

A Role for News Media in Mass Polarization during the COVID-19 Pandemic

Wenyou Ye^{1*}, Gregory Gondwe^{2,3}, and Liviu Aron⁴

¹ Philip Merrill College of Journalism, University of Maryland, 7765 Alumni Dr, College Park, MD 20742

² Department of Communication, California State University - San Bernardino, 5500 University Parkway, San Bernardino CA 92407

³ Institute for Rebooting Social Media, Berkman Klein Center, Harvard University, 1557 Massachusetts Ave, Cambridge, MA 02138

⁴ Harvard University, 77 Avenue Louis Pasteur, Boston, MA 02115

* Correspondence should be addressed to W.Y. wenye@umd.edu

Paper prepared for presentation at the 120th American Political Science Association Annual Meeting, Philadelphia, PA, September 5-8, 2024

ABSTRACT

The extent to which media contributes to mass polarization remains an open question. This study presents a systematic, comprehensive, and longitudinal analysis of COVID-19 coverage by liberal-leaning, conservative-leaning, and ideologically centrist U.S. news media over the first three years of the pandemic. Analyzing over half a million COVID-19-related news items posted on the websites and Twitter accounts of 31 news outlets, we uncover significant polarization in COVID-19 coverage that closely aligns with the political biases of these media entities. Our findings reveal a striking reliance on politicized and out-group partisan cues by conservative-leaning media in their COVID-19 coverage. Unexpectedly, unlike their liberal-leaning counterparts, audiences of conservative-leaning media exhibited a growing preference for COVID-19 news as the pandemic entered its second year. We provide evidence that the online sharing of COVID-19 news featuring out-group partisan cues and videos from conservative media significantly predicted COVID-19 mortality and vaccination rates across U.S. counties, even when accounting for local ideological and socioeconomic factors. Our findings suggest a central role for partisan and socio-psychological cues in mediating the causal link between media polarization, audience polarization, and the resultant polarized patterns of local COVID-19 outcomes throughout the pandemic.

INTRODUCTION

The COVID-19 pandemic has been an unprecedented public health, socioeconomic, and political crisis, claiming millions of lives worldwide and dramatically altering everyday life for many people. Several public health interventions have significantly influenced the evolution of the pandemic. Notably, the early implementation of social-distancing and mask-wearing recommendations, along with the subsequent availability of COVID-19 vaccines and antiviral therapies, has substantially reduced mortality and morbidity rates associated with infections caused by the novel coronavirus.

Despite these successes, several challenges have remained. For example, in the U.S., the vaccination rate peaked in early 2021 but stagnated in mid-to-late 2021, with a significant portion of the population refusing immunization (Mathieu et al., 2020). Additionally, other factors may have hindered societal responses to the COVID-19 crisis. One set of factors is socioeconomic, such as economic inequities and access to healthcare (Mesa et al., 2022; Rothgerber et al., 2020). Another set of factors includes individual beliefs, attitudes, and behaviors regarding preventative measures, such as mask-wearing, social distancing, or vaccination (Bolsen & Palm, 2022). These individual attitudes and behaviors can be influenced by the information people receive from various sources, including public health officials, news media, specialized journals, and social circles (family, friends, co-workers), including social media (Rothgerber et al., 2020). It has been suggested that effective, consistent, and congruent COVID-19 communication strategies, implemented at multiple levels by various societal stakeholders, are required to inform citizens about COVID-19 (including risks, prevention strategies, and treatment options) and to manage the pandemic effectively, as well as to better prepare for future public health crises (Seeger, 2020).

MASS POLARIZATION DURING THE COVID-19 PANDEMIC

A major challenge for the management of the COVID-19 pandemic has been the stark polarization, chiefly along ideological lines, of COVID-19 beliefs, attitudes and behaviors among citizens (Grossman et al., 2020). Studies have shown that, in the U.S., liberals and conservatives have harbored contrasting perspectives on various dimensions of the pandemic, spanning social distancing, mask mandates, lockdown measures, school closures, vaccination efforts, and differential levels of trust in scientists and doctors (Gollwitzer et al., 2020; Jones & McDermott, 2022). For example, conservatism predicted decreased perceived severity of the coronavirus and the personal vulnerability to the virus (Calvillo et al., 2020), as well as reduced compliance with stay-at-home orders (Wiedemann & Goldstein, 2021) and social distancing guidelines (Allcott et al., 2020; Becher et al., 2021; Kerr et al., 2021; Rothgerber et al., 2020).

Longitudinal studies provided more direct evidence of progressive mass polarization of COVID-19-related beliefs and behaviors. A survey of public opinion, conducted between March and October 2020 found a progressive polarization of public attitudes toward the coronavirus, along party affiliation lines (Sides et al., 2020). A

longitudinal survey found that Republicans' vaccination intentions continued to drop from March to August 2020 (Fridman et al., 2021).

A March-April 2020 survey of 1,699 of a representative U.S. sample suggested that both political ideology and party affiliation predicted trust in politicians and medical experts to handle the COVID-19 pandemic, and engagement in preventative behaviors – with liberals being more trusting of experts and showing greater engagement in protective behaviors than conservatives (Kerr et al., 2021). A Pew survey conducted shortly before the 2020 presidential election revealed a stark divergence between liberals and conservatives regarding the significance of the coronavirus outbreak. Among likely voters intending to support Joe Biden, a striking 82% regarded COVID-19 as "very important" to their voting decision. In contrast, only 24% of likely voters planning to vote for Donald Trump considered the pandemic as "very important" in shaping their vote (Dimock & Wike, 2020). This suggests that the polarization of citizens' beliefs, attitudes and behaviors related to COVID-19 may also have had important electoral consequences.

MEDIA'S IDEOLOGICAL BIAS

Two major types of mass polarization – ideological and affective – have been identified and studied in the past two decades. Ideological polarization refers to the divergence of beliefs on ideological issues along partisan lines, which can lead to polarized voting patterns during elections and a widening gap between partisan beliefs, attitudes, and political behaviors. Affective polarization indicates a pattern of increasing dislike and negative views towards the political outgroup among the electorate. The drivers of ideological and affective polarization are poorly understood. One driver has been suggested to be elite polarization and the polarizing rhetoric of political elites (Jost et al., 2022; Levendusky & Malhotra, 2016). Another may be the alignment of partisans with their parties' positions on important issues, which then become polarizing because partisans exhibit partisan sorting (Davis & Dunaway, 2016; Jost et al., 2022; Mason, 2015).

Besides the influence of elite polarization on mass polarization and the polarizing role of partisan sorting, previous research has raised the prospect that media may play a role in mass polarization (Bail et al., 2018; González-Bailón et al., 2023; Jost et al., 2022; Kubin & von Sikorski, 2021; Levendusky & Malhotra, 2016; Levendusky, 2013; Prior, 2013; Stroud, 2010; Tucker et al., 2018).

Previous research has suggested that the media's ideological bias may be involved in the process of mass polarization. Media have long been known to exhibit any number of biases, which are caused by any number of processes, such as the individual beliefs and biases of journalists, editors and media owners; the competition for audiences, which may facilitate the emergence, persistence and increase in media bias; pressure from interests groups, the government and other entities (Chiang & Knight, 2011; D'Alessio & Allen, 2000). The media's political bias can be further increased by the ability to cover politically-charged stories, including stories featuring ideologically more extreme politicians or points of view, and by the differential coverage

of in-group and out-group partisans (Levendusky, 2013; Puglisi & Snyder, 2015; Wilson et al., 2020). Wagner and Gruszczynski (2018) analyzed political news coverage in The New York Times, CBS Evening News, and NBC Nightly News from the 103rd to the 112th Congresses to test whether House members with more extreme ideologies were more likely to receive media coverage, controlling for factors such as their terms in office, partisanship, and the number of floor speeches. They found that a House member's ideological extremity was a significant predictor of being mentioned in the media. Additionally, they discovered that extreme Republican members were more likely to attract media attention than their Democratic counterparts. Thus, the media may amplify the messages of the most polarizing politicians and may thus contribute to mass polarization.

One consequence of the media's ideological and political bias may also be that issues are politicized to a higher degree, and issues that are apolitical may become politicized. One prominent example is COVID-19, which is largely a medical and public health issue, but which has been heavily politicized throughout the pandemic. Thus, during the early stages of the COVID-19 pandemic, COVID-19 communication in print and broadcast news outlets was politicized, with mentions of politicians far surpassing mentions of scientists (Hart et al., 2020). Rothgerber et al. (2020) found that conservatives were more likely than liberals to report skepticism and disregard the credibility of mainstream media's coverage of COVID-19. COVID-19 news media coverage was similarly politicized on social media, such as Twitter, where COVID-19 news coverage had a substantial focus on political issues (Ye et al., 2021). In addition, in an early stage of the pandemic, both print newspaper and network news coverage on Twitter was highly politicized, featuring politicians more often than scientists (Hart et al., 2020). A survey of partisan Twitter users in the early phases of the pandemic found that self-declared right-wing users were more active and engaged with COVID-19 news than neutral and left-wing users. Moreover, right-wing users got their information almost exclusively from right-wing sources (Jiang et al., 2021) and right-wing ideology was shown to be associated with anti-vaccine discussions on Twitter (Thelwall et al., 2021).

Recent efforts have been devoted to systematically and objectively identifying, and quantifying, media bias, in particular media's ideological bias. Two such efforts are the AllSides¹ and Ad Fontes² media bias charts. Allsides and Ad Fontes invite individuals of different professions and partisan affiliations to rate news media's political and ideological leaning, by carefully and objectively evaluating a large sample of news. As a result, the partisan bias of each news media entity is determined by the aggregate score or categorization of the coding.

In seeking to further explore a potential involvement of news media in mass polarization during the COVID-19 pandemic, this paper conducted a systematic, comprehensive and longitudinal analysis of COVID-19 coverage by the news media during the first three years of the COVID-19 pandemic, from January 2020 until

¹ See <https://www.allsides.com/media-bias> for information on Allsides Media Bias Chart's methodology

² See <https://adfontesmedia.com/how-ad-fontes-ranks-news-sources/> for more information on the methodology of Ad Fontes Media Bias Chart

December 2022. Despite granular evidence that some liberal-leaning and conservative-leaning media outlets covered COVID-19 differently (Hart et al., 2020), there is, to our knowledge, no systematic study of COVID-19 coverage by the news media, throughout the pandemic. Our analytical approach makes use of the established media bias charts to identify and classify 31 prominent news media outlets (see Methods). Because media's ideological bias charts reflect the overall bias in covering news about many events and issues, it remained to be determined whether the most recent media bias estimates also applied to COVID-19, which represented a new and emerging polarizing issue. Based on the existing evidence derived from a few prominent examples of media coverage of COVID-19, and on our belief that the media bias charts reflect an overall ideological bias that will be manifest during the coverage of emerging issues, such as COVID-19, we hypothesized that news media's pre-existing ideological bias predicted its coverage of COVID-19:

H1: News media's ideological bias predicts the differential coverage of COVID-19 by liberal-leaning and conservative-leaning news media.

To gain a more global understanding of news media's COVID-19 coverage during the pandemic, we chose to analyze COVID-19-related news that were disseminated on both the news media's websites as well as their social media accounts (Twitter). We hypothesized that the coverage of COVID-19 by news media was similar on the two types of platforms (media websites and Twitter):

H2: the coverage of COVID-19 by the news media is similar on their websites and Twitter accounts.

We reasoned that if the coverage on media websites and Twitter was very similar, we could use social media analytics to gain insights into which aspects of the coverage were most engaging and widely disseminated—such as retweeted or amplified—by audiences on Twitter. This would allow us to link news media coverage of COVID-19 to its impact on audiences. By analyzing patterns of audience engagement and news dissemination, we could connect news media coverage to the mass polarization patterns observed in U.S. communities during the pandemic.

DOES MEDIA CONTRIBUTE TO MASS POLARIZATION?

The potential role of the media as a contributor to, or a driver of, mass polarization has been explored by a number of previous empirical studies. An earlier review by Prior (2013) concluded that the evidence linking the media to mass polarization was weak. However, subsequent work has provided more convincing evidence that the rise in partisan media consumption is linked to increases in both ideological and affective polarization (Kubin & von Sikorski, 2021; Martin & Yurukoglu, 2017). Kubin and von Sikorski (2021) conducted a systematic review of 94 studies linking media consumption (including both traditional and social media) to polarization. The studies reviewed by Kubin and von Sikorski (2021) assessed the potential influence of polarized media content on audiences, as well as the effect of media exposure on mass polarization. The authors concluded that the existing studies supported a *positive* relationship

between exposure to like-minded media and an increase in polarization – although the authors found that two thirds of the studies examined did not differentiate between ideological and affective polarization.

Despite these observed connections between media and polarization, other studies have suggested that partisan media consumption did not lead to increased polarization. For example, (Wojcieszak et al., 2022) traced the web activities of participants in a study over a year and found that the consumption of partisan news only accounted for a small fraction of all web activities and there was no increase in political polarization (both ideological and affective) among the participants throughout the year. The authors concluded that exposure to partisan news online, for both strong partisan members or for political independents, did not increase political polarization. However, it remains possible that pre-existing polarization may have influenced the participants' media choices and exposure, reaching a “steady state” before the start of the experiment.

Thus, despite a significant increase in research on the media's role in mass polarization over the past two decades, the media's potential involvement in mass polarization is still not well understood, and further empirical research is needed to clarify this involvement.

EMERGING THEORETICAL FRAMEWORKS OF MEDIA'S INVOLVEMENT IN MASS POLARIZATION

In parallel to empirical studies linking media to mass polarization, some studies have explored potential theoretical underpinnings of media's involvement in mass polarization.

Framing and agenda setting theories have been employed as a guide by Baum and Groeling (2008) to examine news coverage of five types of news sources leading up to the 2006 midterm elections. The authors found that partisan media tended to feature news from news wire services, such as the Associated Press (AP), that were in favor of their political ideology. Hyun & Moon, (2016) analyzed the coverage of three broadcast TV programs (CNN, Fox News, and NBC) two months before the 2012 presidential election to examine whether media partisan bias and preferential coverage of presidential candidates could exert an agenda-setting effect that polarizes citizens' evaluations of the candidates. Based on questions asked in a national survey of TV viewers, the authors manually coded the coverage of presidential candidates by each TV program and derived a numerical profile for the portrayal of each candidate's attributes (e.g. leadership, intelligence, honesty). The authors found that CNN's coverage tended to favor Barack Obama, Fox News favored Mitt Romney, while NBC News offered a more balanced portrayal of both candidates. Besides questions about feelings towards candidates, the national survey also collected the respondents' media consumption habits, allowing the authors to infer whether media consumption predicted the citizens' assessments of the candidates. After collecting the data, the authors measured polarization as the absolute difference between the ratings of Obama and Romney. The authors found that the respondents whose assessments of the candidates

closely aligned with the attributes portrayed by the media exhibited more polarized attitudes toward the opposing party's candidate, even after controlling for partisanship. These findings provide evidence that media's coverage bias may contribute to mass polarization.

Selective exposure. Scholars have argued that increased consumption of partisan media, along with selective exposure to pro-attitudinal content – that agrees with their pre-existing political beliefs – reinforces individuals' partisan identities. Stroud (2010) conducted daily phone interviews in the lead up to the 2004 presidential election asking respondents to report their consumption of news in the past week, as well as their partisan affiliation. The respondents were then asked about their feelings towards candidates and issues, and polarization was conceptualized as the absolute value of difference of feeling towards candidates and issues. Partisan media exposure was measured by summing media consumption of either liberal (e.g. CNN) or conservative media (e.g. Fox News). The author found that partisan selective exposure led to increased polarization. Higher levels of exposure to like-minded news media on previous days contributed to higher levels of polarization on subsequent days. Notably, the author did not find the reverse relationship – i.e. prior polarization levels did not predict increased partisan selective exposure. A subsequent study conducted by Arceneaux et al., (2012) also used the framework of the theory of selective exposure to design a survey experiment to test whether consumption of like-minded political talk shows can increase polarization. The results suggested that watching pro-attitudinal political shows made participants more resistant to counterarguments. At the same time, consuming political shows that were counter-attitudinal did not make participants more accepting of the counterarguments.

A particularly strong selective exposure to news can be found on social media platforms, such as Twitter, which were suggested to facilitate the development of political polarization by reducing the likelihood of chance encounters with disagreeable, counter-attitudinal, content (Hahn et al., 2015). Twitter further facilitates the selective exposure to pro-attitudinal content, which, in the case of COVID-19, was suggested to strengthen users' pre-existing perceptions of the pandemic (Cinelli et al., 2021; Thelwall et al., 2021). Levendusky (2013) suggested that the reinforcement of pre-existing beliefs by selective exposure can lead to echo chamber and filter bubble effects, which may increase affective polarization.

The current evidence that audience polarization may result from the interaction between selective media exposure and political ideology is currently weak (Davis & Dunaway, 2016; Prior, 2013; Van Aelst et al., 2017). Some experimental studies have found moderate effects on individuals selectively exposed to content that aligns with or opposes their existing attitudes (Davis & Dunaway, 2016). However, other studies have not identified significant effects on ideological polarization (Leeper & Slothuus, 2014; Van Aelst et al., 2017) and some researchers contend that it is the existing level of polarization that drives subsequent behavior in consuming partisan media (Nordbrandt, 2021).

Construal Level Theory (CLT). Several studies linking media to polarization have explored the theoretical framework of CLT (Trope & Liberman, 2010) to manipulate construal levels in messages, exploring how the specific structure of sentences and word concreteness may trigger ideological thinking and changes in attitudes and behaviors among partisan media consumers. CLT explains how individuals process information based on perceived psychological distance. According to CLT, people tend to think more abstractly when they perceive phenomena as distant, focusing on broader concepts, whereas they think more concretely when something feels closer, emphasizing specific details. CLT has often been applied to analyze polarizing issues like climate change. For example, Chu and Yang (2018) conducted a survey study involving 1,086 U.S. adults, testing whether the framing of climate change politics using different construal levels would elicit attitude and behavioral changes, accounting for participants' political ideology. They found that when climate change impacts were framed in lower construal (i.e., more concrete terms), ideological polarization on climate change issues between partisan members was reduced compared to higher construal (i.e., more abstract) framing (Chu & Yang, 2018).

Social Identity Theory (SIT). Intergroup thinking, as explained by SIT (Tajfel & Turner, 2004), suggests that individuals naturally maintain their social identity by favoring their political in-group over out-groups through intergroup comparison. Kim and Zhou (2020) found that news stories framed around political conflicts can effectively heighten the salience of news consumers' partisan identities, leading to a temporary increase in polarized attitudes toward political out-groups and social issues. Similarly, when consuming news on contentious issues like climate change, the presence of out-party cues, such as those from Democratic elites, can significantly amplify skepticism among Republicans (Merkley & Stecula, 2021). This phenomenon is also evident on social media platforms, where political out-group cues are particularly engaging. Rathje et al. (2024) found that posts containing out-group cues were shared or retweeted almost twice as often as those containing in-group cues. Out-group language consistently emerged as the strongest predictor of message dissemination on both Facebook and Twitter, as well as a strong predictor of angry reactions on Facebook (Rathje et al., 2021).

McLaughlin (2018) argued that the perception of intergroup conflict mediates the impact of news media coverage on political polarization. By emphasizing political out-groups, news media can heighten partisans' perception of conflict between parties, thereby making partisan identity more salient and inducing both affective and ideological polarization. The authors tested their hypothesis on 300 American partisans, who were assigned to read a news story depicting the public's belief in either high or low levels of party conflict. The findings revealed that news media coverage of political conflict increased perceptions of intergroup conflict, which in turn led to heightened partisan identity salience and greater affective and ideological polarization. This study provides evidence that media's framing of news using social, out-group cues, has the potential to polarize audiences. Further studies, including studies using longitudinal designs, are required to solidify these conclusions.

As noted by Van Aelst et al. (2017), most studies of polarization do not have a longitudinal design, which may prevent the detection of true polarizing effects, because polarization is thought to be a process that develops progressively over time – it may increase during a given period, and may recede subsequently (Van Aelst et al. 2017). Our study of media’s involvement in mass polarization followed Van Aelst’s suggestion, and included a longitudinal survey of COVID-19 coverage during the first three years of the pandemic. As noted above, our study conducted a parallel analysis of the news disseminated by news media on two types of platforms: the media’s websites and their Twitter accounts. We argue that such a dual approach is necessary in order to better capture the complexity of the modern media ecosystem, and in order to make inferences about media effects that may be relevant to more than one platform of news dissemination.

A previous examination of several social media platforms found that Twitter and YouTube had the biggest volume of posts, as well as interactions and discussions related to COVID-19 (Cinelli et al., 2020). Thus, Twitter provides an ideal platform for capturing and modeling COVID-19 communication, the involvement of the media, and its interaction with audiences. Twitter analytics also provides additional advantages to the study of mass polarization: 1) the combined audiences of the 31 news media entities on Twitter exceeded 220 million users, making the analysis of Twitter communication more relevant to large-scale population studies and mass polarization; 2) Twitter allows us to collect real-world engagement data, representing the quasi-simultaneous, real-time responses of mass audiences COVID-19 news posted by the media; this provides great statistical power to study mass effects which are involved in mass polarization; 3) many Twitter users can be geo-located when they exhibit a consistent pattern of posting geo-tagged tweets or indicate their place of residence – thus facilitating a large-scale geographic analysis of COVID-19 news dissemination in U.S. communities throughout the pandemic.

Our analytical survey was divided into three major efforts. First, we characterized the coverage of COVID-19 by the different ideological sectors of the U.S. news media, both on news websites and Twitter, during the first three years of the pandemic:

RQ1: Are there differences in the coverage of COVID-19 by conservative-leaning, liberal-leaning and ideologically centric media?

Next, we identified the aspects of COVID-19 coverage that had the greatest impact on audience behaviors:

RQ2: What elements of the COVID-19 coverage are most engaging for audiences of liberal-leaning and conservative-leaning media on Twitter?

And finally, we attempted to link the dissemination of COVID-19 news by geo-located Twitter users to the known COVID-19 outcomes in U.S. communities (COVID-19 mortality and vaccination rates), which were polarized during the pandemic – most liberal-leaning communities exhibited lower mortality rates and higher vaccination rates compared to conservative-leaning communities:

RQ3: Does the dissemination of COVID-19 news through social media by local community members predict local outcomes of COVID-19 in American communities?

DATA AND METHODS

The choice of media entities

The study used two media bias charts, AllSides Media¹ and Ad Fontes², as a guide for identifying and selecting U.S. media outlets for analysis, including liberal-leaning, conservative-leaning, and ideologically centric media outlets. This selection aimed to compare the three main sectors of the ideological spectrum: liberal-leaning, centric, and conservative-leaning media. We argue that such a comparison is important for exploring the role of media bias in mass polarization. The analysis encompassed 29 U.S. news media outlets. This included liberal-leaning media (The New York Times, the Washington Post, CNN, BuzzFeedNews, HuffPost, MSNBC, ABC News, NBC News, CBS News, Politico, and TIME), conservative leaning-media (Fox News, Breitbart News, One America News, Newsmax, Epoch Times, National Review, the Washington Times, the Washington Examiner, New York Post, the Daily Wire, and the Blaze) and ideologically-centric media (the Associated Press, Axios, the Hill, the Wall Street Journal, USA Today, NPR, and Newsweek).

Tweet retrieval

This study retrieved and assembled a historical dataset of 2,966,240 tweets posted by the 29 media accounts on Twitter between January 1, 2020 and December 31, 2022. All tweets were retrieved from Twitter Application Programming Interface for Academic Research (Twitter Academic API). We then developed an automatic COVID-19 filter to identify any tweets that referred to COVID-19, using a set of keywords previously published (Ye et al., 2021) to which additional keywords were added. For the analysis of coverage and audience engagement, we only included original and quote tweets from the selected 29 media accounts and excluded the retweets by news media accounts of other tweets. This led to the assembly of a dataset of 377,995 COVID-19 related tweets that were posted by the 29 media accounts between January 1, 2020 and December 31, 2022. We also assembled a second dataset of 25,571,914 posts, representing all the retweets (by audience members) of the original COVID-19-related media tweets.

News article retrieval

For the news media outlets surveyed on Twitter, we also gathered online news articles related to COVID-19, published on the websites of these media outlets, during the same period, from January 1, 2020, to December 31, 2022. We first gathered web links of COVID-19 news articles, using the same keywords related to COVID-19, from the selected news site from GDELT GKG 2.0 database on Google Big Query. While attempting to collect news from all 29 news media outlets, GDELT did not return any

links for ABC News and Daily Wire. We subsequently selected two additional news media entities with a similar ideological bias, to replace ABC News (replaced with CNBC) and Daily Wire (replaced with Daily Signal). GDELT returned 299,150 news article links to the 29 news media websites. We then eliminated non-English articles and articles related to countries other than the U.S. As a result, 145,939 news articles were included in the analysis.

Automatic topic filters

We employed the closed-dictionary approach (Schwartz & Ungar, 2015) to collect lists of keywords identifying 12 distinct topics related to COVID-19 communication by the media. Because each tweet only contains 280 characters, distinct phrases and words, such as 'wear a mask' and 'relief bill' can serve as an efficient way to identify aspects of COVID-19 communication in short text. A random sample of 2,000 COVID-19 related media tweets were selected and manually read to extract keywords of distinct aspects related to the COVID-19 pandemic. These topics were masking, pro-masking (encouraging people to wear a mask), COVID-19 vaccination, healthcare (not masking and vaccination-related), social aspects, politics, economy, education, religion, race and ethnicity, divisive and partisan words, and conspiracies. For in-group and out-group automatic filters, we followed Merkle and Stecula's (2020) guidelines to develop an in-group and out-group dictionary for Democratic and Republican-leaning media by including key terms such as party names and prominent party leaders. To develop the filters for pro-masking and conspiracies, keywords that were previously identified and validated in the literature, specifically for COVID-19 communication, were used (Lang et al., 2021; Motta et al., 2020; Havey, 2020). The 12 filters were then reapplied to another random set of 1,000 tweets. Then the accuracy of each filter was manually assessed, and specific words were either added or removed to ensure that each filter was specific. We iterated this process four times. Finally, the updated topic filters were applied to a new set of 2,000 randomly selected posts to examine the validity of each filter. This showed that the accuracy rate of all filters was between 93-98%, indicating that the automatic filter detection is robust and specific for all topics of COVID-19 communication.

Construal level analysis

To automatically assess the construal level of COVID-19 news posted by the media on their websites as well as Twitter, we utilized a dictionary of the 4,000 most commonly used English words, with concreteness scores developed by Brysbaert et al. (2014). This concreteness word list has been previously used to automatically code the construal levels of social media posts (Aboufoul et al., 2021). A construal score was automatically assigned to each tweet or news article title, with 1 indicating a highly abstract text and 5 indicating a very concrete text.

Sentiment Analysis

Hyperlinks and mentions were removed before the sentiment analysis. The nltk sentiment Python package (Bird, Klein, and Loper, 2009) was used to obtain the sentiment score for each tweet. The sentiment scores span from -1 (negative), 0 (neutral), to +1 (positive).

Network Analysis

To visualize the shared sources of news used by the 29 media entities and the relationships among them, we built a network using the python *networkx* package to identify network connections between the sources of news employed by the news media. Gephi version 0.10.1 was then used to visualize the network. All types of COVID-19 tweets, including original tweets, quote tweets, and retweets, were included in the network analysis (N = 407,804). The network was unidirectional and was visualized using Gephi's Yifan Hu algorithm, which distributes nodes and edges to minimize overlaps and edge crossings, providing a clear layout. Based on the news media political bias categorization, we colored the nodes of conservative-leaning (red), liberal-leaning (blue), and ideologically balanced media (green) accounts.

Retweet geolocation and analysis of local communities

We used the Twitter Academic API to retrieve the retweets of all collected COVID-19 tweets from 29 selected media accounts, resulting in 25,571,914 retweet records. Since retweets do not contain location metadata, we examined the users' location fields, where Twitter users can voluntarily enter their location. We used Python's *fuzzymatch* package to match all retweeters' locations against existing U.S. states and then within cities and towns in each state, using a reference list from SimpleMaps.com that includes 30,844 cities in the U.S. Only user locations containing both a state name and a city or town name were included in the subsequent analysis. A match score ranging from 0 (no match) to 100 (perfect match) was assigned to each user location. We manually examined 2,000 user locations and found that those with a match score of 82 or higher had a 90.2% accuracy in identifying the cities and states in the reference list. We then retained all geo-located users with a match score of 82 and above. As a result, 4,589,702 geo-located retweet records were included in the subsequent analysis. Using the American Ideology Project (AIP)³, we retrieved the political ideology (mrp) scores for U.S. counties to which the retweets were geo-located. Each county's ideology score had been previously derived by AIP, based on citizens' voting records. City socioeconomic data was obtained from the U.S. Census Bureau⁴. Data from the

³The American Ideology Project can be accessed on <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/BQKU4M>. The mrp score refers to the multilevel regression and post-stratification model. It represents the public's ideology in each U.S. geographic unit.

⁴ The city and county level socioeconomic data can be accessed on <https://data.census.gov/>.

American Communities Project⁵ was used to define 15 major community types. Metrics related to the COVID-19 pandemic were the cumulative rates of COVID-19 mortality (expressed as cases per 100k inhabitants) and COVID-19 vaccination rates (as percentage of each county's population who completed both vaccination series) for each county, between January 1, 2020 and December 31, 2022.

RESULTS

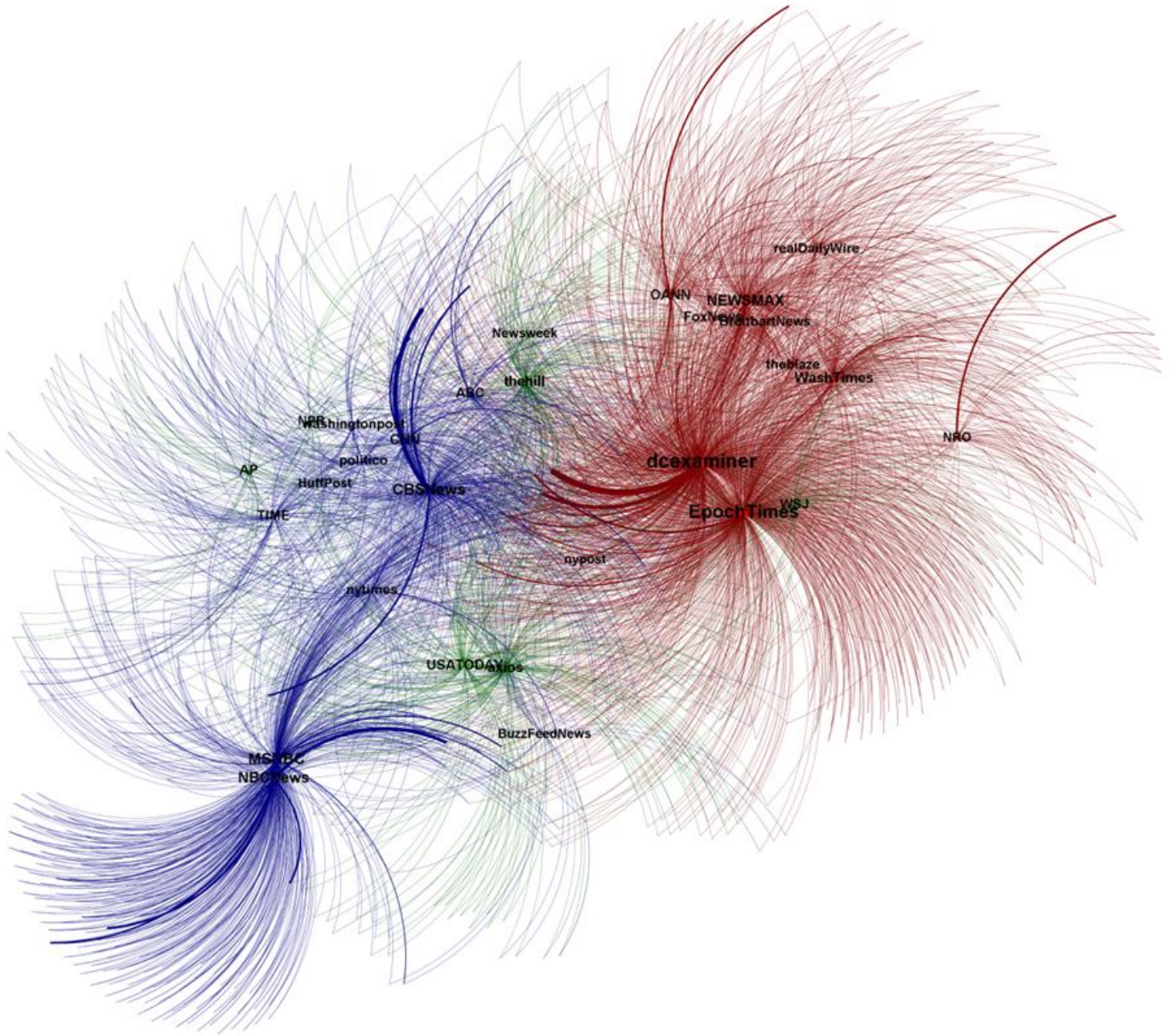
Polarization of COVID-19 news media coverage

To address the first hypothesis, H1, and determine whether the previously-observed ideological bias of news media also applies to their coverage of COVID-19, we began by building a network that included all the news sources used by the media to generate the COVID-19 news that were posted on Twitter. The network graph presented in Figure 1 represents the overall view of the relationships between the sources used by the 29 media entities, as well as any other Twitter accounts that they mentioned when tweeting about COVID-19.

The unbiased statistical analysis run on Gephi identified two major communities, and a value of 0.637 modularity for the network, suggesting that the nodes in the network tend to form cohesive groups or clusters with higher internal connections compared to connections between different hubs. These two major communities consist of liberal and conservative media accounts, and show minimal overlap. Within each community, the liberal or conservative media entities were closely connected, showing that they share similar sources. The sources used by centric media were largely distinct from the sources used by the politically-biased media, although we did notice some minimal overlap. We also note that conservative-leaning media accounts overall exhibit a more cohesive community, whereas liberal and ideological-centric media accounts are more spreaded out. This suggests that conservative media entities rely on more similar types of primary sources. Taken together, the network visualization confirms the previous categorization of conservative, liberal media and politically-neutral media entities (featured in the AdFontes and All Sides media charts) and validates our *a priori* analytical classification of liberal-leaning, conservative-leaning and ideologically-centric media sectors based on previous literature. Our analysis further shows that, in the context of COVID-19 coverage specifically, the politically-biased media used very different primary sources of information in its coverage, which exhibited a polarized distribution (Figure 1).

⁵ For more information on methodology of how fifteen communities were defined, access <https://www.americancommunities.org/methodology/>.

FIGURE 1. Network analysis of COVID-19 news sources



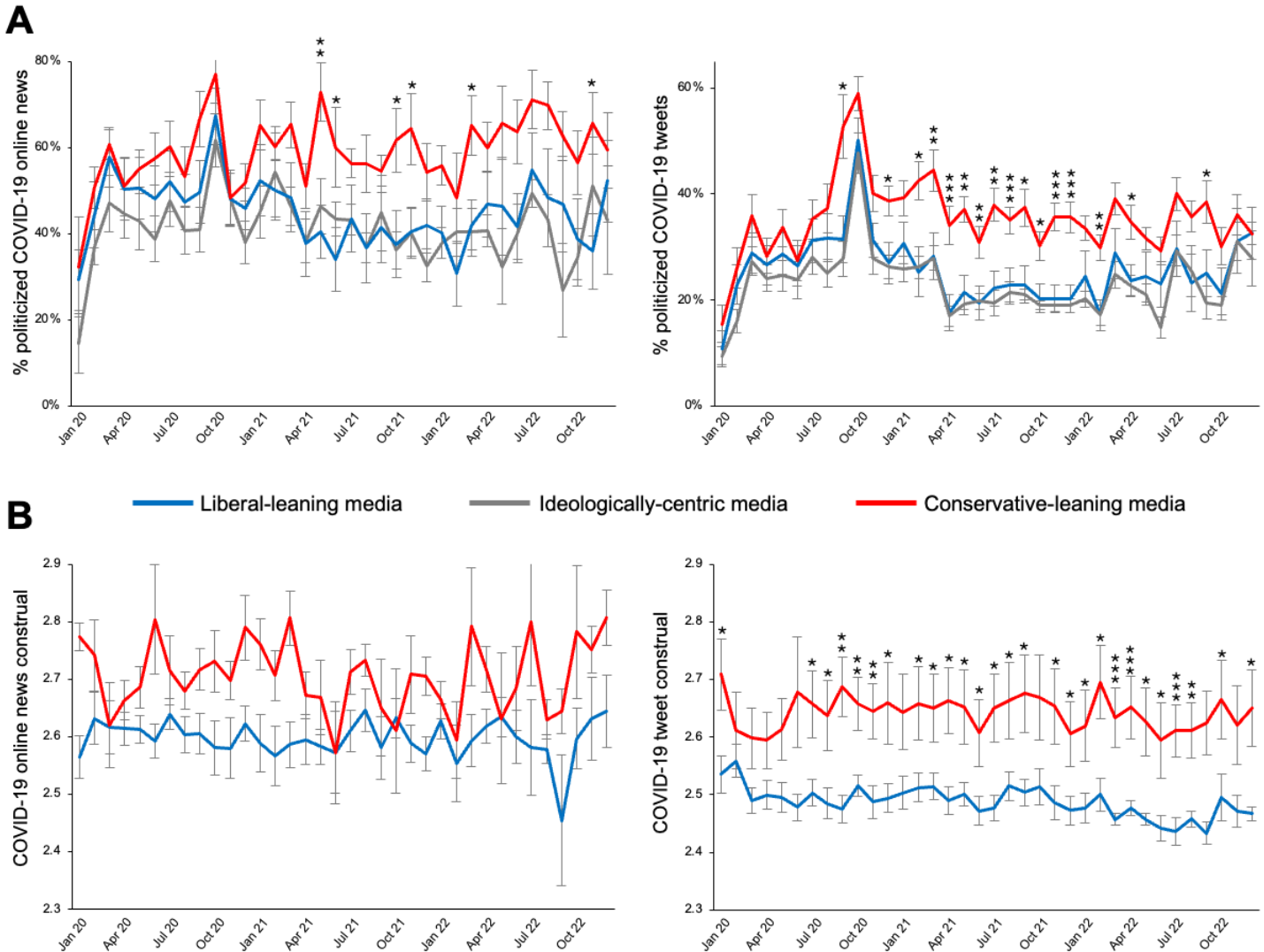
Note. This unidirectional network, in which all 29 media accounts are labeled, includes 1,460 nodes and 4,289 edges. The edges are colored by the media’s published political bias (blue for liberal-leaning, red for conservative-leaning and green for ideologically centric media).

We next addressed the second hypothesis, H2, as well as our first research question, RQ1, and set out to compare the COVID-19 coverage on news media websites and on news media's Twitter accounts. We conducted a monthly analysis of COVID-19 coverage, and calculated the percentage of COVID-19 news or tweets that featured each of the pre-selected topics (see Methods), as well as the construal levels and the usage of in-group/out-group partisan cues to cover COVID-19. These monthly percentages were then categorized based on the political leanings of the selected media outlets.

Figure 2A shows that, in the early phase of the pandemic, the monthly percentage of politicized COVID-19 news – indicating mentions of political entities or politicians when communicating about COVID-19 – was similar for the liberal-leaning, conservative-leaning and conservative-leaning media, both on media websites and on Twitter. Politicized COVID-19 coverage peaked in October 2020, in the lead up to the 2020 U.S. Presidential election. Starting in November 2020, the politicized COVID-19 coverage by liberal and centric media declined, while conservative media maintained a consistent higher level of politicized coverage of covid19 content throughout the rest of the pandemic.

Figure 2B shows that the COVID-19 news disseminated by the conservative-leaning media exhibited a higher construal throughout the pandemic, indicating that conservative media framed COVID-19 in more concrete terms relative to liberal-leaning media.

FIGURE 2. Increased politicization and concreteness of COVID-19 coverage by conservative-leaning media



Note. The monthly mean coverage for liberal, conservative and centric media are shown, as well as the standard errors of mean. * $p < 0.05$, ** $p < 0.01$. *** $p < 0.001$, two-tailed unpaired t-test (liberal vs conservative media).

We then asked whether the news media employed any partisan in-group or out-group cues to frame COVID-19 throughout the pandemic. Figure 3A shows that conservative media covered COVID-19, both on their websites and on Twitter, using significantly more in-group partisan cues (mentions of Republican politicians and policies) compared to liberal media, in the first 10 months of the pandemic. Strikingly, the framing of COVID-19 changed after October 2020, when conservative media

exhibited a sharp increase in the framing of COVID-19 using out-group partisan cues (news that preferentially mentioned Democratic politicians and policies) (Figure 3B). By contrast, the liberal media exhibited a decrease in out-group framing of COVID-19 after October 2020. The framing of COVID-19 (Figure 3B).

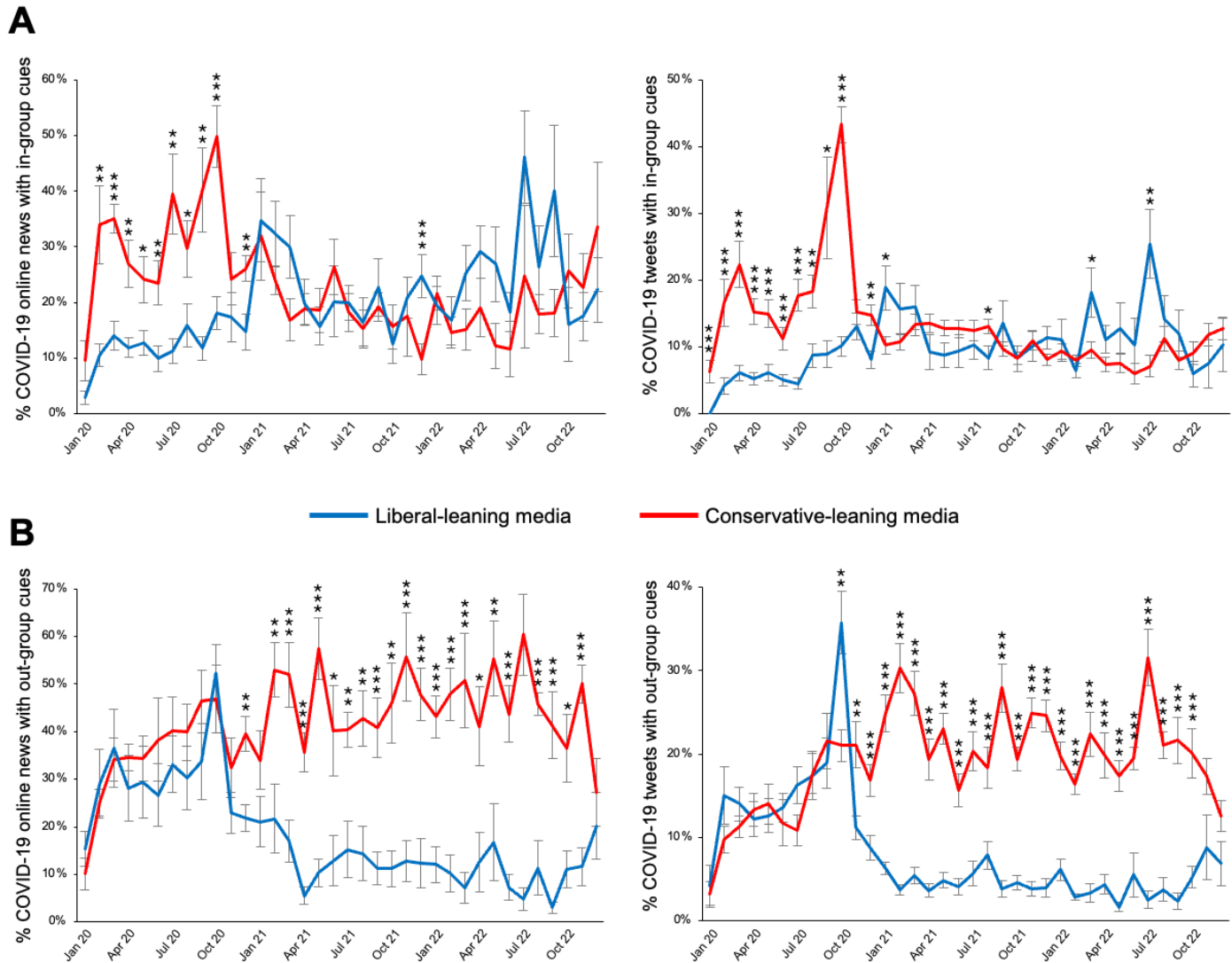
An analysis of the tweets posted by conservative-leaning news media featuring out-group partisan cues showed that most of them were criticizing Democrats (mainly the Biden administration, but also Democratic elites such as Nancy Pelosi or Democratic Governors) for their policies and their handling of the pandemic (see Supplementary Table 1 for a selection of some of the most retweeted post – top 1%).

We also found that conservative media employed more conspiratorial language in their COVID-19 coverage, both on their websites and on Twitter, particularly during the early stages of the pandemic, compared to liberal and ideologically-centric media (Supplementary Figure 1A). A qualitative analysis of the coverage showed that it included discussion of the virus as being a “hoax” or made on purpose in the lab in order to kill Americans, the pandemic as a way of population control, or the COVID-19 as an agenda of the deep state government.

We further found that the conservative media coverage tended to featured more extreme or incendiary political rhetoric, which was significantly more prevalent during several months during the pandemic, and featured words that referred to political opponents as ‘radical’ or ‘extreme’ as well as words and phrases that are closely associated with a political party or contain high political connotation, such as ‘defund the police’, ‘QAnon’ or “WWG1WGA” (Supplementary Figure 1B).

The analysis of COVID-19 coverage further revealed that both liberal and conservative media exhibited comparable degrees of vaccination coverage (Supplementary Figure 2A), while conservative media exhibited a higher coverage of mask wearing on Twitter, but not on media websites (Supplementary Figure 2B).

FIGURE 3. Social framing of COVID-19 by the news media



Note. Shown are the monthly means, as well as the standard errors of mean. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, two-tailed unpaired t-test.

Finally, the Twitter COVID-19 coverage also exhibited differential coverage of education (increased coverage by liberal media in early 2020 followed by increased coverage by conservative media in 2022) and race and ethnicity (higher coverage by liberal media in the first half of 2021) in the context of COVID-19, while the coverage of public health and economic issues related to COVID-19 did not differ between liberal and conservative media (Supplementary Figure 3).

Thus, our results provide support for our second hypothesis, H2, and indicate that COVID-19 coverage was very similar on news media websites and Twitter. Furthermore, in addressing RQ1, we uncovered a marked polarization of COVID-19 coverage by liberal-leaning and conservative-leaning media – with conservative media featuring coverage that was more politicized, conspiratorial and relied more heavily on social in-group/out-group partisan cues.

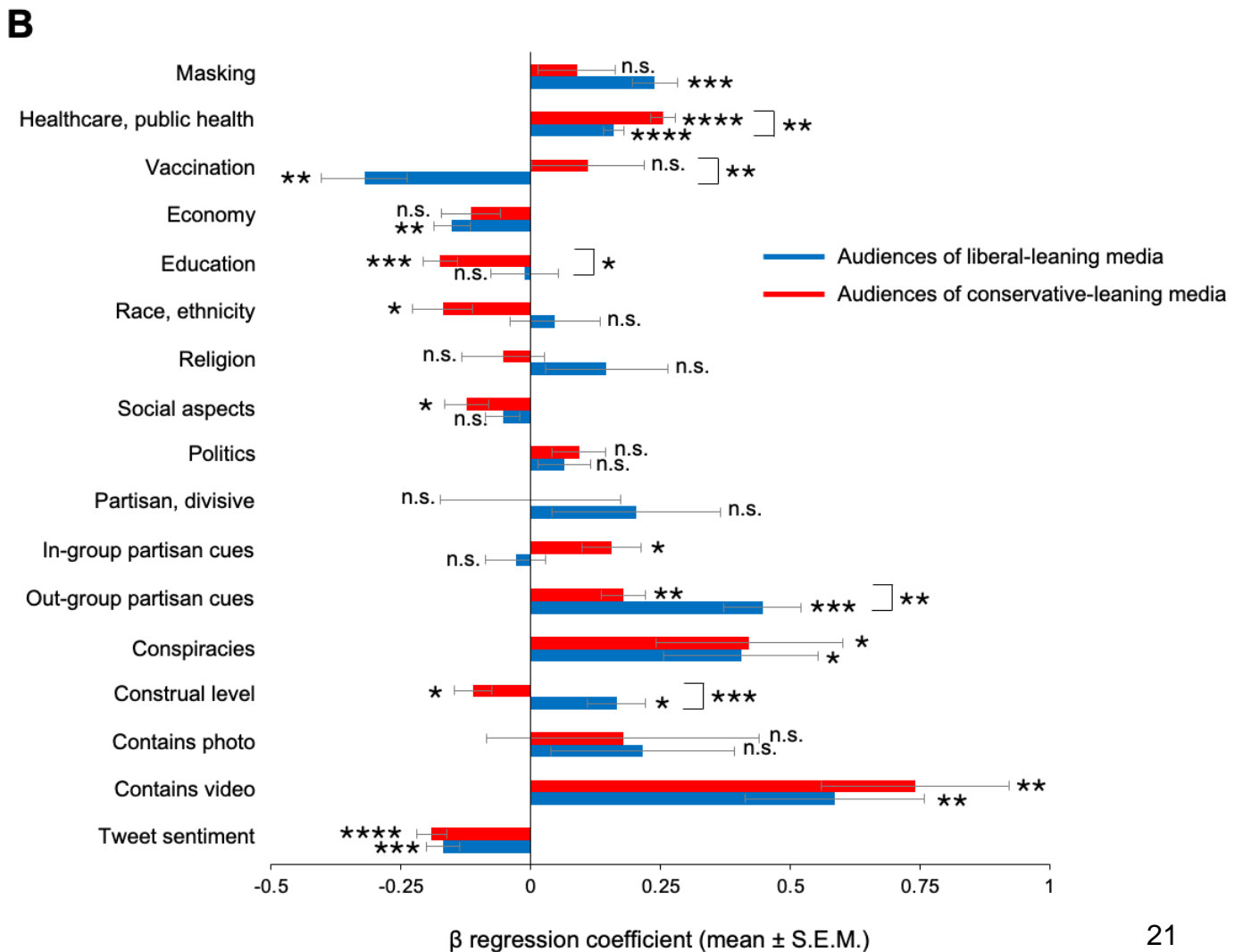
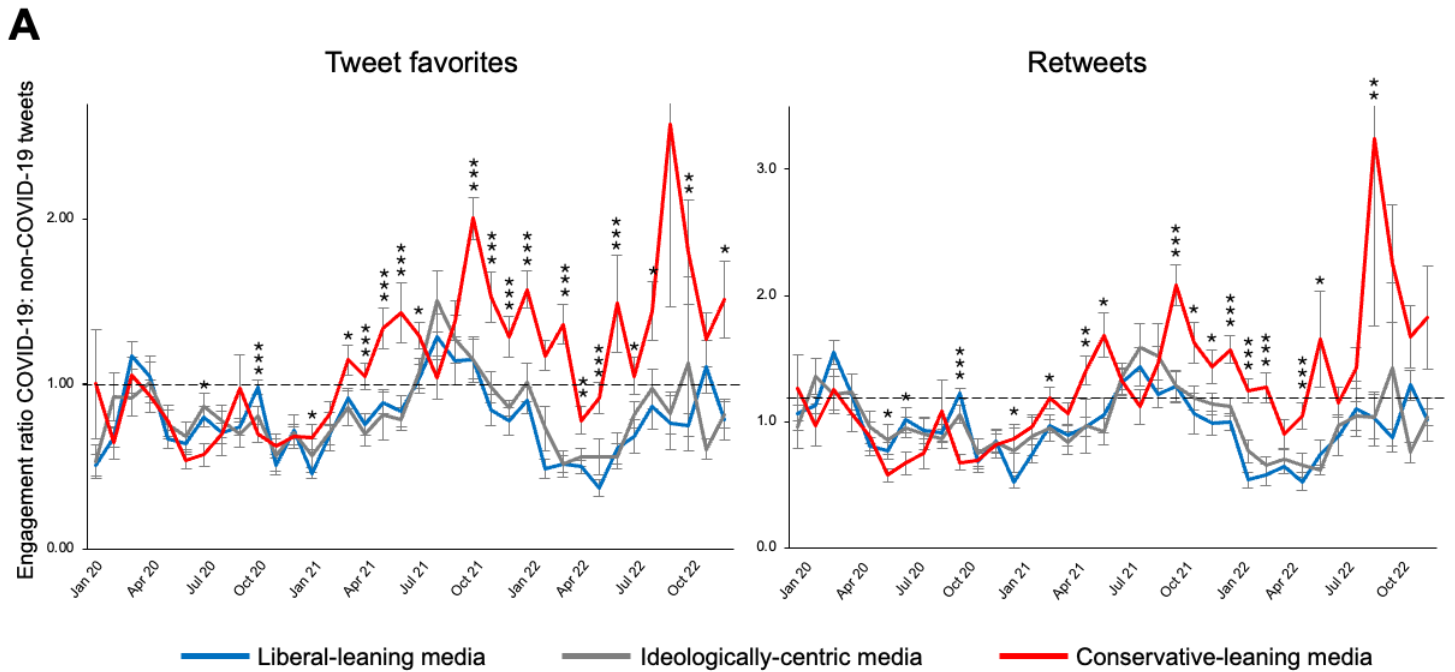
Distinct patterns of engagement for audiences of liberal and conservative media

Having established that the coverage of COVID-19 was polarized along media's ideological alignment, we then addressed RQ2 and examined the patterns of audience engagement with the COVID-19 coverage. We argue that i) since COVID-19 coverage was very similar on news media websites and their Twitter accounts; and ii) the combined Twitter audience of the 29 news media accounts analyzed is over 220 million followers, the analysis of audience engagement on Twitter may reveal the types of COVID-19 news that are not only more engaging for Twitter audiences, but also for potentially large audience segments on other platforms for news dissemination (such as news websites, TV or radio), at the national level.

In order to pool all accounts belonging to a particular ideological sector (liberal, conservative, centric) and compare across accounts, we derived a measure of preferential engagement with COVID-19 news. For each month and each media account, we collected all tweets posted on a given month and separated them into COVID-19-containing tweets and tweets about topics other than COVID-19. We then calculated the average engagement of COVID-19 tweets posted that month (average number of likes/favorites and average number of retweets), and separately the average engagement of tweets about any other topic except COVID-19. We then derived a measure of preferential engagement by COVID-19 content by dividing the mean engagement by COVID-19 content by the mean engagement of other content. If the preference ratio is >1 , the audience was more engaged by the COVID-19 coverage, taken as a whole, than by any other content.

Figure 4A shows that the preferential engagement ratio for COVID-19 news was below 1 in the first months of the pandemic, for all media, suggesting that people did not preferentially engage with COVID-19 news. Liberal and centric media audiences were preferentially more engaged with COVID-19 news in summer 2021.

FIGURE 4. Polarization of audience engagement with COVID-19 news



Note. Shown are the monthly preference indices (y-axis) derived from the numbers of tweet favorites/likes. Shown are the monthly means, as well as the standard errors of mean. * $p < 0.05$, ** $p < 0.01$. *** $p < 0.001$, **** $p < 0.0001$, two-tailed unpaired t-test (liberal vs conservative media).

Remarkably, audiences of conservative media started to preferentially engage with COVID-19 news after March 2021 and remained more engaged with COVID-19 news for the duration of the pandemic compared to audiences of liberal and centric media. The conservative audiences preferred to like/favor (Figure 4A, left), as well as retweet COVID-19 news (Figure 4A, right), unlike liberal audiences and audiences of centric media. These differences between the three types of media were statistically significant for most months after March 2021. Taken together, these studies uncover a polarization of audience engagement with COVID-19 news, and show that audiences of conservative media were more engaged with COVID-19 news after March 2021.

We next set out to identify the granular aspects of COVID-19 communication that may be preferentially engaging, or de-engaging, for news media audiences. Because each media account has a different audience size, and merging audiences may limit the statistical power of engagement modeling, we built separate negative binomial regression models for each media account. We then used the regression coefficients for each variable to compute a mean regression coefficient for both liberal-leaning and conservative-leaning media accounts (Figure 4B). Mean regression coefficients above 0 indicate that the variable predicted a higher audience engagement, whereas mean coefficients below 0 predicted audience de-engagement. For each mean regression coefficient we determined whether i) it was significantly higher or lower than 0 and ii) whether it was different between liberal and conservative audiences.

Figure 4B analyzed the retweeting behavior of audiences, and shows that the most engaging elements (which elicited the highest numbers of retweets), for both types of audiences, were tweets featuring videos of COVID-19 news, followed by tweets featuring or debunking conspiracies, out-group partisan cues, and public health issues. News about masking was only engaging for liberal media audiences, whereas tweets featuring in-group partisan cues were only engaging for conservative media audiences. News mentioning social aspects or race and ethnicity were de-engaging for conservative media audiences, whereas COVID-19 news mentioning vaccination or the economy were de-engaging for liberal media audiences. Interestingly, the construal framing of COVID-19 news had a differential effect on audiences – conservative media audiences were de-engaged, while liberal media audiences were more engaged, by higher COVID-19 construal (more concrete framing). Finally, both types of audiences were de-engaged by news framed more positively (exhibiting a higher sentiment), suggesting that COVID-19 news framed more negatively may have been the most engaging for all audiences. We conducted a similar analysis for another type of audience engagement, liking/favoriting tweets, and the results are similar to those obtained for retweeting behavior (Supplementary Figure 4).

Collectively, these results uncover a polarization of COVID-19 news preference during the second half of the pandemic – with audiences of conservative media

developing a preference for COVID-19 news – and identify discrete elements featured in the COVID-19 coverage that were most engaging, or de-engaging, for audiences.

The dissemination of COVID-19 news by local community members predicts local outcomes of COVID-19

We next asked whether we can link the behavior of Twitter audiences to COVID-19 outcomes in the communities where they live. To address RQ3, we analyzed the entire pool of retweets that was generated by the audiences of liberal and conservative media by retweeting news media tweets related to COVID-19. In total, the original media tweets were retweeted (shared) by over 25 million retweets. Of these ~ 25 million retweets, over 5 million could be geo-located with high accuracy (see Methods). We were thus able to geo-locate a subset of users that retweeted COVID-19 news, by placing them into a U.S. county. We then pooled all retweets by residents of each county and calculated, for each topic, the percentage of retweets featuring the topic that were disseminated from conservative media news, relative to all the retweets featuring the topic that were disseminated from both conservative and liberal news media. This allowed us to estimate, for each county, the relative amplification of topical news from conservative vs. conservative and liberal media.

We then built multivariate regression models to determine whether the relative amplification (retweeting) of COVID-19 news can serve as predictors for the polarized patterns of COVID-19 mortality and COVID-19 vaccination⁶ that were observed in the U.S. throughout the pandemic. In each of these models, we included known socio-economic factors that were previously linked to local COVID-19 outcomes. When modeling COVID-19 mortality (dependent variable) we found that a subset of socioeconomic indices were significant predictors of mortality – population density and unemployment predicted higher mortality; higher education and higher household income predicted lower mortality – while the local segregation index and percentage of rural area in each county were not significant predictors (Table 1).

Importantly, to control for the local ideology and political leaning, we included the local ideology (mrp) score of each county. The local ideology (mrp score) of each county was a strong predictor of COVID-19 mortality ($p < 10^{-15}$) – the more conservative the county (the higher the mrp score) the higher the COVID-19 mortality (Table 1).

To assess whether COVID-19 local news amplification can predict COVID-19 local outcomes, we included the global (% of local COVID-19 retweets that were from conservative media vs. conservative and liberal media combined) and topical (% topic dissemination from conservative media vs. conservative and liberal media combined) COVID-19 news dissemination as independent variables in these models. We found that the overall amplification of COVID-19 news from conservative vs. all partisan media did not predict COVID-19 mortality ($p = 0.75$). Most of the topical news also did not predict mortality. However, higher amplification of news featuring videos ($p = 1.3e-05$)

⁶ COVID-19 vaccination rate at the county level was obtained from the Centers for Disease Control and Prevention <https://data.cdc.gov/Vaccinations/Vaccine-Hesitancy-for-COVID-19-County-and-local-es/q9mh-h2tw>.

and out-group partisan cues ($p=0.021$) from conservative-media predicted higher COVID-19 mortality rates in U.S. counties (Table 1).

TABLE 1. Multivariate regression modeling of COVID-19 mortality and vaccination rates in U.S. counties

Variable	COVID-19 mortality rate				COVID-19 vaccination rate			
	Estimate	SE	t	P value	Estimate	SE	t	P value
Intercept	486.88	129.82	3.75	0.00019	10.77	10.40	1.04	0.30
Population density	0.05	0.01	6.27	6E-10	0.00	0.00	1.06	0.29
% some college	-3.58	0.53	6.81	2E-11	0.14	0.04	3.28	0.0011
% unemployed	13.32	3.06	4.35	1E-05	1.35	0.24	5.49	5E-08
Median household income	-2.3E-03	0.00	9.07	P<10-15	2.4E-04	0.00	11.86	P<10-15
Segregation index	-0.22	0.26	0.84	0.40	0.13	0.02	6.30	5E-10
% rural	-0.36	0.21	1.71	0.087	-0.01	0.02	0.55	0.58
County ideology (mrp score)	297.93	29.47	10.11	P<10-15	-29.22	2.32	12.60	P<10-15
% COVID-19 retweets from conservative media	68.86	215.76	0.32	0.75	-3.94	17.31	0.23	0.82
% in-group retweets from conservative media	-66.55	56.00	1.19	0.23	-0.24	4.49	0.05	0.96
% out-group retweets from conservative media	197.01	85.43	2.31	0.021	-18.04	6.85	2.63	0.0086
% masking retweets from conservative media	-54.85	52.24	1.05	0.29	3.79	4.19	0.91	0.37
% vaccination retweets from conservative media	20.27	40.25	0.50	0.61	3.18	3.23	0.98	0.33
% political retweets from conservative media	-235.83	161.42	1.46	0.14	13.27	12.93	1.03	0.31
% healthcare retweets from conservative media	111.19	124.86	0.89	0.37	-8.36	10.01	0.83	0.40
% social retweets from conservative media	-92.52	114.94	0.80	0.42	6.96	9.21	0.75	0.45
% economy retweets from conservative media	-98.98	52.09	1.90	0.058	3.97	4.17	0.95	0.34
% religion retweets from conservative media	11.58	17.76	0.65	0.51	1.05	1.42	0.74	0.46
% race retweets from conservative media	34.83	21.48	1.62	0.105	2.29	1.72	1.33	0.18
% education retweets from conservative media	-26.83	33.66	0.80	0.43	3.39	2.71	1.25	0.21
% conspiracy retweets from conservative media	14.25	13.72	1.04	0.30	0.53	1.11	0.48	0.63
% partisan retweets from conservative media	8.85	13.56	0.65	0.51	-0.06	1.09	0.06	0.95
Construal ratio (conservative : liberal media)	145.80	112.16	1.30	0.19	14.45	8.99	1.61	0.11
% retweets with photo from conservative media	12.33	28.99	0.43	0.67	-2.49	2.32	1.07	0.28
% retweets with video from conservative media	201.40	45.99	4.38	1.335E-05	-9.57	3.68	2.60	0.0096

Degrees of freedom	888
R square	0.55

888
0.60

Note. SE-standard error. The models were built using geolocated media retweets from $n=913$ U.S. counties. COVID-19 mortality and vaccination rates, media dissemination variables and socioeconomic variables corresponded to the period between January 1, 2020 and December 31, 2022.

We then modeled COVID-19 vaccination rates in U.S. counties. Similar to COVID-19 mortality, we found that socio-economic local factors were significant predictors of vaccination rates – a higher education, unemployment, household income and segregation index predicted higher vaccination rates – whereas the population density and percentage of rural areas in a county were not significant predictors (Figure 5). We also found that a more conservative ideology (higher mrp score) was a strong negative predictor of vaccination ($p < 10^{-15}$).

When modeling the impact of COVID-19 news dissemination, we found that the overall amplification of COVID-19 news from conservative vs. all partisan media did not predict local COVID-19 vaccination rates ($p = 0.82$). The amplification of most topics also did not predict vaccination rates. However, higher amplification of news featuring videos ($p = 0.0096$) and out-group partisan cues ($p = 0.0086$) from conservative-media predicted lower COVID-19 vaccination rates in U.S. counties (Table 1).

Taken together, these modeling insights reveal a potential role for COVID-19 news dissemination from partisan media – and in particular, the amplification of news in video format, as well as partisan out-group cues – in predicting local COVID-19 outcomes during the pandemic.

COVID-19 news coverage and socioeconomic stress

The contribution of both socio-economic factors and COVID-19 news amplification to explaining local COVID-19 outcomes prompted us to further explore a link between socioeconomic metrics and COVID-19 news coverage during the pandemic. We correlated the COVID-19 coverage on Twitter with i) the public health metrics related to the COVID-19 pandemic (national rates of cases, hospitalizations, ICU admissions, deaths, vaccination rates), as well as ii) macroeconomic indicators (unemployment rate and SP&500 index). Supplementary Figure 5 shows that the overall COVID-19 coverage by the media was higher in months with more COVID-19 hospital and ICU admissions and COVID-19-related deaths. Furthermore, the coverage of COVID-19 by liberal and centric media was strongly correlated with national unemployment rates, and inversely correlated with the performance of the stock exchange. The correlation of the coverage by conservative media was weaker with unemployment and was not correlated with stock exchange performance. Thus, the coverage of COVID-19 was similarly correlated with healthcare metrics for all media, but conservative media coverage was less correlated with macroeconomic indices.

We also found that the dissemination of conspiratorial language by conservative media was strongly correlated with COVID-19 ICU admissions and deaths, while liberal media coverage was not correlated with healthcare metrics (Supplementary Figure 5). Thus, COVID-19 coverage by liberal and conservative media was differently correlated with indices of socioeconomic stress.

DISCUSSION

To our knowledge, we have conducted the most comprehensive longitudinal analysis of COVID-19 coverage by ideologically biased media during the pandemic. Our findings reveal a distinct pattern of media coverage that is consistently aligned with the political biases of the news outlets, as well as a corresponding pattern of audience engagement with COVID-19 news that mirrors these biases. Furthermore, we provide evidence that the dissemination of COVID-19 information by ideologically biased media and their audiences serves as a predictor of the polarized COVID-19 outcomes observed in liberal-leaning and conservative-leaning U.S. communities. These findings underscore the systematic ideological bias in COVID-19 coverage by American news media, which not only elicited differential engagement from liberal and conservative audiences but also predicted COVID-19 outcomes in local communities when disseminated. We suggest that the polarized coverage of COVID-19, shaped by the ideological divisions within U.S. news media, triggered a corresponding polarization in audience engagement, which, together with local ideology and socioeconomic pressures and ideology, may have contributed to the polarized COVID-19 outcomes observed across politically aligned communities.

Polarization of COVID-19 media coverage

Polarization of news media coverage of COVID-19 has been previously suggested. A longitudinal study of broadcast and newspaper COVID-19 coverage found differences in the coverage of scientists and politicians, but the study did not analyze conservative-leaning news media, so the impact of media's ideological bias on COVID-19 coverage was not addressed (Hart et al., 2020).

This study provides direct evidence that the media coverage of COVID-19 was both politicized and polarized along media's ideological lines. Our network analysis uncovered a clear distinction between the usage of news sources for liberal-leaning and conservative-leaning media. Moreover, our topical analysis showed that conservative-leaning media framed COVID-19 in substantially more political terms, unlike liberal-leaning and centric media. Moreover, the conservative media made substantial use of out-group partisan cues to frame COVID-19 stories. Many of these out-group partisan cues were mentions and criticism of the Biden administration and other Democratic politicians and officials, who were accused of promoting highly restrictive policies that harmed the economy and impaired other societal aspects, such as education and social interactions.

Conservative-leaning media also disseminated conspiracy theories linked to COVID-19, its origins and the negative effects of vaccines on health. These conspiracies were highly engaging for audiences. Our qualitative analysis found that left-leaning media also mentioned COVID-19-related conspiracies, but it attempted to debunk them and blame Republicans for disseminating them. These news debunking COVID-19 conspiracies were highly engaging for audiences of liberal-leaning media.

Additionally, throughout the progression of the pandemic, conservative-leaning media's COVID-19 coverage was at a lower construal level, indicating that the language and words they used were more concrete compared to those of liberal-leaning media. Interestingly, the effects of COVID-19 construal framing on audiences was different – with liberal audiences being engaged by higher COVID-19 construal, while the conservative audiences were de-engaged.

A previous study also found that the coverage of another polarizing issue – climate change – was strongly politicized. Chinn et al. (2020) analyzed climate change coverage in eleven major U.S. newspapers from 1985 to 2017. They found that media coverage of climate change has become increasingly politicized, with a growing presence of political actors and fewer mentions of scientists, and more polarized, showing clear differences in the narratives about climate change between Democratic and Republican politicians.

Our results, showing a coordinated and highly similar framing of COVID-19 stories by conservative and liberal media, raise the possibility that the ideological sectors of the media may exhibit a coordinated effort to frame certain polarizing issues. This may be consistent with the ideological sectors of the media attempting to set a political agenda for new and emerging polarizing issues, which may be manifested by a highly similar framing of emerging polarizing issues, including COVID-19. This is consistent with the prior studies that have based their analysis of media's coverage of polarizing issues on the agenda setting theory (Baum and Groeling, 2008; Hyun and Moon, 2016).

Out-group partisan cues: a link between media and mass polarization?

Exposure to partisan media messages containing in-group and out-group cues was previously suggested to increase affective polarization (Jost et al., 2022). However, the extent to which partisan media employ these cues in their coverage of polarizing issues remains poorly understood. This study reveals a collective pattern in which media political bias is linked to the use of specific partisan group cues. The analysis of intergroup dynamics was guided by the theoretical foundations of affective polarization and SIT. This study demonstrates that as a polarizing issue progresses, media entities with different ideological leanings employ varying levels of in-group and out-group cues. Conservative media initially relied more on in-group partisan cues during the first year of the pandemic and subsequently increasingly employed out-group partisan cues to frame COVID-19 as the pandemic continued. This pattern was consistent across both Twitter and news articles from these media entities, suggesting that the collective adaptation of in-group and out-group cues in covering a polarizing issue may be a sign of deepening polarization.

Our study found not only a differential reliance on out-group partisan cues to frame COVID-19 stories, but we also found that these out-group partisan cues were highly engaging, for both conservative and liberal audiences. When conservative media news containing COVID-19 news featuring out-group cues were disseminated

(retweeted) by users throughout the country, we found that the preferential dissemination of out-group cues from conservative media predicted lower vaccination rates and higher COVID-19 mortality across U.S. counties. Thus, our study provides evidence that social framing of COVID-19 using out-group partisan cues may have been particularly polarizing for audiences as well as COVID-19 outcomes during the pandemic. Interestingly, we also found that COVID-19 news in a video format was equally very engaging for both types of audiences, and also predicted COVID-19 outcomes in local communities.

Previous research also suggested that out-group partisan cues may be more polarizing than in-group cues. Nicholson (2012) conducted a survey experiment manipulating political candidates' statements with in-group and out-group cues. The study found that out-party cues in candidates' statements had a greater persuasive effect on changing participants' beliefs and attitudes. In contrast, in-group partisan cues did not demonstrate significant persuasive power. Recently, Rathje et al. (2024) showed that on both Facebook and Twitter, the presence of out-group cues such as tweets or Facebook posts featuring political out-group party and politicians, were shared twice as much as the posts containing in-group cues.

We note that preferential usage of out-group cues has been prominently implicated in the emergence of affective polarization, which is defined as a rejection or dislike of out-group partisans. Previous studies have shown that the usage of out-group cues, compared to in-group partisan cues, was more effective in heightening people's partisan identities and induced inter-group comparison and out-group animus (Goren et al., 2009). Based on the widely-accepted prominence of affective polarization in the U.S., including during the COVID-19 pandemic, and the conservative media's striking usage of out-group cues to frame COVID-19 during the pandemic, we propose that conservative media may have exacerbate affective polarization during the pandemic by preferentially framing COVID-19 stories using partisan out-group cues. Because the conservative-leaning and liberal-leaning media are primarily distinguished by ideology, our findings raise the possibility that media's ideological polarization may fuel mass affective polarization through the use of out-group social framing of issues such as COVID-19.

There has been an ongoing effort investigating the relationship between ideological and affective polarization. Some scholars believe that ideological polarization fuels effective polarization and that the current ideological polarization level is a predictor of future affective polarization (Riera & Madariaga, 2023; Stroud, 2010), whereas others argue that political polarization is merely the consequence of the emergence of extremism and ideological differences between parties and political elites (Rogowski & Sutherland, 2016). Our findings provide stronger support for a link between media's ideological polarization and mass affective polarization, but we cannot rule out a possible role for media in mass ideological polarization. We note that the increased polarization of audience COVID-19 preferences (driven by the conservative media's audiences preference for COVID-19 news) was driven by factors other than out-group partisan cues. Thus, besides out-group cues, audiences of conservative

media also engaged with in-group partisan cues, as well as conspiratorial language, and mentions of mask-wearing, vaccination, and public health. It remains thus possible that media polarization can fuel both ideological and affective mass polarization, and future studies can address a possible role for media polarization in these two types of mass polarization.

Our study utilized the theoretical frameworks of both SIT and CLT to probe the potential mechanisms linking media to COVID-19 polarization. We found differences in both the social framing of COVID-19 (increased usage of out-group cues by conservative media) and the construal framing of COVID-19 (higher for conservative media). Our results are consistent with both theories playing a potential role in explaining the media's involvement in mass polarization. While multiple studies have employed either SIT or CLT individually to examine media's role in polarization, few other studies have combined these theories to explore their interaction. One such study is by Luguri and Napier (2013) who investigated the interplay between construal and social cues by prompting participants to respond to questions that highlighted their partisan identity and encouraged either abstract or concrete thinking. Their findings revealed an interaction effect between construal level and social identity cues, suggesting that the prominence of partisan identity may signal political polarization. Specifically, when partisan identity was salient, both liberals and conservatives displayed more polarized beliefs and attitudes on various issues when prompted to think abstractly rather than concretely. Thus, an interplay between the concreteness of COVID-19 stories and the presence of social, out-group, cues, may underlie the polarizing potential of the media, and future studies could address this possibility.

A model of media involvement in mass polarization

Our findings that audiences of conservative-leaning media developed a preference for COVID-19 news during the second year of the pandemic illustrate the progressive nature of polarization, which was emphasized in the field (van Aelst et al., 2017). Moreover, by simultaneously analyzing the news media coverage of COVID-19 and the audience responses to it, this study provides more direct evidence that exposure to ideologically polarized COVID-19 news media coverage leads to increased polarization of news media audience responses to the same coverage.

The progressive increase in the preferential engagement with COVID-19 news of conservative audiences was unexpected. Given that conservatives have typically been less engaged in preventative behaviors related to COVID-19 (such as social distancing, mask-wearing, or vaccination) it is interesting to see that they were more engaged by COVID-19 content than liberal audiences. A possible explanation, in agreement with the theory of reasoned action (Montaño & Kasprzyk, 2015), is that the increased mental involvement of conservatives in COVID-19 online communication results in increased neural processing, leading to altered reasoning and subsequently to altered attitudes and online behaviors. This suggests that the reason for increased audience polarization is, at least in part, due to the active mental engagement of conservative audiences with politicized, divisive and conspiratorial content, rather than their avoidance of COVID-19

information. In support of this, a previous study found that right-leaning Twitter users were more engaged in the consumption and production of COVID-19 information online (Jiang et al., 2021). An analysis of tweets containing misinformation related to the COVID-19 pandemic posted by individual users found that users identified as conservative were far more likely to engage with and share tweets that contained misinformation than liberal users (Havey, 2020). Moreover, users identified as conservative also engaged in more discussions about vaccine side effects and conspiracy theories (Jiang et al., 2021).

Our results are consistent with a model whereby repeated and selective exposure to news may be more polarizing than brief selective exposure. This view is supported by previous observations. Wilson et al. (2020) suggested that repeated and sustained exposure to partisan news, particularly when it emphasizes rare and egregious incidents involving political opponents and portrays them negatively, may not immediately push individuals toward more extreme ideological positions. However, over time, this type of selective exposure can gradually erode perceptions of political opponents and contribute to affective polarization. Partisan media consumers are more likely to accept the framing of events presented by their in-group media, reinforcing their existing biases and fostering intergroup comparison thinking (Tsfati & Nir, 2017). Thus, the framing and message cues related to political in-and-out group thinking may shed light on the mechanism of how media contribute to an increased affective polarization.

Our study found that the partisan (out-group) and conspiratorial framing of COVID-19 by the conservative news media strongly engaged conservative audiences. These audiences then retweeted the politicized, inflammatory and conspiratorial content generated by the news media to their own followers, further amplifying the polarization of their online social networks. This may have contributed to the disinformation of other users, and may have led to the mass polarization of COVID-19 beliefs and behaviors. For example, some of these users may have underestimated the severity of COVID-19, or may have refused to wear a mask or get vaccinated. This in turn may have increased their risk of getting infected with coronavirus, or the risk of hospitalization or death. Indeed, our statistical modeling found evidence that the dissemination of news containing COVID-19-related conspiracies was linked to a higher COVID-19 mortality in U.S. counties.

Finally, we highlight the potential contribution of socioeconomic pressure to the emergence and persistence of mass polarization. We found that the coverage of COVID-19 by the news media could be predicted by socioeconomic and macroeconomic indicators at the national level, suggesting that journalists, editors and other media professionals may take their cues from the overall socioeconomic situation in the country when deciding which stories should be written, promoted or widely disseminated. In addition, multiple, local, socioeconomic factors were significant predictors of COVID-19 mortality and vaccination rates in U.S. communities, in models that also included COVID-19 news dissemination. We thus propose that socioeconomic pressure may be an integral component of mass polarization, and may interact with media polarization to shape the emergence and persistence of mass polarization.

Taken together, our findings linking media polarization, audience polarization and the polarized COVID-19 outcomes in U.S. communities raise the possibility that the interaction between media's ideological bias, audience segmentation, selective exposure, and socioeconomic pressure may have contributed to the observed mass polarization during the COVID-19 pandemic.

ACKNOWLEDGMENTS

We are grateful to Prof. Susan Moeller from the Philip Merrill College of Journalism, University of Maryland for her comments on the initial findings of this paper.

CONFLICT OF INTEREST

The authors declare no ethical issues or conflicts of interest in this research.

ETHICAL STANDARDS

The authors affirm that this article adheres to the APSA's Principles and Guidance on Human Subject Research.

REFERENCES

- Aboufoul, L., Mahajan, K., Gallicano, T., Levens, S., & Shaikh, S. (2021). A Case Study of Analysis of Construals in Language on Social Media Surrounding a Crisis Event. In J. Kabbara, H. Lin, A. Paullada, & J. Vamvas (Eds.), *Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing: Student Research Workshop* (pp. 304–309). Association for Computational Linguistics. <https://doi.org/10.18653/v1/2021.acl-srw.31>
- Allcott, H., Boxell, L., Conway, J., Gentzkow, M., Thaler, M., & Yang, D. (2020). Polarization and public health: Partisan differences in social distancing during the coronavirus pandemic. *Journal of Public Economics*, 191, 104254. <https://doi.org/10.1016/j.jpubeco.2020.104254>
- Arceneaux, K., Johnson, M., & Murphy, C. (2012). Polarized Political Communication, Oppositional Media Hostility, and Selective Exposure. *The Journal of Politics*, 74(1), 174–186. <https://doi.org/10.1017/S002238161100123X>
- Bail, C. A., Argyle, L. P., Brown, T. W., Bumpus, J. P., Chen, H., Hunzaker, M. B. F., Lee, J., Mann, M., Merhout, F., & Volfovsky, A. (2018). Exposure to opposing views on social media can increase political polarization. *Proceedings of the National Academy of Sciences*, 115(37), 9216–9221. <https://doi.org/10.1073/pnas.1804840115>
- Baum, M. A., & Groeling, T. (2008). New Media and the Polarization of American

- Political Discourse. *Political Communication*, 25(4), 345–365.
<https://doi.org/10.1080/10584600802426965>
- Becher, M., Stegmueller, D., Brouard, S., & Kerrouche, E. (2021). Ideology and compliance with health guidelines during the COVID-19 pandemic: A comparative perspective. *Social Science Quarterly*, 102(5), 2106–2123.
<https://doi.org/10.1111/ssqu.13035>
- Bolsen, T., & Palm, R. (2022). Politicization and COVID-19 vaccine resistance in the U.S. In *Progress in Molecular Biology and Translational Science* (Vol. 188, pp. 81–100). Elsevier. <https://doi.org/10.1016/bs.pmbts.2021.10.002>
- Brysbaert, M., Warriner, A. B., & Kuperman, V. (2014). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior Research Methods*, 46(3), 904–911. <https://doi.org/10.3758/s13428-013-0403-5>
- Calvillo, D. P., Ross, B. J., Garcia, R. J. B., Smelter, T. J., & Rutchick, A. M. (2020). Political Ideology Predicts Perceptions of the Threat of COVID-19 (and Susceptibility to Fake News About It). *Social Psychological and Personality Science*, 11(8), 1119–1128. <https://doi.org/10.1177/1948550620940539>
- Chiang, C.-F., & Knight, B. (2011). Media Bias and Influence: Evidence from Newspaper Endorsements. *The Review of Economic Studies*, 78(3), 795–820.
<https://doi.org/10.1093/restud/rdq037>
- Chinn, S., Hart, P. S., & Soroka, S. (2020). Politicization and Polarization in Climate Change News Content, 1985-2017. *Science Communication*, 42(1), 112–129.
<https://doi.org/10.1177/1075547019900290>
- Chu, H., & Yang, J. Z. (2018). Taking climate change here and now – mitigating ideological polarization with psychological distance. *Global Environmental Change*, 53, 174–181. <https://doi.org/10.1016/j.gloenvcha.2018.09.013>
- Cinelli, M., De Francisci Morales, G., Galeazzi, A., Quattrocioni, W., & Starnini, M. (2021). The echo chamber effect on social media. *Proceedings of the National Academy of Sciences*, 118(9), e2023301118.
<https://doi.org/10.1073/pnas.2023301118>
- D’Alessio, D., & Allen, M. (2000). Media Bias in Presidential Elections: A Meta-Analysis. *Journal of Communication*, 50(4), 133–156. <https://doi.org/10.1111/j.1460-2466.2000.tb02866.x>
- Davis, N. T., & Dunaway, J. L. (2016). Party Polarization, Media Choice, and Mass Partisan-Ideological Sorting. *Public Opinion Quarterly*, 80(s1), 272–297.
- Dimock, M., & Wike, R. (2020, November 13). America is exceptional in the nature of its political divide. *Pew Research Center*. <https://www.pewresearch.org/short-reads/2020/11/13/america-is-exceptional-in-the-nature-of-its-political-divide/>
- Fridman, A., Gershon, R., & Gneezy, A. (2021). COVID-19 and vaccine hesitancy: A longitudinal study. *PLOS ONE*, 16(4), e0250123.
<https://doi.org/10.1371/journal.pone.0250123>
- Gollwitzer, A., Martel, C., Brady, W. J., Pärnamets, P., Freedman, I. G., Knowles, E. D., & Van Bavel, J. J. (2020). Partisan differences in physical distancing are linked to health outcomes during the COVID-19 pandemic. *Nature Human Behaviour*, 4(11), 1186–1197. <https://doi.org/10.1038/s41562-020-00977-7>
- González-Bailón, S., Lazer, D., Barberá, P., Zhang, M., Allcott, H., Brown, T., Crespo-Tenorio, A., Freelon, D., Gentzkow, M., Guess, A. M., Iyengar, S., Kim, Y. M.,

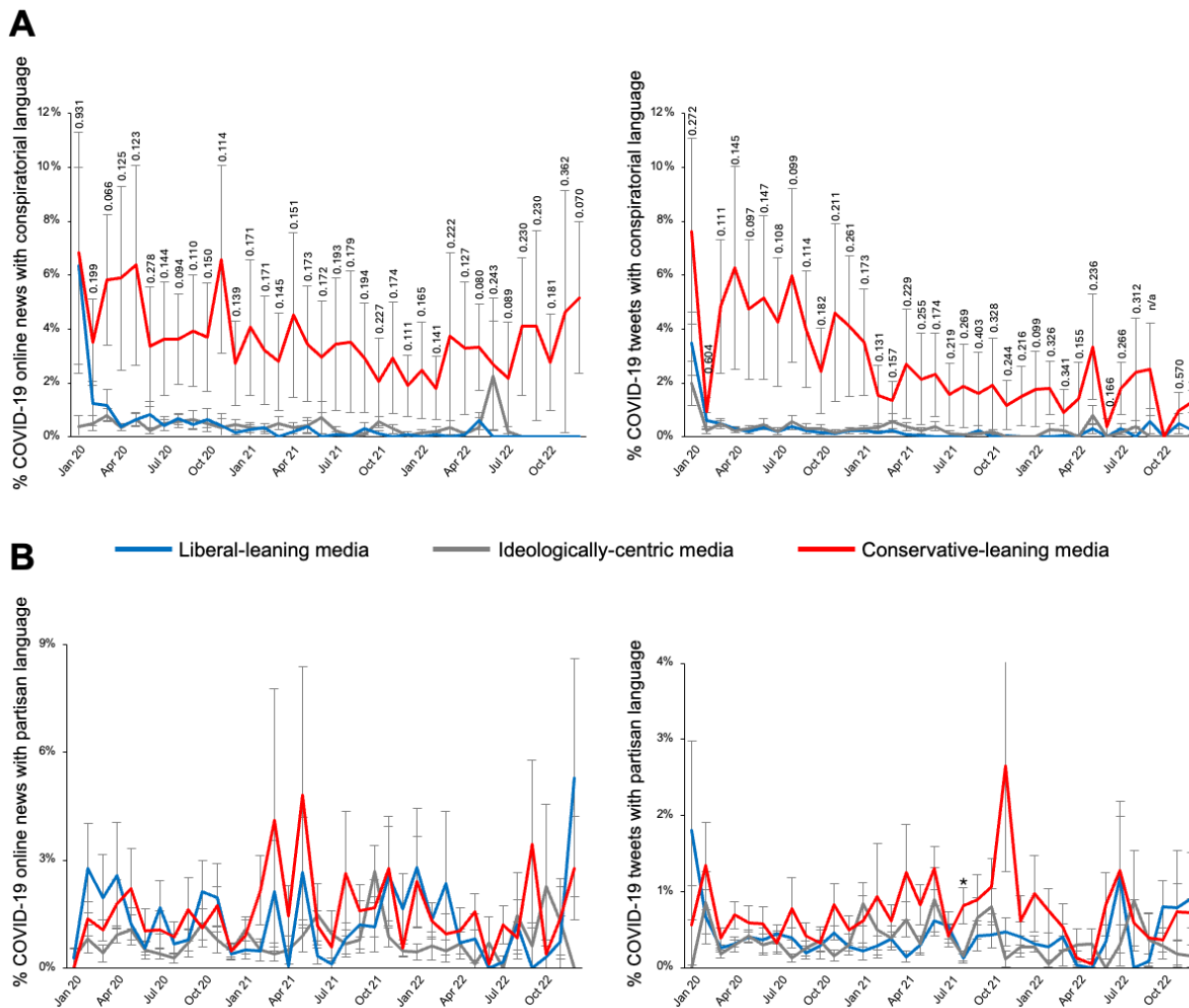
- Malhotra, N., Moehler, D., Nyhan, B., Pan, J., Rivera, C. V., Settle, J., Thorson, E., ... Tucker, J. A. (2023). Asymmetric ideological segregation in exposure to political news on Facebook. *Science (New York, N.Y.)*, 381(6656), 392–398. <https://doi.org/10.1126/science.ade7138>
- Goren, P., Federico, C. M., & Kittilson, M. C. (2009). Source Cues, Partisan Identities, and Political Value Expression. *American Journal of Political Science*, 53(4), 805–820. <https://doi.org/10.1111/j.1540-5907.2009.00402.x>
- Grossman, G., Kim, S., Rexer, J. M., & Thirumurthy, H. (2020). Political partisanship influences behavioral responses to governors' recommendations for COVID-19 prevention in the United States. *Proceedings of the National Academy of Sciences*, 117(39), 24144–24153. <https://doi.org/10.1073/pnas.2007835117>
- Hahn, K. S., Ryu, S., & Park, S. (2015). Fragmentation in the Twitter Following of News Outlets: The Representation of South Korean Users' Ideological and Generational Cleavage. *Journalism & Mass Communication Quarterly*, 92(1), 56–76. <https://doi.org/10.1177/1077699014559499>
- Hart, P. S., Chinn, S., & Soroka, S. (2020). Politicization and Polarization in COVID-19 News Coverage. *Science Communication*, 42(5), 679–697. <https://doi.org/10.1177/1075547020950735>
- Havey, N. F. (2020). Partisan public health: How does political ideology influence support for COVID-19 related misinformation? *Journal of Computational Social Science*, 3(2), 319–342. <https://doi.org/10.1007/s42001-020-00089-2>
- Hyun, K. D., & Moon, S. J. (2016). Agenda Setting in the Partisan TV News Context: Attribute Agenda Setting and Polarized Evaluation of Presidential Candidates Among Viewers of NBC, CNN, and Fox News. *Journalism & Mass Communication Quarterly*, 93(3), 509–529. <https://doi.org/10.1177/1077699016628820>
- Jiang, J., Ren, X., & Ferrara, E. (2021). Social Media Polarization and Echo Chambers in the Context of COVID-19: Case Study. *JMIRx Med*, 2(3), e29570. <https://doi.org/10.2196/29570>
- Jones, D. R., & McDermott, M. L. (2022). Partisanship and the Politics of COVID Vaccine Hesitancy. *Polity*, 54(3), 408–434. <https://doi.org/10.1086/719918>
- Jost, J. T., Baldassarri, D. S., & Druckman, J. N. (2022). Cognitive–motivational mechanisms of political polarization in social-communicative contexts. *Nature Reviews Psychology*, 1(10), 560–576. <https://doi.org/10.1038/s44159-022-00093-5>
- Kerr, J., Panagopoulos, C., & van der Linden, S. (2021). Political polarization on COVID-19 pandemic response in the United States. *Personality and Individual Differences*, 179, 110892. <https://doi.org/10.1016/j.paid.2021.110892>
- Kim, Y., & Zhou, S. (2020). The Effects of Political Conflict News Frame on Political Polarization: A Social Identity Approach. *International Journal of Communication*, 14(0), 22.
- Kubin, E., & von Sikorski, C. (2021). The role of (social) media in political polarization: A systematic review. *Annals of the International Communication Association*, 45(3), 188–206. <https://doi.org/10.1080/23808985.2021.1976070>
- Leeper, T. J., & Slothuus, R. (2014). Political Parties, Motivated Reasoning, and Public Opinion Formation. *Political Psychology*, 35(S1), 129–156.

- <https://doi.org/10.1111/pops.12164>
- Levendusky, M., & Malhotra, N. (2016). Does Media Coverage of Partisan Polarization Affect Political Attitudes? *Political Communication*, 33(2), 283–301. <https://doi.org/10.1080/10584609.2015.1038455>
- Levendusky, M. S. (2013). Why Do Partisan Media Polarize Viewers? *American Journal of Political Science*, 57(3), 611–623. <https://doi.org/10.1111/ajps.12008>
- Luguri, J. B., & Napier, J. L. (2013). Of two minds: The interactive effect of construal level and identity on political polarization. *Journal of Experimental Social Psychology*, 49(6), 972–977. <https://doi.org/10.1016/j.jesp.2013.06.002>
- Martin, G. J., & Yurukoglu, A. (2017). Bias in Cable News: Persuasion and Polarization. *American Economic Review*, 107(9), 2565–2599. <https://doi.org/10.1257/aer.20160812>
- Mason, L. (2015). “I Disrespectfully Agree”: The Differential Effects of Partisan Sorting on Social and Issue Polarization. *American Journal of Political Science*, 59(1), 128–145. <https://doi.org/10.1111/ajps.12089>
- Mathieu, E., Ritchie, H., Rodés-Guirao, L., Appel, C., Giattino, C., Hasell, J., Macdonald, B., Dattani, S., Beltekian, D., Ortiz-Ospina, E., & Roser, M. (2020). Coronavirus Pandemic (COVID-19). *Our World in Data*. <https://ourworldindata.org/coronavirus>
- McLaughlin, B. (2018). Commitment to the Team: Perceived Conflict and Political Polarization. *Journal of Media Psychology*, 30(1), 41–51. <https://doi.org/10.1027/1864-1105/a000176>
- Merkley, E., & Stecula, D. A. (2021). Party Cues in the News: Democratic Elites, Republican Backlash, and the Dynamics of Climate Skepticism. *British Journal of Political Science*, 51(4), 1439–1456. <https://doi.org/10.1017/S0007123420000113>
- Mesa, D. O., Hogan, A. B., Watson, O. J., Charles, G. D., Hauck, K., Ghani, A. C., & Winskill, P. (2022). Modelling the impact of vaccine hesitancy in prolonging the need for Non-Pharmaceutical Interventions to control the COVID-19 pandemic. *Communications Medicine*, 2. <https://doi.org/10.1038/s43856-022-00075-x>
- Montaño, D. E., & Kasprzyk, D. (2015). Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In *Health behavior: Theory, research, and practice*, 5th ed (pp. 95–124). Jossey-Bass/Wiley.
- Nordbrandt, M. (2021). Affective polarization in the digital age: Testing the direction of the relationship between social media and users’ feelings for out-group parties. *New Media & Society*, 146144482110443. <https://doi.org/10.1177/14614448211044393>
- Prior, M. (2013). Media and Political Polarization. *Annual Review of Political Science*, 16(1), 101–127. <https://doi.org/10.1146/annurev-polisci-100711-135242>
- Puglisi, R., & Snyder, J. M. (2015). Chapter 15—Empirical Studies of Media Bias. In S. P. Anderson, J. Waldfogel, & D. Strömberg (Eds.), *Handbook of Media Economics* (Vol. 1, pp. 647–667). North-Holland. <https://doi.org/10.1016/B978-0-444-63685-0.00015-2>
- Rathje, S., Van Bavel, J. J., & Van Der Linden, S. (2021). Out-group animosity drives engagement on social media. *Proceedings of the National Academy of Sciences*, 118(26), e2024292118. <https://doi.org/10.1073/pnas.2024292118>

- Riera, P., & Madariaga, A. G. (2023). Overlapping polarization: On the contextual determinants of the interplay between ideological and affective polarization. *Electoral Studies*, 84, 102628. <https://doi.org/10.1016/j.electstud.2023.102628>
- Rogowski, J. C., & Sutherland, J. L. (2016). How Ideology Fuels Affective Polarization. *Political Behavior*, 38(2), 485–508. <https://doi.org/10.1007/s11109-015-9323-7>
- Rothgerber, H., Wilson, T., Whaley, D., Rosenfeld, D. L., Humphrey, M., Moore, A. L., & Bihl, A. (2020). *Politicizing the COVID-19 Pandemic: Ideological Differences in Adherence to Social Distancing* [Preprint]. PsyArXiv. <https://doi.org/10.31234/osf.io/k23cv>
- Seeger, M. (2020, March 6). *Crisis communication researcher shares 5 key principles that officials should use in coronavirus*. The Conversation. <http://theconversation.com/crisis-communication-researcher-shares-5-key-principles-that-officials-should-use-in-coronavirus-133046>
- Sides, J., Tausanovitch, C., & Vavreck, L. (2020). The Politics of COVID-19: Partisan Polarization About the Pandemic Has Increased, but Support for Health Care Reform Hasn't Moved at All. *Harvard Data Science Review, Special Issue 1*. <https://doi.org/10.1162/99608f92.611350fd>
- Stroud, N. J. (2010). Polarization and Partisan Selective Exposure. *Journal of Communication*, 60(3), 556–576. <https://doi.org/10.1111/j.1460-2466.2010.01497.x>
- Tajfel, H., & Turner, J. C. (2004). *The Social Identity Theory of Intergroup Behavior*. In *Political Psychology*. Psychology Press.
- Thelwall, M., Kousha, K., & Thelwall, S. (2021). Covid-19 vaccine hesitancy on English-language Twitter. 30. <https://doi.org/10.3145/epi.2021.mar.12>
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463. <https://doi.org/10.1037/a0018963>
- Tsfati, Y., & Nir, L. (2017). Frames and Reasoning: Two Pathways From Selective Exposure to Affective Polarization. *International Journal of Communication*, 11(2017), 301–322.
- Tucker, J. A., Guess, A., Barbera, P., Vaccari, C., Siegel, A., Sanovich, S., Stukal, D., & Nyhan, B. (2018). *Social Media, Political Polarization, and Political Disinformation: A Review of the Scientific Literature* (SSRN Scholarly Paper 3144139). <https://doi.org/10.2139/ssrn.3144139>
- Van Aelst, P., Strömbäck, J., Aalberg, T., Esser, F., de Vreese, C., Matthes, J., Hopmann, D., Salgado, S., Hubé, N., Stępińska, A., Papathanassopoulos, S., Berganza, R., Legnante, G., Reinemann, C., Sheafer, T., & Stanyer, J. (2017). Political communication in a high-choice media environment: A challenge for democracy? *Annals of the International Communication Association*, 41(1), 3–27. <https://doi.org/10.1080/23808985.2017.1288551>
- Wagner, M. W., & Gruszczynski, M. (2018). Who Gets Covered? Ideological Extremity and News Coverage of Members of the U.S. Congress, 1993 to 2013. *Journalism & Mass Communication Quarterly*, 95(3), 670–690. <https://doi.org/10.1177/1077699017702836>
- Wiedemann, J., & Goldstein, D. A. N. (2021). Experimental Evidence on Social Trust and Responsiveness to COVID-19 Mitigation Policies. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3835934>

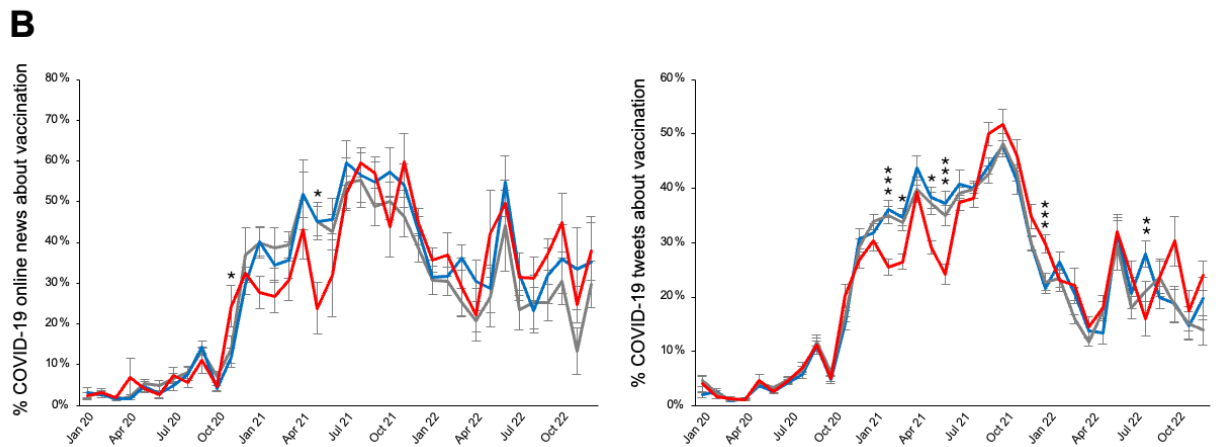
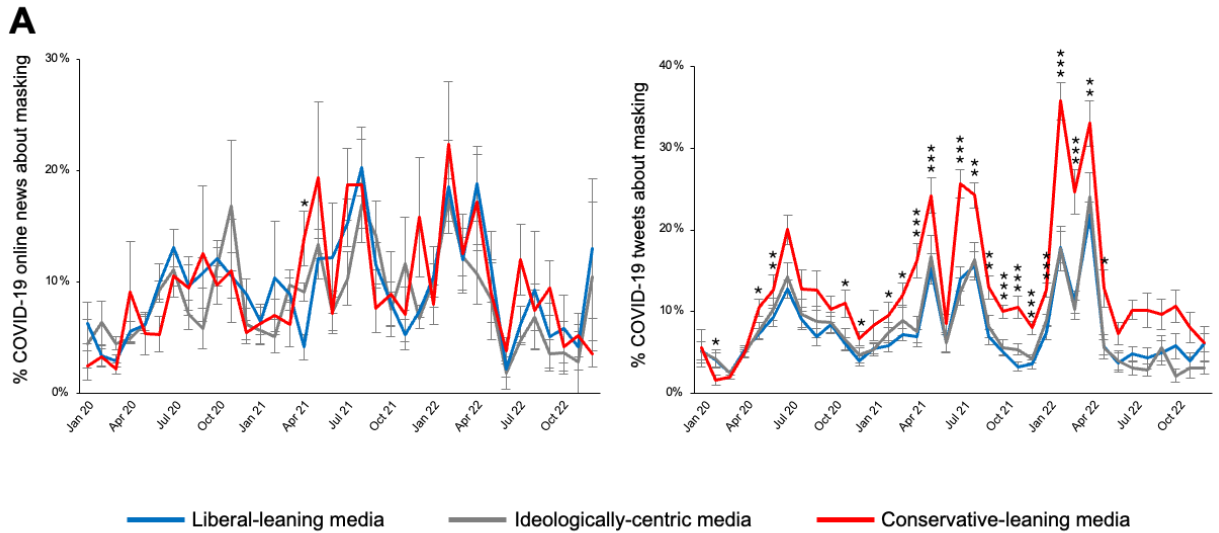
- Wilson, A. E., Parker, V. A., & Feinberg, M. (2020). Polarization in the contemporary political and media landscape. *Current Opinion in Behavioral Sciences*, 34, 223–228. <https://doi.org/10.1016/j.cobeha.2020.07.005>
- Wojcieszak, M., Casas, A., Yu, X., Nagler, J., & Tucker, J. A. (2022). Most users do not follow political elites on Twitter; those who do show overwhelming preferences for ideological congruity. *Science Advances*, 8(39), eabn9418. <https://doi.org/10.1126/sciadv.abn9418>
- Ye, W., Dorantes-Gilardi, R., Xiang, Z., & Aron, L. (2021). COVID-19 Twitter Communication of Major Societal Stakeholders: Health Institutions, the Government, and the News Media. *International Journal of Communication*, 15(0), 37.

SUPPLEMENTARY FIGURE 1. Monthly COVID-19 Coverage and tweets contained conspiratorial language (A) and partisan language (B)



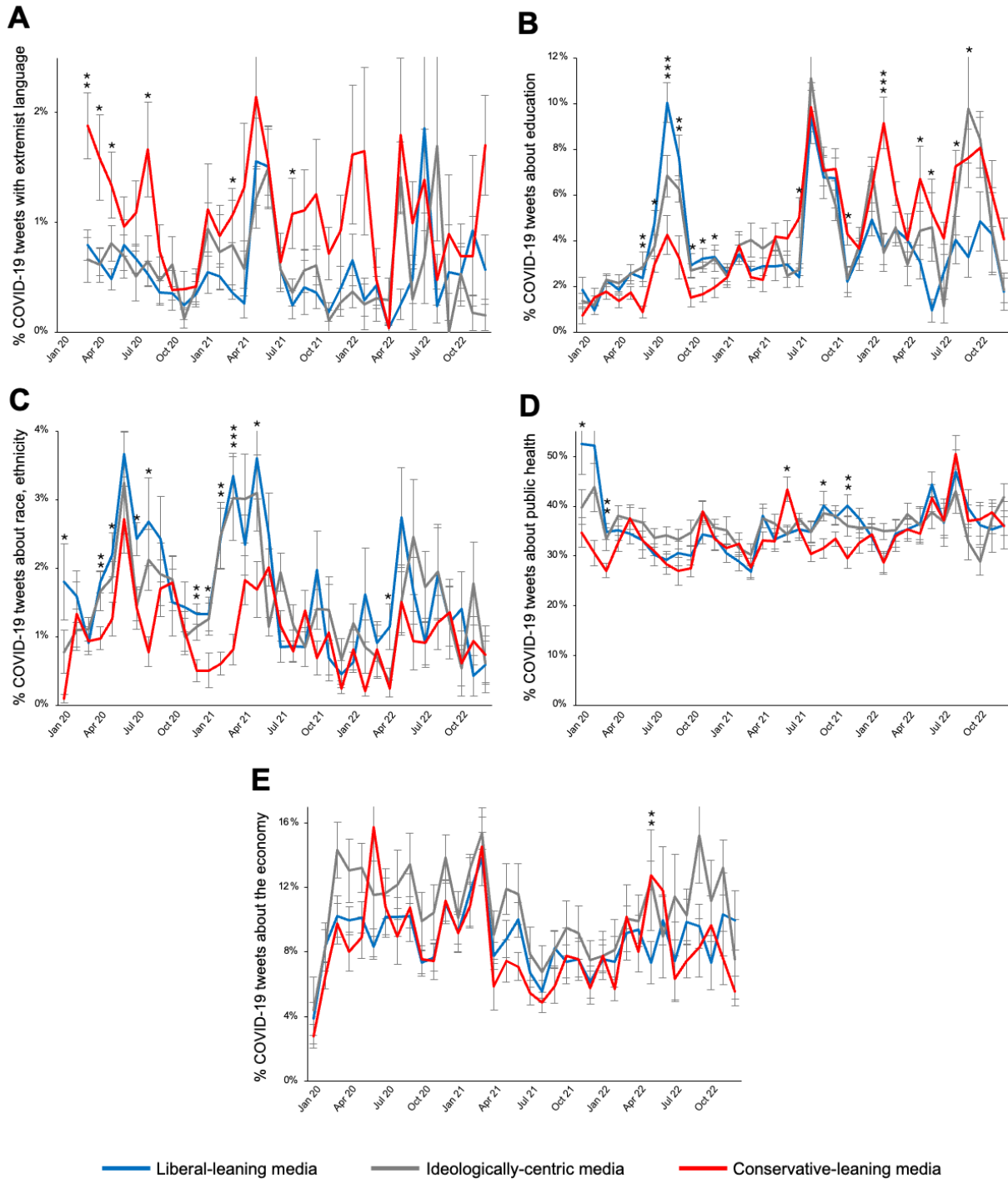
Note. In Panel A, shown are the p-values for comparisons between liberal-leaning and conservative-leaning media. * $p < 0.05$, two-tailed unpaired t-test for all comparisons. In panel B, no significant differences were seen except for August 2021.

SUPPLEMENTARY FIGURE 2. Monthly COVID-19 Coverage and tweets related to masking wearing(A) and vaccination (B)



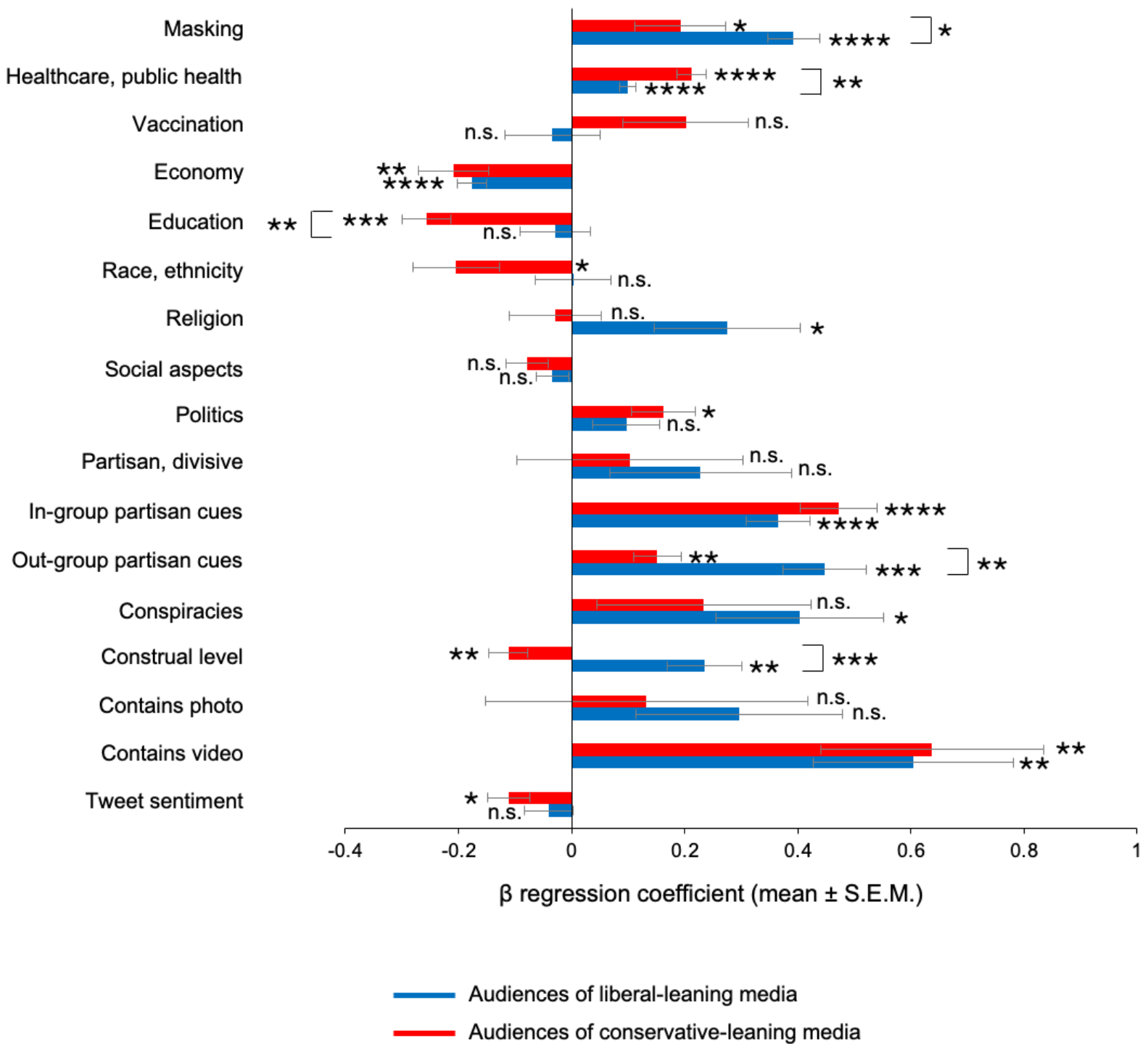
Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ two-tailed unpaired t-test for the comparisons between conservative-leaning and liberal meaning media.

SUPPLEMENTARY FIGURE 3. Monthly COVID-19 Twitter coverage featuring extremist language (A), education (B), race and ethnicity (C), healthcare and public health preventative measures (excluding masking and vaccination) (D), and economic issues (E).



Note. * $p < 0.05$, ** $p < 0.01$. *** $p < 0.001$ two-tailed unpaired t-test.

SUPPLEMENTARY FIGURE 4. Audience engagement with COVID-19 news on Twitter (predictors of tweet favorites)



Note. * p<0.05, ** p<0.01. *** p<0.001, **** p<0.0001, two-tailed unpaired t-test.

SUPPLEMENTARY FIGURE 5. COVID-19 coverage and socioeconomic pressure

Total		Cases	HOSP	ICU	Deaths	VAX	UNEM	S&P500
Liberal	r	0.00	0.49	0.70	0.52	0.22	0.87	-0.38
	p-value	0.99	0.006	2.0E-05	0.001	0.30	7.7E-12	0.026
Centric	r	-0.02	0.48	0.69	0.52	0.20	0.87	-0.39
	p-value	0.90	0.007	2.7E-05	0.001	0.35	4.5E-12	0.022
Conservative	r	0.16	0.63	0.80	0.59	0.46	0.63	0.01
	p-value	0.36	2.1E-04	1.6E-07	1.4E-04	0.025	3.3E-05	0.94

Conspiracies		Cases	HOSP	ICU	Deaths	VAX	UNEM	S&P500
Liberal	r	-0.32	0.23	0.31	0.09	-0.41	0.50	-0.78
	p-value	0.06	0.22	0.091	0.60	0.047	0.002	4E-08
Centric	r	-0.29	0.22	0.41	0.24	-0.01	0.74	-0.63
	p-value	0.09	0.25	0.025	0.17	0.96	3.3E-07	0.000
Conservative	r	0.04	0.56	0.74	0.52	0.29	0.82	-0.37
	p-value	0.81	0.001	2.8E-06	0.001	0.18	1.1E-09	0.027

Note. Shown are the Spearman correlation coefficients between the monthly coverage of COVID-19 (top) or the frequency of COVID-19 news featuring conspiracy theories (bottom) and public healthcare, socioeconomic or macroeconomic metrics, from January 2020 to December 2022. Cases: COVID-19 infection rates (nationally); HOSP: hospitalization rates (nationally); ICU: intensive care unit admissions (nationally); Deaths: COVID-19 death rates (nationally); VAX: COVID-19 vaccination rates (nationally); UNEM: unemployment rates (nationally); S&P500: stock exchange index.

SUPPLEMENTARY TABLE 1. Examples of tweets featuring out-group partisan cues posted by conservative-leaning media, which were among the top 1% most retweeted posts.

Username	Date	Text
BreitbartNews	2021-03-06	BOMBSHELL: New York Gov. Andrew Cuomo's aides rewrote a report from state health officials to hide 9,250 Chinese coronavirus deaths in nursing homes and long-term care facilities.
BreitbartNews	2021-09-16	SHOCK: The Biden administration this week slashed the doses of lifesaving coronavirus antibody treatment to Florida, giving the state less than half of what is needed for a routine week.
BreitbartNews	2021-01-22	.@JoeBiden: "There's nothing we can do to change the trajectory of the pandemic in the next several months."
BreitbartNews	2020-08-09	Pelosi is FURIOUS that President Trump is taking action to help the tens of millions of Americans out of work due to the Chinese coronavirus.
BreitbartNews	2020-03-24	We combed through Nancy Pelosi's insane Leftist Christmas Wishlist coronavirus bill and uncovered all the far-Left giveaways. Here's the outrageous contents, including the page numbers where they appear.
BreitbartNews	2020-04-27	NOLTE: "Top Joe Biden medical expert Dr. Ezekiel Emanuel predicted America would hit a whopping 100 million coronavirus cases by this coming Monday. He was only off by 99 million."

EpochTimes	2021-05-27	The Senate unanimously passed a bill that would require President Biden to declassify all intelligence relating to the origin of #COVID19, including information about what happened at the #WuhanLab at the start of the #Pandemic.
FoxNews	2022-02-04	CNN, MSNBC, NYT, WaPo completely avoid Johns Hopkins study finding COVID lockdowns ineffective
NEWSMAX	2022-01-21	BREAKING NEWS: A federal judge in Texas issued a nationwide ruling Friday that President Joe Biden could not require federal employees to be vaccinated against COVID-19.
NEWSMAX	2022-09-11	New York Gov. Kathy Hochul's paid double for rapid COVID-19 tests from a company owned by one of her major donors.
NEWSMAX	2022-01-13	BREAKING NEWS: The Supreme Court has stopped the Biden administration from enforcing a requirement that employees at large businesses be vaccinated against COVID-19 or undergo weekly testing and wear a mask on the job.
NEWSMAX	2021-09-10	White House Press Secretary Jen Psaki ran from @EmeraldRobinson's question about then President-elect Biden in 2020 saying he would not impose vaccine mandates.
NRO	2020-03-24	Congressional Democrats Add Last-Minute Ideological Demands to Coronavirus Relief Package
NRO	2021-05-13	Five months after his second vaccination shot, President Biden continues to wear his mask and sit six feet away from people in the Oval Office. by @jimgeraghty
NRO	2021-01-18	Joe Biden's \$1.9 trillion stimulus package is bloated, wasteful, and poorly designed if the goal is to get Americans back to work The Editors
OANN	2021-01-23	Biden doesn't appear to have pandemic plan
OANN	2021-04-05	Biden fails to mention Jesus in 'Easter Address,' speaks of COVID
OANN	2021-03-05	Biden admin. continues to lie about vaccines, won't credit President Trump
OANN	2020-11-24	RNC Chair: Democrats used COVID to remove election safeguards
dceaminer	2022-07-26	If Sen. @RandPaul's plight has revealed anything, other than the truth about masks and vaccines, it's that the Democrats who tried to silence him are the real threat to the safety of our country, writes @cwtremo.
dceaminer	2020-04-20	Name one productive thing Speaker Pelosi has accomplished in this pandemic.
nypost	2022-12-04	Hunter Biden's former law firm received \$10M in forgiven COVID loans while donating \$1M to Dems
nypost	2022-01-26	Kid Rock releases 'Let's Go Brandon' song bashing Biden, Dr. Fauci
nypost	2021-02-01	NY Senate Democrats block subpoena for COVID-19 nursing home death data
realDailyWire	2021-01-31	'It's A Mess': Team Biden Loses Track Of 20 Million COVID-19 Doses: Report
realDailyWire	2021-05-20	Pelosi: house members must wear masks
theblaze	2020-11-14	South Dakota Gov. Kristi Noem won't comply if Biden pursues national mask mandate
theblaze	2021-05-27	Gov. DeSantis: Voters are flocking to Florida, 'overwhelmingly' registering as Republicans — including former Democrats — because of COVID lockdowns
theblaze	2021-08-04	City of McAllen, Texas, says Biden administration released more than 7,000 COVID-positive migrants into the community
theblaze	2020-10-19	Gov. Gretchen Whitmer: 'If you're tired of lockdowns ... wearing masks, or you wish you were in church this morning,' then vote for Joe Biden
theblaze	2022-03-15	Just In: Mitt Romney votes with Democrats to keep mask mandates for TODDLERS

theblaze	2020-10-15	Poll: Most Americans blame Nancy Pelosi for failure to pass coronavirus stimulus #ICYMI
----------	------------	---