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Anti-intellectualism amid the COVID-19 pandemic: The discursive elements and sources of anti-Fauci tweets

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Abstract

Anti-intellectualism (resentment, hostility, and mistrust of experts) has become a growing concern during the pandemic. Using topic modeling and supervised machine learning, this study examines the elements and sources of anti-Fauci tweets as a case of anti-intellectual discourse on social media. Based on the theoretical framework of science-related populism, we identified three anti-intellectual discursive elements in anti-Fauci tweets: people-scientist antagonism, delegitimizing the motivation of scientists, and delegitimizing the knowledge of scientists. Delegitimizing the motivation of scientists appeared the most in anti-Fauci tweets. Politicians, conservative news media, and non-institutional actors (e.g. individuals and grassroots advocacy organizations) co-constructed the production and circulation of anti-intellectual discourses on Twitter. Anti-intellectual discourses resurged even under Twitter's content moderation mechanism. We discuss theoretical and practical implications for building public trust in scientists, effective science communication, and content moderation policies on social media.

Keywords

anti-intellectualism, populism, supervised machine learning, topic modeling, Twitter

1. Introduction

Anti-intellectualism, defined as the generalized dislike and distrust of experts (Motta, 2018), has become a major obstacle to public compliance with health policies and behaviors recommended by experts and governments (Merkley and Loewen, 2021). In the COVID-19 context,

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anti-intellectualism, measured by the level of distrust in experts (e.g. doctors, scientists, economists) was associated with low levels of risk perceptions and preventive behaviors, such as social distancing, mask usage, and health information acquisition (Merkley and Loewen, 2021). Social media are platforms where anti-intellectual discourse is produced and spread. Research has found many tweets expressing distrust of scientists, especially in response to posts from medical/health experts or the Centers for Disease Control and Prevention (CDC) and other authoritative health organizations (Batova, 2021; Bonnevie et al., 2021). Exposure to anti-intellectual discourse online influences the public's trust in information and recommendations from experts (Merkley and Loewen, 2021).

Despite the propagation of anti-intellectualism on social media and its negative consequences, current studies pay unbalanced attention to the source and outcome of anti-intellectualism. Most studies have focused on the outcome side. That is, the anti-intellectual attitudes held by the public (Merkley, 2020; Motta, 2018). Fewer studies explored the sources of anti-intellectualism on social media, although various studies have found that social media debates about scientific issues like climate change (Pearce et al., 2019), anti-vaccination (Bonnevie et al., 2021), and conspiracy theories (Mahl et al., 2021) expressed similar anti-intellectual sentiment. Researchers have often treated anti-intellectualism as a component of populist discourse (Merkley and Loewen, 2021). The shortage of analysis about anti-intellectualism on social media leads to two limitations in current anti-intellectualism research. First, the elements (i.e. underlying themes) of anti-intellectual discourse on its own, rather than as a component of populist discourse, are less clear. Second, there is minimal research investigating non-institutional sources of anti-intellectualism on social media. Early analysis of the source of anti-intellectualism focused on institutional sources, highlighting the role of politicians or political parties in providing anti-intellectual discourse in the public sphere (Hofstadter, 1963). However, in today's media landscape, social media has empowered non-institutional actors, individuals and grassroots advocacy organizations, to create and spread anti-intellectual voices in the public sphere.

The current study seeks to understand the formation and construction of anti-intellectualism on Twitter. We consider anti-intellectualism a communication style and focus on its two aspects: (1) the discursive elements that form the expressed anti-intellectual discourses and (2) the sources of different discursive elements of anti-intellectual discourse on Twitter. Drawing on conceptualizations of science-related populism (Mede and Schäfer, 2020), we propose that anti-intellectual discourse will be composed of three elements: people-scientist antagonism, delegitimizing the motivation, and the knowledge of scientists. Based on the networked model of science communication by van Dijck and Alinejad (2020), we propose that both institutional actors (politicians and news media) and non-institutional actors (individuals and grassroots advocacy organizations) will collectively construct anti-intellectual discourse on social media.

We provide empirical evidence to support our theoretical propositions by analyzing a case of anti-intellectual discourse on Twitter. Compared with other mainstream social media (e.g. Facebook, YouTube), Twitter has strength in disseminating information across online networks quickly (Kwak et al., 2010). Various studies have shown the propagation of misleading information, anti-science information, and conspiracy theories on Twitter (e.g. Mahl et al., 2021; Rao et al., 2021). Twitter also claims to have content moderation policies to curb the spread of conspiracy theories and COVID-19 misinformation (Twitter, 2021). We monitor tweets expressing extreme distrust of, opposition to, and hatred of Anthony Fauci, the director of the National Institute of Allergy and Infectious Diseases ("anti-Fauci tweets" hereafter, e.g. *#firefauci, #arrestfauci, #faucifraud*), posted during the pandemic. As a spokesperson for science, Fauci delivered scientific information to the public and handled public anxiety during national health crises, such as the HIV/AIDS epidemic in the 1980s, the H1N1 Swine flu outbreak in 2009, and the Ebola virus outbreak

in 2014. In January 2020, Fauci became a member of the White House Coronavirus Task Force (Santucci, 2020) and the de facto spokesperson for the task force due to his expertise and experiences with disease outbreaks. He has also advocated public health measures (e.g. social distancing, face covering) in media briefings and interviews.

Many prominent political figures, including former US President Donald Trump, publicly criticized Fauci and opposed his suggestions on several occasions (Evans and Hargittai, 2020). Trump retweeted his supporter's tweet saying *Fauci should be fired* and a video suggesting Fauci misled the public about the efficacy of hydroxychloroquine. Several Republican politicians have also expressed doubts or criticisms against Fauci's public health measures, policy suggestions, and scientific research on Twitter (Alba and Frenkel, 2020). Criticisms of Fauci continue to circulate on Twitter, providing digital-trace data for us to observe the dynamics of anti-intellectual discourse in the public sphere.

2. Anti-intellectualism, populism, and science-related populism

Hofstadter (1963) broadly defined anti-intellectualism as "a resentment and suspicion of the life of the mind and of those who are considered to represent it; and a disposition constantly to minimize the value of that life" (p. 7). Hofstadter identified three specific types of anti-intellectualism in American cultural history: Anti-rationalism (denial of the value of critical thinking), unreflective instrumentalism (disdain for ideas that do not provide immediate practical value), and anti-elitism (mistrust and dislike of elites) (Rigney, 1991). Each type links to a distinctive social-structural origin: Anti-rationalism originates from religious structures; unreflective instrumentalism relates to the commercial structures in American capitalism; and anti-elitism connects with populist political structures and movements (Rigney, 1991). Our study focuses on the anti-elite form of anti-intellectualism, which expresses resentment, hostility, and mistrust of experts (Merkley, 2020; Motta, 2018). Experts with superior knowledge, academic training, or credentials in a subject matter are often considered the elite class by anti-intellectuals (Motta, 2018). Anti-intellectuals consider that experts merely apply intellect to benefit themselves or the upper class (Rigney, 1991). Anti-intellectuals also discredit the knowledge of experts and believe that common sense, personal experience, or intuitions of ordinary people can replace expertise (Hofstadter, 1963).

Political populism is one root of anti-intellectualism (Hofstadter, 1963; Merkley, 2020; Motta, 2018). Populist movements and politicians often have anti-intellectual tendencies (Rigney, 1991). In a survey study, Merkley (2020) found that exposure to populist discourse was associated with anti-intellectual sentiment and was further linked to skepticism toward scientific issues that have already reached expert consensus (e.g. anthropogenic climate change). Motta (2018) showed that support for populist movement events and anti-expert politicians predict anti-intellectualism. However, populism and anti-intellectualism are conceptually different for two reasons. First, populism is anti-elitism *and* anti-pluralism (Müller, 2016). Populism emphasizes that society comprises two homogeneous and antagonistic groups: the pure people versus the corrupted elites; politics should express the general will of the people (Mudde, 2017). The elites are corrupted; "the people"—an imagined homogeneous group of ordinary people—are morally superior and should fight against elites (Müller, 2016). Populists are the exclusive representatives of common people, ignoring that the latter are composed of various groups, such as experts and racial minorities (Müller, 2016). Second, although anti-intellectualism and populism are anti-elite, populism is not necessarily anti-expert, especially when populists do not consider experts as the elite class (Merkley and Loewen, 2021; Rigney, 1991).). For example, intellectuals who advocated social reforms received public acceptance during the US Progressive era (Rigney, 1991).

Anti-intellectualism has a closer conceptual relation with science-related populism than political populism. Unlike political populism, science-related populism (Mede and Schäfer, 2020) is a distinctive type of populism targeting academic elites. Science-related populism is "a set of ideas suggesting that the virtuous 'ordinary people' and their common sense—and not allegedly corrupt academic elites—should determine what is deemed 'true knowledge,' how it is produced, and on which topics scientific research should focus" (Mede and Schäfer, 2020: 212). The "ordinary people" are an imagined, homogeneous group of people who share their values and "epistemological sense"; while the elites are the academic elites, such as scientists, researchers, experts, universities, and research institutions, who have authority to make science-related decisions (Mede and Schäfer, 2020: 480–481).

3. Three elements of anti-intellectual discourse

We expect that science-related populism and its components overlap with the key elements of the anti-intellectual discourse. Science-related populism has three key components: people-scientist antagonism, science-related decision-making sovereignty, and truth-speaking sovereignty (Mede and Schäfer, 2020: 473). Although science-related populism and anti-intellectualism both distrust and dislike academic elites, decision-making sovereignty and truth-speaking sovereignty are prerequisites for science-related populism conceptually (Mede et al., 2022). Therefore, we adapted from science-related populist components and proposed three discursive elements as the key components of anti-intellectual discourses: people-scientist antagonism, delegitimizing the motivation, and the knowledge of scientists.

People-scientist antagonism

The core component of science-related populism is people-scientist antagonism: the virtuous people versus the unvirtuous academic elites (Mede and Schäfer, 2020). Similarly, anti-intellectuals see a broader sense of people-elite conflict. They believe that elites are self-seeking, remote from the life of ordinary people, and thus disregard their true benefits and needs (Rigney, 1991). The people-scientist antagonism provides an element that forms anti-intellectual discourse in two ways. First, there is a moral *juxtaposition* between people and scientific experts. For example, people are good and innocent, while scientific experts are evil and ignore the common people (Mede and Schäfer, 2020). Second, the *consequences* of relying on scientists' authority and scientists create ordeals and trouble for common people. For example, Oliver and Rahn (2016) found that blaming experts for unfortunate circumstances is one of the lasting themes in populist discourse by candidates from the 2016 US presidential election. Overall, the people-scientist antagonism involves anger, hostility, opposition, or frustration toward scientists due to the perception that scientists have misaligned goals and priorities or cause problems for ordinary people. We expect to find a strong presence of people-scientist antagonism in anti-intellectual discourse, but given that we know little about how much science-related populism constructs anti-intellectual discourse, we ask:

RQ1. How and to what extent is people-scientist antagonism present in anti-Fauci tweets?

Delegitimizing the motivation of scientists

The second component of science-related populism is science-related decision-making sovereignty, meaning the authority to decide the research agenda, funding, and research designs (Mede and Schäfer, 2020). Science-related populism alleges that academic elites illegitimately hold

science-related decision-making sovereignty; rather, ordinary people should have the authority to decide what will be studied, why, and how the subject should be studied (Mede and Schäfer, 2020). Science-related populists are thus skeptical about the motivation of scientists. Science-related populists believe that scientists have a hidden agenda that only maximizes their interests or political influence by utilizing their knowledge and expertise rather than benefiting the public. In anti-intellectual discourse, a preoccupation with the extrinsic motives of scientists is expected to be a predominant form of populist appeals for decision-making sovereignty.

Recent studies using US national surveys show that distrust in scientists correlates with challenges to their motivations in making science-related decisions. McLaughlin et al. (2021) found that the American public commonly believed political motives decided how scientific research about COVID-19 was conducted and that the objectivity of scientific research was questionable. They further showed that individuals who held these beliefs were likely to distrust scientists. In another study, Evans and Hargittai (2020) found that people who distrust scientists believed scientists did not represent the public's values. Thus, we expect that delegitimizing the scientists' motivations will be an element of anti-intellectual discourse. This element challenges the *motivation* of scientists and questions what scientists should research, how, and why certain subjects should be studied.

RQ2. How and to what extent is the discursive element that delegitimizes the motivations of scientists present in the anti-Fauci tweets?

Delegitimizing the knowledge of scientists

Truth-speaking sovereignty, the third component of science-related populism, means the authority to make true claims about scientific issues (Mede and Schäfer, 2020). Science populists believe ordinary people should have the authority of truth-speaking sovereignty that typically belongs to scientists; scientists do not have the authority to determine what constitutes valid knowledge because scientists rely on theories, models, and research methods that are disconnected from the real world (Mede and Schäfer, 2020).

Similarly, recent studies show public distrust of scientists is associated with uncertain and inconsistent scientific information on COVID-19. Kreps and Kriner (2020) conducted longitudinal surveys and found that COVID-19 predictive models and findings from scientific research often showed contradictory results due to limited data at the beginning of the pandemic. As a result, the public expressed distrust of scientists and less support for science-based policies. Evans and Hargittai (2020) also showed that knowledge-based distrust was prominent among Americans who were skeptical of scientists, particularly among the non-Democrats and Trump supporters. Hence, we expect to find delegitimizing scientists' knowledge as another element of anti-intellectual discourse. This element questions the *knowledge* of scientists and accuses them of providing inconsistent or incorrect information to the public.

RQ3. How and to what extent is the discursive element that delegitimizes the knowledge of scientists present in the anti-Fauci tweets?

Social media users' engagement, such as retweets, likes, and comments, tend to reinforce the production and circulation of anti-intellectual discourse on social media. Driven by the business model of social media platforms, content recommendation algorithms tend to propagate misinformation that elicits conflicts, disagreement, or emotions (van Dijck and Alinejad, 2020). Compared

with true news, false news often elicited fear, disgust, and surprise and was more likely to be retweeted by human users (Vosoughi et al., 2018). Following the platform logic, anti-intellectual discourses—which express aversion, hostility, conflicts, and disagreement between the public and scientists—are likely to capture user attention on social media platforms. Although Twitter (2021) claimed that its content moderation mechanisms had removed many accounts closely related to conspiracy theories and COVID-19 misinformation, it is unknown how distinct types of anti-intellectual discursive elements remain and circulate on Twitter. Considering the joint influence of content recommendation and content moderation algorithms by Twitter, we ask:

RQ4. How has the total number of tweets and retweets of each type of anti-intellectual discursive element changed during the pandemic*?*

4. The constructions of anti-intellectual discourses on Twitter

van Dijck and Alinejad (2020) proposed a networked model to explain the ebbs and flows of scientific information on social media during a public health crisis based on observation of information flows among different social actors. This model highlights two types of actors—institutional and non-institutional—and their role in building public trust in scientific experts on social media. The institutional actors include scientists (representing knowledge-making institutions), politicians (representing policymaking institutions), and news media (representing sense-making institutions), and the non-institutional actors are ordinary citizens and advocacy groups that do not officially represent an institution but have mobilizing power (van Dijck and Alinejad, 2020). They suggest that the production and circulation of scientific information from politicians, news media, scientists, and non-institutional actors can enhance and undermine public understanding of true knowledge in science.

Similarly, institutional and non-institutional actors may individually and collectively construct anti-intellectual social media discourse. We expect that politicians *amplify* anti-intellectual discourse on Twitter. In the early institutional analysis by Hofstadter (1963), left- and right-leaning politicians both provided social origins for anti-intellectualism in American history. They strategically used anti-elite discourse in election campaigns to win voters, capitalizing on the public's negative sentiment toward experts (Motta, 2018; Oliver and Rahn, 2016). During the pandemic, most criticisms of COVID-19 models came from Republican political elites, but a few Republican governors (such as Governors Baker from Massachusetts, DeWine from Ohio, and Hogan from Maryland) endorsed pro-science public policies (Kreps and Kriner, 2020). When political elites tweeted their stances on scientific issues, their tweets often generated spikes of public attention on scientific issues, placing politicians at the center of conversations. Analyzing over 350 million COVID-19 tweets, Durazzi et al. (2021) found that tweets from scientists received considerable numbers of retweets at the beginning of the pandemic, but the number gradually decreased as tweets from political elites increasingly gained more retweets than scientists. Given the findings, we hypothesize:

H1. Anti-intellectual tweets from politicians will spark more retweets than those from news media and the non-institutional actors on Twitter.

In addition to political elites, news media, particularly conservative news media and far-right populism media, are institutional sources that influence the production and circulation of anti-intellectual discourses on social media. Although anti-intellectual discourse is likely to appear in both left- and right-wing news media, Yan et al. (2021) found that science skeptics were mostly associated

with far-right populism websites. The far-right media often claim themselves as the alternative media, which are "corrective of 'traditional,' 'legacy,' or 'mainstream' news media in a given sociocultural and historical context" (Holt et al., 2019: 862). Studies have also found that reliance on conservative media like Fox News as a source of COVID-19 information was associated with fewer concerns about COVID-19 risk and more distrust of scientists (Clinton et al., 2021; Dhanani and Franz, 2020).

Conservative or far-right news media are likely to construct discourses on social media in two ways. First, such news media can directly post anti-intellectual tweets. For example, Boberg et al. (2020) showed that far-right news media in Germany were a generator of pandemic populism by posting Facebook content that was anti-establishment and against fact-based news covered by mainstream media. Second, social media users cite or share content from the websites of conservative or far-right alternative news media. For example, Bovet and Makse (2019) analyzed 171 million tweets related to the 2016 US presidential election and found that 30 million tweets contained a link to news outlets; 25% of tweets included a link to fake or extremely biased news. Based on empirical findings, we hypothesize:

H2. Conservative news media will be more likely to post anti-intellectual tweets than liberal news media.

H3. Anti-intellectual tweets will be more likely to cite conservative news media (by including a URL link to such news media) than liberal news media.

Social media has empowered non-institutional actors to influence the production and circulation of anti-intellectual discourse. Non-institutional actors directly post anti-intellectual discourse on social media. A study of 115 million tweets from accounts located in the United States revealed that anti-science tweets came principally from individual Twitter users, particularly strong partisan identifiers from the Southern and Northwestern states (Rao et al., 2021). In general, most Twitter accounts belong to individual people, with only around 30% of accounts representing organizations (McCorriston et al., 2015). Non-institutional actors likely produce the most anti-intellectual tweets.

H4. Most anti-intellectual tweets will come from non-institutional actors.

In addition to posting tweets, the contents of the tweets from political elites tend to influence tweets from non-institutional actors and conservative media. Previous experiments showed that criticisms of scientists and COVID-19 models from political elites decreased perceptions of pandemic risk (Grossman et al., 2020) and trust in science, particularly for partisan identifiers (Kreps and Kriner, 2020). An analysis of US news coverage of COVID-19 found that news media cited politicians more frequently than scientists (Hart et al., 2020). Therefore, it is likely that the discursive elements from the anti-Fauci tweets by non-institutional actors bear a resemblance to those by politicians and news media outlets. We ask:

RQ5. How do discursive elements in anti-Fauci tweets differ by the type of actor?

5. Materials and methods

Data collection

We used four hashtags: #firefauci, #arrestfauci, #faucithefraud, and #faucifraud to collect our data (anti-Fauci tweets). Hashtags provide a tool for mobilizing public attention to social movements and

indicating public framing of real-life events on Twitter (Lindgren, 2019). We used Brandwatch, a social monitoring tool to identify the four hashtags. Specifically, we monitored tweets that include "fauci" from January 2020 to September 2021 and found that the four hashtags were the most retweeted during the period. We excluded some hashtags (such as #maga, #scamdemic in Supplemental Table S1) that co-occurred but did not directly express anti-Fauci sentiment to reduce irrelevant tweets. We collected 28,690 tweets including at least one of the four hashtags posted by accounts based in the United States between January 1, 2020 and September 30, 2021. We retrieved the data on October 21, 2021. We conducted an initial data cleaning by removing tweets that include contrasting hashtags that support Fauci (such as "SaveFauci," "FauciHero," and "KeepFauci") or against Trump (such as "TrumpLies," "WorstPresidentEver," and "TrumpIsALoser"), because anti-Trump tweets supported Fauci. We also removed tweets that received no retweets and retained 7960 tweets for further analysis.

Identify anti-intellectual discursive elements

We used an inductive and deductive approach to identify anti-intellectual discursive elements. An inductive analysis using unsupervised learning methods is often the first step in extracting concepts of theoretical interest from texts (Grimmer et al., 2022). We first conducted structural topic modeling (STM) (Roberts et al., 2014), an unsupervised machine learning (SML) method to preliminarily examine (1) the presence of the three elements we proposed may exist in the data and (2) how anti-intellectual discursive elements might be expressed through the text data.[1] Please see the Supplemental Material (pp. 2–9) for the procedures and results of STM. Since topic modeling assumes the categories of texts are unknown, treating topics as proposed discursive elements violates the assumption and may produce inaccurate results (Nelson et al., 2018). Therefore, we used SML, a deductive approach for measuring each element in anti-intellectual discursive elements. We built a data labeling instruction based on the definition of each discursive element and the topic modeling results. Then, we employed coders from Amazon Mechanical Turk (a crowdsourcing platform) to manually label 3000 randomly selected tweets into one of the five labels: (1) people-scientist confrontation, (2) question the motivation of Fauci, (3) question the knowledge of Fauci, (4) support Fauci, and (5) none of the above categories. Supplemental Table S3 shows the definitions and examples of each label in the instruction. Finally, we built a multi-classification model using the value of term frequency–inverse document frequency (TF-IDF) of each word and the proportion of each topic from STM. We explained the details of SML steps in the Supplemental Material (pp. 10–13). The results of SML showed how and to what extent anti-intellectual discursive elements were expressed in the anti-Fauci tweets (RQ1–RQ3). To answer RQ4, we plotted the trendline to examine how the number of retweets of anti-Fauci tweets that included each discursive element varied over time.

Identify sources of anti-intellectual discursive elements

We first automatically coded Twitter accounts into one of four categories: politicians, news media, non-institutional actors, and others. The news media category includes organizational accounts that mainly produce news for the public, including mainstream media, alternative media, online news websites, or news blogs. The category of non-institutional actors includes (1) individual Twitter users who are not politicians and (2) organizational accounts that mainly orchestrate advocacy work. Supplemental Table S5 shows the steps in automatic coding. A post hoc manual validation based on 237 randomly selected accounts (10% of total accounts) showed that the agreement between human coding and automatic coding was 98%. The validation indicated that the automatic

coding produced reliable coding results. We compared the average retweets of tweets by politicians, news media, and non-institutional actors using the Mann–Whitney tests (H1). Using a fact-checking tool (https://mediabiasfactcheck.com), we then manually inspected partisan bias and source credibility of news accounts on Twitter (H2) and the domain names of URLs that anti-intellectual tweets contained (H3). We manually labeled media bias and the source credibility of 26 domain names (from the 15 most common and the 15 most retweeted domain names). Finally, we performed a Chi-Squared test to compare the total volume of tweets (H4) and the discursive elements tweeted by politicians, news media, and non-institutional actors (RQ5).

6. Findings

Anti-intellectual discursive elements present in anti-Fauci tweets (RQ1–RQ4)

The SML results show that the most common element was delegitimizing the motivation of scientists (n = 2711, 40%). Tweets in this category alleged that Fauci and other scientists (e.g. Deborah Birx, a physician and White House Coronavirus Response Coordinator) were corrupt and had hidden political agendas. They also mentioned Bill Gates, Democratic politicians (such as Hilary Clinton), and conspiracy theories, such as Big Pharma, Scamdemic, Plandemic, and QAnon (Supplemental Figure S3B). Example tweets are: "Fauci is driven by big Pharma, Greed and Profit. He let millions die with AIDS because he wanted to tout his Big Pharma agenda. Now he's pushing his vaccine agenda #FauciTheFraud," "Dr. Fauci, Gates, Clinton and billions to be made in vaccines. Fauci paid $3.75 Million to Wuhan to develop Covid19. #FireFauci/Birx," and "#Qanons #FireFauci he has known all along and has the most to gain! #WWG1WGA #GreatAwakening."

Next was people-scientist confrontation (n = 1531, 23%). Tweets in this category expressed resistance to COVID-19 policies (e.g. shutdowns and mask mandates) and the opposition between Fauci and the Americans (Supplemental Figure S3A). Example tweets are: "You need to #FIREFAUCI He is hurting YOU and AMERICA #ArmyForTrump #Trump2020," "Wake Up America!! #CDC is NOT a govt Agency! Why are we even following their guidelines at all," and "As elites profit from 'pandemic' in very huge ways . . . rest of America suffers. No job, no food, no necessities for many households."

Delegitimizing the knowledge of scientists (n = 1184, 18%) was the least common element. Tweets in this category alleged faulty evidence behind mask policies, hydroxychloroquine, and skepticism toward prediction models (Supplemental Figure S3C). Example tweets are: "Dear Trump, it's time to #FireFauci. Fauci's Follies: US Coronavirus Field Hospitals Shut Down—Most Without Treating a Single Patient—Because Garbage Models Used by US 'Experts,'" "New #Hydroxychloroquine Study Vindicates President Trump and Should End Dr. Fauci's Career at NIAID and in Medicine #FireFauci #CDC," and "scientific models were wrong! #FireFauci Discharges Outpace Hospitalizations in New York for 4th Straight Day."

In addition to tweets in the three anti-intellectual discursive categories, we found that the remaining tweets did not belong to any three discursive elements (Supplemental Figure S3D). For example, we found tweets that support Fauci, express no clear attitudes about Fauci (e.g."The #firefauci hashtag was trending"), or simply mention "#firefauci" with verbal attacks on scientists (e.g. "You lying sack of poo! #FireFauci" "This little nugget popped up just now . . . #FireFauci") or politicians (e.g. "Joe lied & people died! #FireFauci"). Many tweets also used anti-Fauci hashtags to promote far-right radio shows, podcasts, YouTube videos, and news programs. For example, a user tweeted "Mark Levin Show PODCAST Friday 8/13/2021 . . . #TheGreat #Afganistan #BidenAdministration #coronavirus #FireFauci #masks #inflation #unemployment

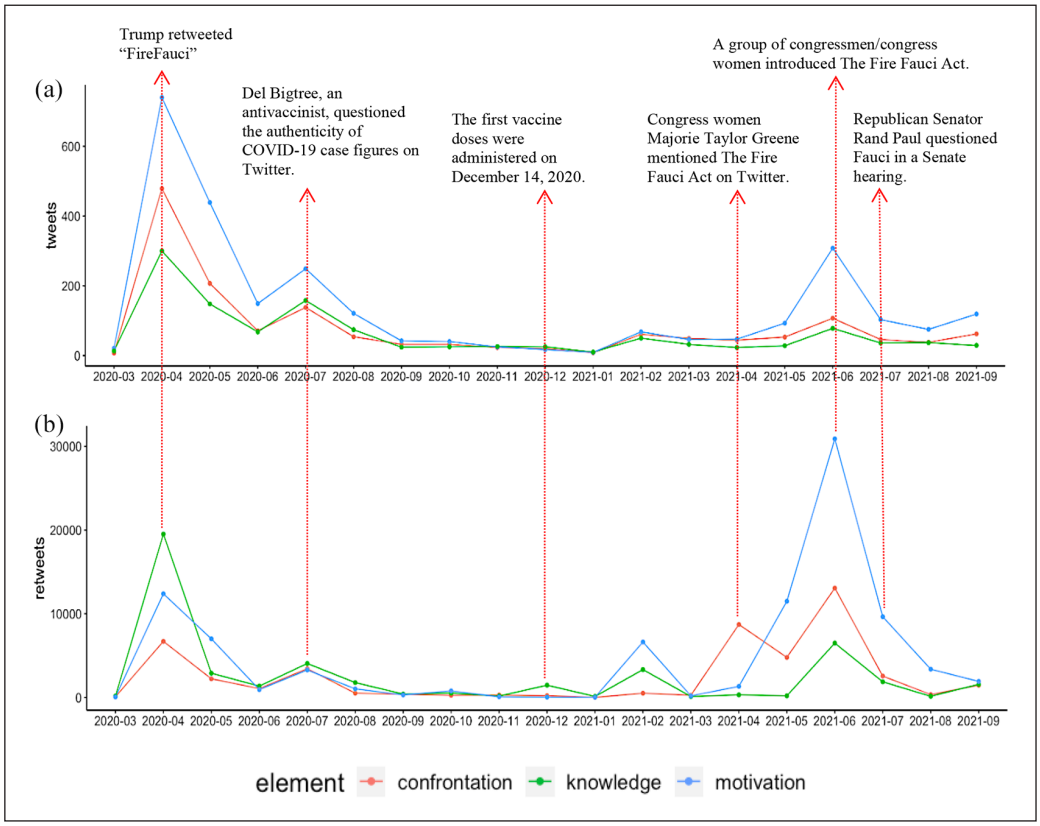

Figure 1. The presence of three anti-intellectual discursive elements over time.
Note. The labels indicate the major events described through the most retweeted tweets in the month.

#teachersunions #reopenourschools #1776patriots #silent #majority #AmericaFirst #trump #BackToSchool." Such tweets were categorized in the "other" category ($n = 1305$, 19%).

We examined whether the retweets of anti-Fauci tweets that included three anti-intellectual discursive elements increased over time (RQ4). Although the volume of tweets that delegitimized motivation was consistently the most common (Figure 1a), the pattern of retweets of the three discursive elements differed over time (Figure 1b). Retweets of the three discursive elements first spiked in April 2020, when Trump retweeted a message from a supporter who questioned Fauci's early judgment and advocated for firing Fauci (Orr and Levine, 2020). Tweets that delegitimized the knowledge of scientists received the highest retweets then. The volume of retweets for all three discursive elements sharply decreased from May 2020 until February 2021, when Fox News reporter, Lisa Boothe, criticized Fauci for exploiting the pandemic for his benefit. Retweets that delegitimized the motivation of scientists received a growing number of retweets from April 2021 and peaked in June 2021, when Republican politicians proposed the so-called Fire Fauci Act.

The construction of anti-intellectual discourses (H1–H4, RQ5)

We found a total of 2685 accounts posted 5425 tweets that included at least one of the three anti-intellectual discourses (excluding tweets in the "other" category). Politicians ($n = 47$, 2%), news media ($n = 9$, 0.3%), and non-institutional actors ($n = 2308$, 86%) accounted for nearly 89% of

total accounts. Six accounts were coded as "other" (0.2%). They included religious groups (e.g. catholicisourco), bots, and local community organizations (e.g. Coal Region Canary). We dropped 315 accounts that were suspended by Twitter. We hypothesized that tweets from politicians spark more retweets than tweets from news media and non-institutionalized actors (H1). Tweets from politicians generated a greater number of retweets (*Mean* = 1489, *Median* = 34, *SD* = 6254, *Min* = 1, *Max* = 41,987) than the tweets from news media (*Mean* = 15, *Median* = 4, *SD* = 24, *Min* = 1, *Max* = 76). The difference was significant in a Wilcoxon test to compare two samples that were not normally distributed ($W = 293.5$, $p = .01$). Tweets from politicians gained significantly more retweets than non-institutional actors (*Mean* = 43, *Median* = 2, *SD* = 450, *Min* = 1, *Max* = 14,481; $W = 84{,}868$, $p < .001$). This finding supported H1.

We hypothesized that more conservative news media than liberal news media would post anti-intellectual tweets (H2). We identified nine news outlet accounts. Six were conservative news outlets (see Supplemental Table S6 for full information). These include three far-right alternative news media with questionable credibility (The Colorado Herald, TruNews, and The Western Journal) and three conservative news media (The College Fix, The Jewish Voice, and Washington Examiner). Our methodology identified no liberal news media accounts on Twitter posting an anti-Fauci tweet. This finding supports H2.

We hypothesized that anti-intellectual tweets would link more to conservative news media than liberal news media (H3). We found 2335 tweets (43%) including a URL link. Of the 26 domain names analyzed, 18 were conservative news outlets and four were liberal news outlets (Supplemental Tables S7 and S8). Specifically, 497 tweets (21% of tweets with a link) included a link to the 18 conservative news media, while only 31 (0.1 %) included a link to one of the four liberal news media. ($\chi^2 = 607.11$, p-value $< .001$). Thus, this finding supported H3. Many tweets included a link to far-right media or conspiracy/pseudoscience sources with questionable credibility (e.g. washingtontimes.com, truepundit.com). Two organizations (The Gateway Pundits, True Pundit) have been suspended by Twitter. Although four domains were also from moderate or liberal mainstream media (nytimes.com, today.com, msn.com, newsweek.com), their stories were often misinterpreted or reframed to support anti-Fauci claims. For example, Peter Navarro, the assistant to former US President Trump, shared a New York Times article but tweeted "Fauci racket. Create pandemic. Jam vaccine down kids throats. Profits for big pharma. Rinse and repeat. #firefauci." This generated 2202 retweets.

We expected more anti-intellectual tweets from non-institutional actors than politicians and news media (H4). We found that 4656 anti-intellectual tweets (97.5 %) were from non-institutional actors, 99 from politicians (2.1%), and 11 tweets from news media (0.2%. $\chi^2 = 13{,}403$, $p < .001$). Six tweets were from accounts labeled as "other." This finding supported H4. Some individual users were journalists affiliated with conservative news media, such as TV anchors working for conservative news media, and hosts for far-right radio shows. We also found several anti-Fauci medical "experts," such as Dr Christiane Northrup, who is known for advocating alternative medicine, anti-vaccine claims, and the QAnon conspiracy theory.

Finally, we compared the prevalence of discursive elements by politicians, news media, and non-institutional actors (RQ5). As shown in Table 1, politicians were the most likely to express the delegitimization of scientists' motivations, followed by grassroots organizations, and then individual users. However, these differences in the use of discursive elements were not statistically significant (χ^2 (6, 5424) = 8.27, p-value = .21).

7. Discussion, implications, and limitations

This study examined the elements and sources of anti-intellectual discourse in anti-Fauci tweets posted from 2020 to 2021, covering the period of the COVID-19 pandemic. We identified the

Table 1. Comparing proportions of discursive elements in tweets by politicians, news media, grassroots advocacy organizations, and individuals.

	Politicians	News media	Non-institutional actors
People-scientist confrontation	27% ($n = 27$)	27% ($n = 3$)	28% ($n = 1323$)
Delegitimizing motivation	59% ($n = 58$)	55% ($n = 6$)	49% ($n = 2292$)
Delegitimizing knowledge	14% ($n = 14$)	18% ($n = 2$)	22% ($n = 1041$)

presence of three discursive elements: people-scientist antagonism, delegitimizing the motivations of scientists, and delegitimizing the knowledge of scientists in anti-intellectual discourse, aligned with the theoretical conceptualization of science-related populism by Mede and Schäfer (2020). Tweets expressing the three discursive elements accounted for most anti-Fauci tweets (81%). Politicians, news media, and non-institutional actors played distinct roles and jointly constructed anti-intellectual discourses on social media. Tweets from politicians received more retweets, while conservative and far-right news media were the main institutional sources cited in many anti-intellectual tweets. Non-institutional actors contributed to the majority (98%) of anti-intellectual tweets. The discursive elements used by politicians, news media, and non-institutional actors were not significantly different.

Our findings provide several theoretical and practical implications. First, the components of anti-intellectual discourse were highly correlated with science-related populism. Tweets that delegitimized the motivation of scientists had more presence than tweets that delegitimized the knowledge of scientists. This pattern is consistent with previous findings by Evans and Hargittai (2020), which showed that people who distrust scientists tend to believe that scientists do not represent public value. We also found that several conspiracy theories (e.g. Plandemic, Big Pharma, Scamdemic) were expressed through this discursive element. This finding echoed previous studies, which showed that the beliefs in COVID-19 conspiracy theories were closely related to far-right ideologies and the low trust of scientific experts (Eberl et al., 2021).

Additionally, our findings showed that Fauci's connection with Democratic politicians and the refutation from Republican politicians often became the reason for anti-intellectualists to question the motivation of scientists. Fauci communicated the current scientific understanding of COVID-19 with other policymakers and news media. However, scientists' involvement with policymaking may create a dilemma for them in communicating science with the public. As shown in our findings, anti-intellectualists often misinterpreted Fauci's communications with politicians and their involvement with policymaking.

We also found that tweets that included people-scientist antagonism express a strong objection to COVID-19 control policies (e.g. mask mandate, business restriction vaccination, quarantine policy). Fauci was blamed for the personal and economic challenges, such as economic recession and violation of individual freedom. This finding echoes Merkley and Loewen (2021), which showed anti-intellectualism relates to low COVID-19 risk perceptions, social distancing, mask usage, and misperception. The empirical evidence opens questions of whether scientists should be the key spokespeople to deliver public health policy decisions and how to communicate public health policies with the public who show distrust in science/scientists. As Evans and Hargittai (2020) also show, a proscription about policies, rather than the description of scientific facts, is more likely to elicit anti-scientist sentiment. Considering our findings, scientists might fare better by explaining scientific facts instead of public health policies. Policymakers, news media, or local community organizations could take more responsibility to communicate health policies.

Over time, the volume of anti-intellectual tweets has decreased, likely because Twitter suspended accounts owned by a few politicians (Donald Trump, Marjorie Taylor Greene, and Shiva Ayyadurai) and several anti-science accounts. This finding echoes a recent study by Mede and Schäfer (2022), which showed that science-related populist attitudes decreased after the pandemic; the Swiss public, even supporters of science-related populism before the pandemic, trusted in science and science-related institutions more in November 2020 than in June/July of 2019. However, the trend in retweets of anti-intellectual discourses was somewhat different in our analysis; the retweets of anti-Fauci tweets resurged and sustained after their volumes of retweets remained low for a long time. This trend correlates with the stances of US political elites who brought back the anti-Fauci sentiment as they attempted to pass the Fire Fauci Act. This finding suggests that there may be a difference in the formation and construction of anti-intellectualism between the United States and other countries. In the United States, the lasting affective polarization leads to the politicization of COVID-19 and public trust in science and scientists (Hegland et al., 2022), whereas countries like Switzerland tend to have less polarized debates on scientific issues (Arlt et al., 2019).

Regarding the institutional and non-institutional sources that construct different anti-intellectual discursive elements on Twitter, we showed that the conservative news media, far-right groups, and fake news information sites were closely related to anti-intellectual discourse circulated on Twitter. The far-right media did not directly supply anti-intellectual discourse, probably because of Twitter's content moderation mechanism. Instead, Twitter users shared anti-intellectual content from their websites by containing the links in tweets. These findings provide us with two implications. First, the media environment for science communication is complicated. The flows of anti-intellectual discourse have involved collaboration from both institutional and non-institutional actors in a networked model, but also inter-media transmission between social media and web media. Second, Twitter can remove problematic accounts (like far-right groups, and misinformation news media), but anti-intellectual information from external sources is still spreading on Twitter.

We also found some anti-Fauci tweets from medical experts, which seems paradoxical to the definition of anti-intellectualism. This finding suggests that anti-intellectualists are selective in the kind of "expert" to believe. Many conspiracy theories (Plandemic and QAnon) originated from medical experts (Judy Mikovits) who believed in pseudoscientists, anti-vaccine, and the practice of alternative medicine. As Peck (2018) pointed out, the relationship between populists and intellectual culture is complicated because people have different understandings of what an expert is. The far-right populists also rely on studies, facts, and scientific languages from experts to debunk science (Peck, 2018) and construct counter-knowledge, alternative science, or alternative fact to support right-wing populism (Ylä-Anttila, 2018). Along with these studies, our finding suggests that emphasizing scientific facts may be insufficient for scientists to communicate with the public because anti-intellectuals may only believe "facts" and "experts" that support their anti-establishment goals or are aligned with their partisanship. Individual trust in a scientist and the perception of their expertise may rely more on one's partisanship or ideologies than the knowledge or public value that the scientist has expressed to the public.

Our study has several limitations. First, our analysis of anti-Fauci tweets only examined the components and constructions of anti-intellectual discourses during the pandemic, using and applying a theoretical lens from science-related populism. We found that delegitimizing the motivation of scientists was much more popular than delegitimizing the knowledge of scientists, likely because of the impact of political elites and partisan conflicts in the US social and political context. The findings may be generalizable to countries where institutional actors like political elites sparked polarized debates on scientific issues, and scientists (like Fauci) closely participate in communicating science to the public. In other countries with lower affective

polarization and high positive public views on science (e.g. Switzerland) (Mede et al., 2022), questioning the knowledge of scientists may be more prevalent than questioning their motivation in anti-intellectual discourse. As Merkley (2020) pointed out, anti-intellectualism is also related to several other reasons, such as religious fundamentalism, ideology, and individual characteristics (such as the tendency for rational thinking). At least in the European context, postmodernism shows an increasing impact on public trust in science and scientists, particularly for the younger generations (Kuntz, 2012). It remains an open question for future studies to explore and compare different components of anti-intellectual discourses on social media across countries and cultures.

Second, although we showed homogeneity exists among the discursive elements produced by politicians, news media, and non-institutional actors, we did not analyze the contents of the news media websites that were embedded in anti-Fauci tweets. Our findings could be limited to the affordances and the content moderation mechanism of Twitter. As we have shown, the spread of anti-intellectual discourse is intermedia. Future studies need to consider web and social media platforms as an ecosystem and explore the coordinated propagation across platforms.

8. Conclusion

Despite the limitations, our study contributes to the scholarship in anti-intellectualism, science-related populism, and public science communication. First, theoretically, we bridge the studies in populism and anti-intellectualism. We enhanced the current understanding of the components of anti-intellectualism and their connections to science-related populism. We also found distinct roles of institutional and non-institutional actors in producing and spreading anti-intellectual discourses on Twitter. To enhance the literature on anti-intellectualism and public science communication, future studies may consider examining: (1) effective content moderation mechanisms to curb the spread of anti-intellectual discourses on social media; (2) the trans-media diffusion of anti-intellectual discourse, especially those from the far-right media; and (3) the factors that drive multi-step flows of anti-intellectual discourse among institutional and non-institutional actors in a networked science communication model.

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Supplemental material

Supplemental material for this article is available online.

Note

1. We removed 813 tweets that were duplicated and 416 tweets with less than five words (excluding hashtags) in machine learning. Manual inspection showed many tweets simply mentioned uncivil words or hashtags as verbal attacks. They are less likely to address explicitly any of the three discursive elements we proposed. Examples are: "The Big Lie!! #ArrestFauci," "Fauci is a clown! #FirueFauci," and "Time to #FireFauci."

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