) discovered that anti-vaccine users on Twitter tend to employ intra-group communication, clustering in close communities and only communicating with each other, making it more difficult for pro-vaccine users and campaigns to reach or persuade them. In the following sections, we examine the different strategies used by those who promote treatment over prevention.

Individualism and anti-statism

Some of the rhetorical strategies employed by those who oppose vaccination focus on individual rights, resistance to government mandated actions, and freedom of choice (Hoffman et al., 2019; Lawrence, 2018; Scannell et al., 2021b). These rhetorical strategies likely reflect a primary cultural value of rugged individualism in the U.S., rooted in the country's founding as a frontier nation (Bazzi et al., 2021; Sabin, 2012; Slotkin, 2000). Bazzi et al. (2021) consider individualism and anti-statism the two defining features of rugged individualism and argue that they hinder collective action in response to public health crises, including COVID-19. They also link these features to distrust in science, rooted in an aversion to hierarchies and elites, which dates to the U.S.'s founding. This distrust often manifests itself by suppressing, censoring, or denying messages from official sources that are seen as less credible (Kata, 2012; Stolle et al., 2020). Leader et al. (2021) suggest that if government messages are to be accepted, new messengers are needed because traditional physicians,

public health officials, government sources, and others with formal education in medicine and public health are seen by vaccine skeptics as less credible.

Bazzi et al.'s (2021) analysis finds that counties with a stronger frontier culture are associated with weaker local government effort to control COVID-19, aligned with the opposition of their voters to government intervention. It is important to note that individualism is not antithetical to civic culture and a strong collective ideology (Bazzi et al., 2021). In fact, shaping collective ideology via online groups can be a tool to motivate individuals with anti-government and extreme beliefs (Gaudette et al., 2021).

Challenging scientific efficacy

As the following research suggests, challenging scientific efficacy is a dominant rhetorical strategy used to promote skepticism to vaccines. Rhetorical forms that challenge scientific efficacy primarily aim to either “skew the science” (Kata, 2012, p. 3781) or offer combative evidence, often leading to distributing misinformation (misleading false information) or disinformation (intentionally misleading false information) (Goldberg & Vandenberg, 2021; Wardle & Derakshan, 2018). Another rhetorical form includes employing post hoc, ergo propter hoc (false equivalencies) to justify an anti-prevention stance (Hoffman et al., 2019; Stolle et al., 2020). A prevalent example of this rhetorical style is the myth that there is a link between autism and vaccines, which has been disproven (LeGare, 2017).

Other rhetorical forms cast doubt by focusing on the risks associated with anecdotal cases to emphasize the need for future research (Cuesta-Cambra et al., 2019; Featherstone & Zhang, 2020; Hoffman et al., 2019; Scannell et al., 2021b). Still others employ ingredient-focused messages to suggest there are alternative medicines or homeopathic remedies that work as well or better than prevention therapies (Hoffman et al., 2019). If these other methods fail, “shifting hypotheses” by proposing new theories is a common tactic used by vaccine skeptics (Kata, 2012).

Methods

We examined Twitter data over a period of six months, from March 1 to August 31, 2021, targeting most-engaged (most liked and retweeted) posts discussing both mAbs and vaccines. We collected relevant Twitter data in the U.S. using a social media monitoring and analysis tool, Talkwalker (Trendiction, 2021), based on criteria limited to mentions of monoclonal antibody treatment and vaccines. Our dataset was extracted from tweets collected continuously throughout the period of analysis. Tweets were collected and archived 16 to 24 hours after they had been posted. Thus, we were able to analyze tweets that may have been subsequently deleted or removed from Twitter (discussed further in limitations). The number of retweets and likes for each tweet was recorded once at the time of data capture. The number of retweets and likes was not subsequently updated, although it may have changed after the moment of data capture.

The mAb search query (Figure 1) used a variety of words related to mAbs, specific names of mAb treatments (e.g., Bamlanivimab), acronyms (e.g., mAbs), and references to treatment

sites. The query was limited to posts originating in the U.S. and not limited to any language. To reduce extraneous data, other diseases for which mAbs are used (e.g., Alzheimer's and arthritis) were excluded.

Figure 1. Monoclonal antibodies search query

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((monoclonal* OR monoclonal* OR etesevimab OR bamlanivimab OR
sotrovimab OR "laboratory-made proteins" OR "laboratory made proteins" OR "antibody
cocktail" OR casirivimab OR imdevimab OR Tocilizumab OR Actemra OR "REGN-COV2" OR
"REGN-COV2" OR "LY-CoV555" OR "REGN10933" OR "REGN10987" OR ((mab OR mabs
OR moab OR moabs) AND (treatment OR covid OR infusion OR tratamiento)) OR ("Eli Lilly"
OR "lilly" OR Regeneron OR vir OR glaxo* OR GSK) AND (antibod* OR monoclonal* OR
mab OR mabs)) OR (("infusion sites" OR "infusion centers" OR "infusion site" OR "infusion
center" OR "pop up sites"~ OR "pop up site"~ OR "pop up centers"~ OR "pop up center"~ OR
"centro de infusion" OR "centros de infusion") AND (antibod* OR anticuerpo*)) OR
"anticuerpos monoclonales" OR "anticuerpo monoclonal") AND (sourcecountry:us)
AND NOT (alzheimers OR "alzheimer's" OR arthritis)
```

The data set was further refined to include references to vaccines in English and Spanish, the most commonly spoken languages in the U.S. (Figure 2). Using these criteria for the research project period, we retrieved 74,391 tweets that mentioned both mAbs and vaccines from March 1 to August 31, 2021.

Figure 2. Vaccine search query

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(vaccin* OR vax* OR vacun* OR shot* OR jab* OR moderna OR pfizer OR
booster* OR (j&j) OR johnson*) AND engagement:>0
```

Next, we limited the data set to original tweets (excluding quote tweets and retweets) to avoid coding repetitive content. Because it was not possible for us to measure the number of people who saw a tweet or changed their behavior after viewing a tweet, we instead chose to focus on likes and retweets as a proxy measure for influence. Following precedent set by Basch et al. (2017), the refined data were then limited to the top 10% most-engaged tweets by adding the number of retweets and likes for each individual tweet. This resulted in a sample of n=1678 results. The median number of likes for tweets in the sample was 22 likes (min=2, max=29,760). The median number of retweets for tweets in the sample was 4 retweets (min=0, max=6,304).

Notably, August had a much higher volume of total posts as compared to previous months (29,955 total results for March through July versus 44,436 results for August alone); we did not want the August results to bias the results of the previous months. We compared two

different sampling approaches (10% most-engaged posts by month versus 10% most-engaged posts overall) and 97% of the posts were the same. We chose to sample the top 10% most-retweeted and most-liked posts by month, instead of the top 10% most-engaged posts overall, since sampling by month allowed us to understand the development of trends over time.

The data set of tweets was uploaded to the qualitative data analysis software, NVivo (QSR International, 2021). The literature review informed a baseline codebook of anticipated themes against which emerging and divergent themes were identified. All four authors met regularly to discuss, add, and group new themes that appeared regularly and made sense conceptually (Tracy, 2019).

Results

We organized the tweets by coding them as anti-vaccine, pro-vaccine, and indeterminant. We define anti-vaccine as tweets that clearly articulate sentiment against vaccination. These tweets may include warnings about the dangers of vaccines, express mistrust in authorities promoting vaccines, and/or encourage treatment like mAbs instead of vaccines, among other messaging. Pro-vaccine tweets actively promoted vaccines, such as by highlighting the efficacy of the vaccines in preventing COVID-19, and by encouraging others to get vaccinated. Sometimes pro-vaccine tweets also respond to messaging in anti-vaccine tweets promoting treatment over prevention by calling attention to the irony of this choice. Tweets coded as indeterminant were not clearly anti- or pro-vaccine. Many of the tweets coded as “indeterminant” were from news sources, and others appeared to be spam accounts using vaccine-related hashtags to draw attention to an unrelated product.

Of the 1678 tweets that referenced both mAbs and vaccines, 79 were coded as anti-vaccine, 968 were coded as pro-vaccine, and 631 were indeterminant. We anticipated the low number of anti-vaccine posts for two reasons. First, we searched for posts that mentioned mAbs and then limited the data to posts that *also* discussed vaccines. Second, mis- and disinformation enforcement from social media platforms may have reduced the amount of anti-vaccine content, which we discuss further in our limitations. Although fewer in number, the impact of anti-vaccine posts was significant because both pro-vaccine tweets and other public discourse responded to the anti-vaccine messaging. For example, many of the pro-vaccine posts (n=341) mentioned the irony of preferring treatment over prevention. Additionally, many pro-vaccine posts (n=306) expressed frustration with the politicians who advocated for mAbs more than they advocated for vaccines (a bias we anticipated given the context of the national discourse involving some politicians promoting mAbs over vaccines, particularly in states where COVID-related hospitalizations were rising but vaccinations lagged (Aleccia, 2021)). Our data set focused on the most popular tweets (top 10% most liked and retweeted), so the presence of anti-vaccine posts indicates that vaccine skeptical content did resonate with a large audience. Table 1 outlines the primary themes discovered through this study along with a representative sample tweet for each.

Table 1 Themes and sample tweets from the qualitative analysis

Themes	Example tweets
Skepticism and distrust in science	
1. Distrust in EUA	Another study shows how well mAbs work - and that C19 is not an emergency justifying vaccine EUAs. mAbs cut Covid severity by 70%.
2. Perceived inefficacy of vaccines	I don't believe C19 variants exist. They are an excuse for the worthless vaccine.
3. Perceived concerns about vaccine safety	If I got a severe case of covid, I would take the monoclonal antibody treatment immediately. But I won't take the mRNA vaccine. Why? I am not an early adopter of new technologies. And there isn't anything wrong with that.
4. Promoting alternative treatments	The only therapies that work for Covid are the alternative ones! The vax doesn't work dummy! Hydroxychloroquine, Ivermectin, zinc, vitamin D and monoclonal antibodies all work!
5. Suppression of treatment and questioning medical authorities	Follow the truth. Not what the CDC says.
Individualism, anti-mandate, and freedom of choice	Individuals should be able to choose what approach they want to deal with the risk from the pandemic.
Politically oriented and/or partisan sentiment	Florida lieutenant governor on mAbs treatments right now talking about how the state of Florida is allowing people to choose whether they want the vaccine or the mAb treatment! Imagine! It's called freedom in America!

We employed fabrication as outlined by Markham (2012) to address ethical considerations and methods needed to protect privacy in reporting our qualitative research results. For privacy and ethical considerations, we removed identifying information (including usernames, dates, times, and links) from each tweet represented in our results. Additionally, tweets were included in both excerpted and paraphrased forms to limit the discoverability of the tweets (Mason & Singh, 2022). Excerpted tweets retain their original wording and are indicated using quotation marks. Paraphrased forms of tweets preserve the meaning of the original text and are indicated in italics. The tweets have been shortened from their original text for further readability. Thus, the tweet examples included in our results may not include references to both vaccines and mAbs. However, the original and complete tweet texts did include both references to mAbs and vaccines (see Figures 1 and 2).

In what follows, we discuss the three major themes that emerged in our analysis of tweets coded as anti-vaccine and report them in their order of prominence in the tweets: (a) skepticism and distrust in science; (b) individualism, anti-mandate, and freedom of choice sentiment; and (c) politically oriented and/or partisan sentiment.

Skepticism and distrust in science

The category of skepticism and distrust in science contained posts expressing a variety of skeptical opinions about the underlying science and authority on monoclonal antibodies and vaccines. Over half the anti-vaccine posts (54%) were categorized in this theme. Overarching sub-themes include a distrust of the EUA of vaccines; allegations of the inefficacy of vaccines and monoclonal antibodies; concerns that vaccines were not safe, had harmful ingredients, or caused serious side effects and that mAbs were preferable; promotion of alternative treatments (such as hydroxychloroquine or ivermectin), or alternatives to vaccines (including

“natural immunity”); and doubts about scientific expertise and the governing bodies that approve and recommend treatments and vaccines.

Distrust in EUA

Several tweets expressed skepticism about vaccine EUAs because they did not believe that the pandemic was an emergency and took issue with vaccine EUAs on the grounds that mAbs provided an effective and alternative treatment. For example, one post in April stated, *How can the C19 vaccines be approved under an EUA? There is NO emergency... Also, Monoclonal antibodies are an adequate and available alternative treatment based on clinical trial data.* Another post stated, *A study shows how well monoclonal antibodies work - and that covid is far from an emergency justifying vaccine EUAs. Antibodies decreased Covid severity by 70%.* The idea that the EUA status of vaccines was not justified appeared in several other posts, with one inaccurately alleging that *it's illegal to make a vaccine if there's an effective treatment protocol.* After the Pfizer-BioNTech vaccine was approved for individuals 16 years and older in August, the individual approval status of vaccines continued to be a source of tension; one post from August questioned how *J&J and Moderna can keep distributing their vaccine under EUA* after the Pfizer-BioNTech vaccine was approved and mAbs were instead *proving to be an effective treatment when used early.*

Perceived inefficacy of vaccines

Another source of distrust was the perceived inefficacy of vaccines, and a general belief that mAbs were more effective. These posts referred to “failing vaccines,” “worthless vaccines,” “so called vaccines,” or that “the vaccines are bullshit.” Many posts demonstrated doubt in the effectiveness of vaccines by pointing to other countries with high vaccination rates. For example, one post claimed, *In Israel, where most of the country is jabbed, hospital admissions among the jabbed are increasing more and more every day. The focus should be on effective treatments, like mAbs, to save lives. The jab ship has sailed and is sinking.* Another alleged that *the most-vaxxed countries have the worst-case numbers.* Several others stated that vaccines were making the pandemic worse. For example, tweets claimed that the emergence of new variants was “due to the vaccine itself,” and that *the virus evolves to evade both current vaccines and monoclonal antibodies.* Alternatively, one tweet expressed the belief that *I don't believe C19 variants exist. They are an excuse for the worthless vaccine.*

Perceived concerns about vaccine safety

Some tweets alleged that vaccines were not safe, had serious side effects, or expressed doubts about “substances in your body.” One tweet questioned, *Why did the government say safe and effective dozens of times?* Others stated, *the vaccine has higher risk associated with it than the virus,* or that it's a “toxic jab” or that *vaccines are making the situation worse.* Multiple tweets also questioned the *long-term side effects of the vaccine, such as bells palsy, blood clots, or Guillain Barre syndrome.* Several tweets showed a preference for mAbs over

vaccines, which were perceived as less risky. For example, one tweet asked rhetorically, why take the risk when mAb treatments are available. Another post showed concern about the newness of mRNA vaccines, but not mAbs: If I got a severe case of covid, I would take the monoclonal antibody treatment immediately. But I won't take the mRNA vaccine. Why? I am not an early adopter of new technologies. And there isn't anything wrong with that. Although both vaccines and mAbs were under EUA, anti-vaccine posts still portrayed mAbs treatment as safer than prevention via vaccine.

Promoting alternative treatments

Some tweets also promoted alternative treatments due to vaccine skepticism, despite a lack of evidence of scientific consensus on their use as COVID-19 treatments. For example, the ambiguous idea of "natural immunity" and that *their immune system will work just fine* were shared. Additionally, mAbs were lumped together with many tweets that promoted what one post called "proven covid fighting therapeutics." These included unauthorized treatments not supported by scientific evidence like ivermectin and hydroxychloroquine¹, as well as vitamins or exercise. Many of these posts alleged that the vaccines were more dangerous than the treatments, stating things like, *Jab might kill, others won't*.

It is also notable that the language used in tweets evolved, perhaps to avoid detection by social media platforms. For example, one tweet referred to the "prophylaxis we're not allowed to discuss."

Suppression of treatment and questioning medical authorities

Many tweets also questioned traditional authorities associated with science and medical recommendations, often accusing them of suppressing the treatment option in favor of vaccination. Multiple tweets questioned the authority and motivation of governing bodies such as the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC). For example, one tweet urged readers to *Follow the truth. Not what the CDC says*. Another inaccurately claimed, *the NIH has been trying to block mAbs*. Several tweets referred to alleged ambiguous entities that were controlling access to COVID-19 treatments. For example, one tweet speculated, without naming anyone, *Who prevented Americans from using mAbs? Who insisted on taking experimental vaccines?*

Many tweets directly implied that Dr. Anthony Fauci, the director of the National Institute of Allergy and Infectious Diseases, was not to be trusted or was withholding monoclonal antibody treatments. For example, one post stated that *Fauci refused to promote monoclonals after great data... Fauci alone decided we'd all stay home waiting for mRNA 'vaccines.'* This tweet and many others used scare quotes to signal disagreement and disapproval of vaccines.

The notion of a government conspiracy against treatment emerged in anti-mandate and anti-government tweets that expressed strident opposition to a strategy (vaccination) that was supported by the government. Tweets regarding a government conspiracy against treatment asserted *The government chose not to save lives* and that *Treatment was denied to hundreds of thousands who died while waiting for the corporate government-forced vaccine solution*.

Similarly, one tweet wondered, *I hope we didn't withhold effective C19 treatments like mAb infusions because those complicate vaccine mandates.*

These conspiracy and suppression tweets support the idea discussed in our introduction that pandemic public health measures have activated individuals who are opposed in principle to government intervention. These tweets almost never included a rationale for preferring treatment over vaccination; in fact, treatment was declared “effective” while vaccines were “unproven” and “experimental,” despite that both treatment and vaccines were in fact experimental at that time. It appears the opposition to a government-mandated vaccine approach *was* the rationale for preferring treatment.

Individualism, anti-mandate, and freedom of choice

Thirty percent of the anti-vaccine tweets were coded with the related themes of individualism, opposition to mandates, and freedom of choice. Many of these focused on individual choice as an overarching principle. They stated that people had a right to choose for themselves how to respond to the pandemic without government mandates. For example, one stated, *No government mandates. You, or your company, can pick any policy you and your children want.* As in that example, some of the tweets did not oppose mandates entirely, only mandates imposed by the government. They stated that mandates imposed by private employers were acceptable.

All tweets coded for the themes of individualism, anti-mandate, and freedom of choice shared an opposition to being told what to do by an authority. Some raised concepts that have been explored elsewhere, such as parents' rights and bodily autonomy (Halle, 2021). These tweets overwhelmingly expressed a preference for a pandemic strategy that would let individuals decide how to respond.

Politically oriented and/or partisan sentiment

Twenty-three percent of anti-vaccine posts were coded as expressing partisan sentiment, and most of them occurred in August as the Governors of Texas and Florida heavily promoted monoclonal antibody treatment beginning that month in response to COVID-19 surges in their states. Anti-vaccine posts expressed support for this focus on therapeutics. Many of these posts commented about politicians, political parties, and their approaches to the pandemic, reinforcing other themes discussed in this paper including anti-mandate sentiment and freedom of choice. For example, one post stated: *Florida lieutenant governor on mAbs treatments right now talking about how the state of Florida is allowing people to choose whether they want the vaccine or the mAb treatment! Imagine! It's called freedom in America!*

Discussion

We began this paper exploring the preference for treatment over prevention and identified the themes that emerged in anti-vaccine Twitter posts. We found that skepticism and distrust in science were the most prominent themes, along with intersecting themes of staunch individualism, freedom of choice, opposition to mandates and government intervention, and political/partisan beliefs. Our results are consistent with ongoing surveys of American adults that find “about half believe that getting vaccinated against COVID-19 is a personal choice and the other half see it as part of everyone’s responsibility to protect the health of others,” with a partisan split in this sentiment (Hamel et al., 2021).

Moving from the identification of anti-vaccine sentiment to countering it remains a challenge for public health communication (Scannell et al., 2021b). Given the intersecting sentiments and political beliefs that contribute to a preference for treatment over prevention, the challenge of preventing vaccine hesitancy from solidifying into anti-vaccine sentiment is complex. However, no consensus exists about the source of this challenge or the most effective means for resolving it (Dubé et al., 2021). Little is known about “modifying the beliefs” of people who are hesitant about vaccines or skeptical about science (Rosenbaum, 2021). The comprehensive Health Information Persuasion Exploration (HIPE) framework calls for evidence-based design principles to advance “knowledge about the characteristics of the intervention and appropriate implementation conditions” (Scannell et al., 2021b). Building on this framework, we suggest several promising avenues for message design and recommend testing them to understand their effectiveness in countering the preference for treatment over vaccines in anti-vaccine messaging, including on which media platforms and to which audiences.

Countering anti-vaccine and anti-science sentiment

The following suggested messaging approaches can be tested in online surveys, paid and organic social media, and real-world settings. The most effective messaging strategies that emerge from testing can then be disseminated and used by local influencers and in social media.

- (1) Design and test messages that unmask anti-vaccine techniques and uncover “impossible expectations.”

Experiments conducted by Schmid and Betsch (2019) revealed effective techniques for countering anti-vaccine and anti-science arguments to blunt their impact on vaccine hesitant individuals. Schmid and Betsch (2019) concluded that unmasking the techniques used in anti-vaccine arguments is the most promising “universal strategy” for countering these arguments. Unmasking means explaining or uncovering the technique being used that creates “the appearance of a strong argument when there is none”. For example, to counter the claim that mAb treatment is preferred because vaccines aren’t 100% safe, science and public health advocates “can uncover the technique of impossible expectations—because no medical product can ever guarantee 100% safety,” including the mAb treatment itself as well as everyday items like aspirin (Schmid & Betsch, 2019). Unmasking the technique and putting the topic into context is a way to potentially mitigate the influence of the anti-vaccine message

(Dubé et al., 2021; Schmid & Betsch, 2019). Schmid and Betsch's (2019) experiments also revealed the importance of responding: when anti-vaccine and anti-science arguments were presented and not countered by pro-vaccine arguments, the anti-vaccine arguments had the strongest effect on the audience.

Notably, unmasking techniques can avoid the pitfalls of the "backfire effect" (Nyhan & Reifler, 2015) in that unmasking need not rely on restating myths or inaccurate information in a way that might reinforce them, instead focusing on the source and/or technique being used to manipulate. For example, anti-smoking campaigns have used unmasking techniques to expose young people to the manipulative practices of tobacco companies in targeting their age group (Farrelly et al., 2005). These unmasking campaigns avoid overt and directive messages that tell teens not to smoke and instead use stark facts and exposés of manipulative marketing practices. Our study revealed frequent use of "impossible expectations" arguments in anti-vaccine posts claiming that treatment was better than prevention. These posts argued that because vaccines were not 100% effective and/or under EUA, treatment was preferable, while not mentioning that treatment was also not 100% effective and under EUA as well (as discussed earlier, both mAb treatment and vaccines were under EUA at the time of our study, and mAb treatment could not be relied upon as 100% effective or available to every patient). Unmasking could hold promise for countering the treatment versus prevention argument. The World Health Organization Regional Office for Europe (2017) has used unmasking techniques to train scientists to counter anti-vaccine arguments in public. We recommend design and testing of messages that unmask anti-vaccine arguments, including an assessment of whether the backfire effect (reinforcing inaccurate messaging) was avoided.

- (2) Design and test vaccine messages that use colloquial, values driven, emotionally compelling language to appeal to individuals across a wide political spectrum.

A second promising approach comes from the systematically researched and widely used messages that use values-driven, colloquial language rather than academic or scientific language to communicate about health to individuals across the political spectrum (RWJF, 2010). These messages prime audiences about the connection to values they hold or messages they already believe to make a message more credible, for example, by focusing on personal responsibility. While this messaging research dealt with communicating about Social Determinants of Health and not vaccines, the findings about values-driven, colloquial language resonating with individuals across the political spectrum are a promising avenue for testing vaccine messaging, given the partisan split in vaccine sentiment discussed earlier (Kirzinger et al., 2021). The RWJF findings about connecting to values such as individual responsibility and decision-making (RWJF, 2010), which is a theme that also emerged in the anti-vaccine tweets in our study, suggests that the RWJF insights may be relevant to vaccine messaging. Given the importance of individualism revealed in our study, in the Hamel et al. (2021) survey findings cited earlier, and in the RWJF research, messaging focused on personal benefits as opposed to collective outcomes for vaccinating should be explored and tested.

In the time period since our study was conducted, several developments have made the treatment versus prevention preference even more important to address. First, the effectiveness and continued availability of mAb treatment became less certain due to new variants, making prevention through vaccination more critical (Jewett et al., 2021). Second, the attention to treatment versus prevention in public discourse has continued, including statements by public figures that received widespread media coverage. For example, a

prominent professional athlete has repeatedly conflated treatment and prevention in widely reported public statements, saying that he believed he was immunized because he was “taking ivermectin, zinc, and monoclonal treatments” and that he believed “strongly in bodily autonomy and the ability to make choices for your body” (Demovsky, 2021; Li, 2021). These themes—promoting alternative treatments, focusing on individualism and choice, and conflating treatment and prevention—are examples of the narratives examined in our study appearing in widespread popular discourse, well beyond the Twitter analysis we conducted. This continued attention underlines the importance of monitoring public and social media discourse and designing messages that navigate the treatment versus prevention dynamic.

Limitations

There were several limitations related to social media data availability. First, anti-vaccine posts became more difficult to find during the period of data collection (March 1 to August 31, 2021). While the vaccine query (Figure 1) does include a variety of words related to vaccines, evidence suggests that social media users have adapted their language to circumvent detection and enforcement from social media platforms (Collins & Zadrozny, 2021). In addition, social media platforms have taken further action to limit the spread of COVID-19 mis- and disinformation. On March 1, 2021—the same day we began our data collection—Twitter introduced a labeling and strike system for Twitter posts that shared COVID-19 mis- and disinformation (Twitter Safety, 2021). Therefore, we have likely undercounted anti-vaccine posts in our data sample.

Second, our findings are not generalizable to understand the prevalence of anti-vaccine posts on Twitter overall. We structured the data collection method to search for references to mAbs and then vaccines, and therefore did not collect posts that only discussed vaccines.

Third, we limited posts to those that originated in the US. This was a practical decision as “mab” and its variations brought in too much extraneous data unrelated to monoclonal antibodies. Additionally, the EUA only applied to the US. Last, our analysis was limited to posts on Twitter. Twitter users are not representative of the U.S. overall. They tend to be younger, more highly educated, wealthier, and more likely to identify as Democrats than the public overall (Pew Research Center, 2021).

Conclusions

The tension that emerged between COVID-19 treatment and prevention during the period of our study revealed deeper challenges for public health messaging that will continue to be relevant in public health emergencies. Our findings reinforce the need for public health practitioners to monitor public and social media discourse and adopt messaging that navigates the strongly held beliefs and themes that influence the adoption of preventive strategies, including the preference for treatment examined in this study. The themes revealed in our study, including skepticism, distrust in science, and opposition to government intervention, tap into deep-seated cultural forces and partisan beliefs in America related to individualism and freedom. As such, countering them must involve careful attention to message design that

addresses the preference for treatment over prevention, capitalizing on promising evidence about effective approaches and testing them. Effective approaches include unmasking sources and using colloquial, values driven, emotional language. Providing trusted messengers with tested, carefully designed messaging holds promise for increased adoption of preventive strategies such as vaccines by addressing the preference for treatment.

Notes

- 1) Shortly after the increase in promotion of ivermectin as an alternative treatment in August 2021, poison control centers saw a sharp increase in calls and severe illness as a result of people taking livestock or animal formulations of the drug (CDC Health Alert Network, 2021; Mississippi State Department of Health, 2021; Romo, 2021; Temple et al., 2021).

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