Chapter 14
Masks Don't Work but You Should Get One: Circulation of the Science of Masking During the Covid-19 Pandemic

Ekaterina Bogomoletc, Jean Goodwin, and Andrew R. Binder

Abstract The Covid-19 pandemic quickly increased public demand for scientific information, thus providing a stress test that can reveal whether, and how, the science communication environment is able to meet those demands. The topic of mask use by the general public emerged as particularly fraught. Informed by the intermediate agenda setting theory, framing theory, and research on flows of information, our chapter examines how scientific information about masks was disseminated and interpreted by the mainstream media and Twitter users during the early months of the Covid-19 pandemic. The study revealed that neither news media nor Twitter were securely in the lead when it comes to disseminating scientific articles. The analysis also demonstrated that both mainstream media and Twitter users cited the same scholarly articles in support of opposite positions regarding masks, and that media publications were more likely to communicate the uncertainty of the science than Twitter posts.

Keywords Framing · Information flows · Intermedia agenda setting · Facemasks · Covid-19 · Science communication

14.1 Introduction

The emergence of the Covid-19 pandemic in February, 2020 quickly increased public demand for scientific information, thus providing a stress test that can reveal whether, and how, the science communication environment (Kahan 2017) is able to meet those demands. The topic of mask use by the general public emerged as particularly fraught. Americans received conflicting and changing official guidance regarding mask efficacy, until in April the CDC (US Centers for Disease Control) finally recommended that everyone wear a mask, including even a homemade face covering, in public places. Such adjustments were not easy, leaving people with diverging views on mask use even before the issue became caught up in partisan divides. While it might

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be tempting to blame lay publics for not reacting quickly enough to official guidelines, or leaders for not promoting the correct behavior, the deliberations about mask usage also underscored the growing complexity of the science communication environment, where individuals can seek information directly from published research, from traditional and new media, and from each other.

In the current chapter, we look at the ways scientific information about masks was disseminated and interpreted during the early months of the Covid-19 pandemic. First, we provide the overall context of the debate and discuss how inconsistent messaging from health officials together with the new media environment created the conditions nurturing uncertainty regarding mask behavior. Second, we discuss scholarship and theoretical frameworks such as framing theory, agenda setting theory, and research on information flows that informed our study. We then present the results of our study, tracing the dissemination and interpretation of six widely shared research articles on the efficacy of cloth masks. We examine both the trends in media and social media coverage of mask research during the pandemic. Ultimately, we address the broader question of information flows through the science communication environment during the pandemic.

14.2 The Context of the Debate

14.2.1 Ambiguous Science

Public and official discussion about use of masks[1] emerged soon after the first reports in January, 2020, of what we now call the Covid-19 pandemic. Although the use of masks to limit the spread of disease in community settings had become customary in many Asian countries (MacIntyre and Chughtai 2015), there had been little research into the efficacy of the practice. As will be detailed below, these studies failed to provide definitive evidence of the efficacy of homemade masks in non-medical settings. For example, some provided data on different materials without considering fit or the exigencies of daily life, while others tested masks in actual hospital settings, but comparing them with medical masks, not with going unmasked. While none of these articles rejected mask use by the general public, none of them gave the practice a ringing endorsement. The uncertainty only got worse due to the inconsistent messaging of public health officials.

[1] Unless further specified, we use the term "mask" to refer to cloth face coverings used by the general public, the recommendation eventually adopted by public health officials and thus the technology of interest for our study.

14.2.2 Inconsistent Messaging

Throughout the first stages of the pandemic, public health officials changed their position regarding masks multiple times, aggravating public uncertainty regarding the issue (see Fig. 14.1).

Early official recommendations urged mask use only when there were clear signs of infection; the general public was told specifically *not* to mask. This stance began receiving pushback in March, with an influential *New York Times* editorial by Zeynip Tufekci (2020), an online campaign urging #Masks4All, and a movement among "makers" to answer a Million Mask Challenge to produce homemade masks for hospitals. But public health officials were facing multiple challenges. They needed to avoid provoking the hoarding that would exacerbate the shortage of personal protection equipment (PPE) for health care workers. At the same time, they needed to address the issue of spread of the virus as well as the growing public anxiety and public request for recommendations on personal protection. And they had to make recommendations with limited information about how Covid-19 was transmitted and about the efficacy of masks, especially homemade masks in community settings. The attempts to find a balance between these challenges would result in CDC finally taking a clear stand regarding the masks by focusing on homemade "cloth covers" at the very beginning of April. In addition, CDC published links to DIY (Do-It-Yourself) tutorials on how to make face covers as well as a video tutorial with Surgeon General. The video went viral and received over four and one-half million views by December 2020.

At the international level, WHO went through a similar process, finally recommending mask wearing on June 5, 2020. Caught between the need to prevent mask hoarding, provide safety guidance for lay public and find the best science-driven solution, the organizations produced inconsistent messaging which only fueled the debate. Moreover, as noted by Tufekci (2020), "the message became counterproductive… because it seemed as though authorities were shaping the message around managing the scarcity rather than confronting the reality of the situation" (para. 2). One might speculate that such lack of guidance could force lay publics to seek guidance elsewhere. However, when seeking information beyond official sources, people faced the challenge of navigating the so-called "infodemic".

14.2.3 Infodemic

In addition to navigating the spread of the virus itself, the Covid-19 crisis brought up the issue of "infodemic": a situation characterized by "too much information including false or misleading information in digital and physical environments during a disease outbreak" (WHO 2020). Some scholars and public health experts blamed social media for allowing misinformation to spread and called them "an engine of

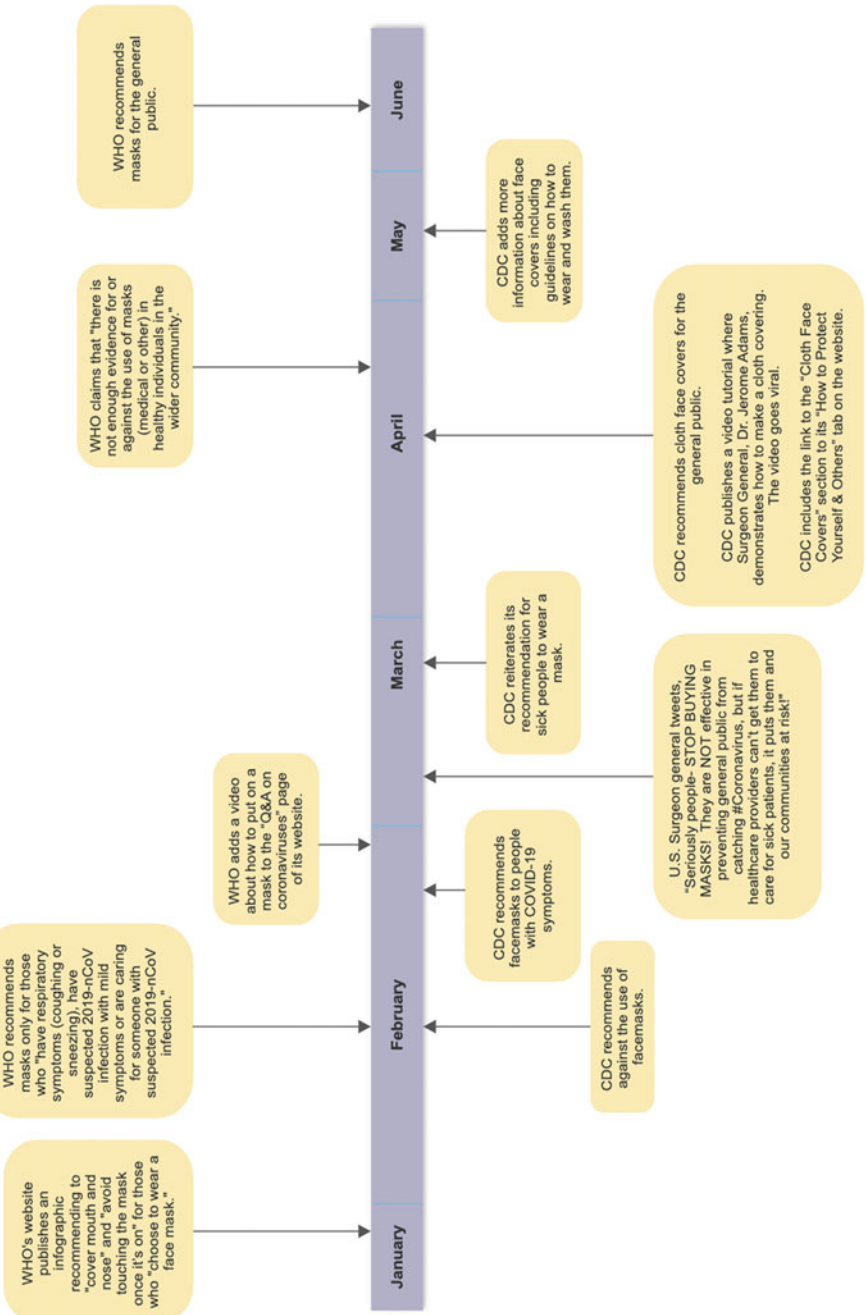

Fig. 14.1 The timeline of the changes in the positions of CDC and WHO (World Health Organization) on masks (based on the internet archive wayback machine)

untruths" (Buchanan 2020, p. 894). They suggested that while the issue of misinformation existed during previous pandemics, social media aggravated this problem for the Covid-19 pandemic by increasing the speed of information distribution and amplifying purveyors of false information, such as anti-vaccination views (Buchanan 2020; Zarocostas 2020). As a result, WHO had to put extra efforts into addressing social media rumors and promoting evidence-based information online (Zarocostas 2020).

However, the issue of infodemic is not limited by the affordances of social media platforms. Among the factors contributing to the infodemic, scholars also named low health literacy (Alvarez-Risco et al. 2020; Chong et al. 2020), increased free time (Alvarez-Risco et al. 2020), and a shift in the audiences of scientific information (The Lancet Infectious Diseases 2020). The latter refers to the situation in which scientists faced the challenge of "reaching experts and non-experts alike in an emotionally charged global environment" (The Lancet Infectious Diseases 2020, p. 875). In other words, while in the pre-pandemic world, scientists would usually target the expert community which is familiar both with scientific and publishing processes, the Covid-19 crisis brought scholarly articles to the attention of lay publics who might not have training or experience in dealing with scientific research.

Taken together, these factors have put media and lay publics in the position where they needed to search for sources in addition to official advisories, interpret original research articles, and adapt their views and behavior to the quickly changing science communication environment. Informed by research on flows of information (Bucchi 2017), by intermediate agenda setting theory (McCombs 2005), and by framing theory (Cacciatore et al. 2016), we conducted a study that examines trends in the use of research articles on masks by the media and by the general public. More specifically, the chapter tracks differences in interpretation of the six widely cited articles on facemask efficacy during the public debate on masks.

14.3 Literature Review

14.3.1 Information Flows

While we are still developing an understanding of information flows within the emerging online science communication environment, the general shape of the changes have become clear. According to what Bucchi (1996) has termed the "canonical account" of science communication, forty years ago scientific knowledge was available only to those who had physical access to a research library and the knowledge of how to use complex indexes to locate relevant articles. Most people therefore received topical science information through the "narrow communications channel" provided by print and television journalism (Mazur 1981, p. 109). These gatekeepers transmitted only a tiny fraction of scientists' output (Suleski and Ibaraki 2010), selected to fulfill journalistic norms such as conflict and novelty (Dunwoody 2014).

In particular, in what became a "compelling issue within the domain of science news" (Jensen 2008, p. 349), science journalists often stripped studies of their qualifications and limitations (Nelkin 1987; Singer 1990). The simplifying required for science news can easily cross over into oversimplifying and sensationalizing, potentially contributing to public misconceptions about science (see, e.g., Gustafson and Rice 2020; Jensen et al. 2013; Retzbach and Maier 2015).

The internet continues to disrupt this traditional system. Gatekeepers have experienced swift declines, with science news coverage shrinking and science journalism units being downsized or eliminated, in what Scheufele (2013) has characterized as a "crumbling science-public infrastructure" (see also Schäfer 2017). Close to 70% of Americans now say that they turn to online sources to find information about a specific science topic (NSB 2020). There they find and use (Su et al. 2015) a much broader array of information sources than previously available: online editions of traditional media, new online-only publications, advocates and advertisers of all stripes, and of course each other, through the affordances of social media (Brossard and Scheufele 2013; Schäfer 2017; NASEM 2016). Scientists encouraged by the open science movement (Grand et al. 2012), by the desire to gain public attention to their work (Bucchi 1996), and by long-standing calls for increased science communication (Yeo and Brossard 2017) are also now making their work directly accessible to anyone with an internet connection. As Brossard concludes, "a simple Google search can give anyone access to virtually unlimited information about a specific scientific topic" (Brossard 2013).

In evaluating these rapid and large-scale changes, researchers have frequently noted a dilemma (e.g., Bubela et al. 2009; Bucchi 2017; Southwell 2017; Trench 2008). Does direct access to information reduce the impact of media biases, improve public understanding of science and lead to better decision-making? Or does the decline of traditional gatekeeping enable a proliferation of mis- and disinformation from unqualified sources and drive polarization? The Covid-19 pandemic has raised these questions in a particularly pressing way (Rosenberg et al. 2020). In the early months of the pandemic, Americans were putting together information from multiple sources, including the government (88%), television (74%), social media (74%), newspapers (70%) and websites (68%) (Ali et al. 2020). Analyses of online sources, however, suggest that the quality of information they found online was often low, whether on websites (Cuan-Baltazar et al. 2020), YouTube (Szmuda et al. 2020), or Twitter (Al-Rakhami and Al-Amri 2020). Prevention measures, including the use of face masks, emerged as a popular topic of discussion on social media (Xue et al. 2020). But one review found that less than half of websites included correct information on the use of masks, with even public health websites varying substantially from WHO guidance (Hernández-García and Giménez-Júlvez 2020).

Not much is known about either the supply or demand side of science info online: what is available, from what sources, with what perspectives, and why and how differently situated individuals access it (Xenos 2017). In this study, we target *good* information–published research articles, examining how it flowed through and was interpreted by gatekeepers and among social media communicators. In particular, we explore whether communicators retained the limitations and qualifications of

the studies, since the failure to communicate scientific uncertainty seems especially significant during a pandemic when the demand for evidence-based guidance dramatically increases while the science itself remains uncertain and inconclusive.

14.3.2 Intermedia Agenda Setting

Agenda setting theory was initially introduced to explain the way media affect public perceptions of the salience of certain issues. The theory suggests that media direct the public to what to think *about* (McCombs 2005): the more media cover an issue, the higher importance the audience assigns to this issue. The theory was later developed in several directions, one of which is concerned with *intermedia agenda setting* effects (McCombs 2005). Studies in this area investigate whether traditional media affect each other's agenda (Denham 2014; Vliegenthart and Walgrave 2008); whether online media affect each other's agenda (Vargo and Guo 2017); how traditional media interact with online media in terms of setting the agenda (Vonbun et al. 2016); how online media interact with social media, and in particular whether there is such a thing as reverse agenda setting, i.e., whether social media users dictate to the media what to communicate about (Groshek and Groshek 2013).

It is worth noting that a large part of this research is concerned with topics outside of health communication. However, several findings offered by existing scholarship on intermedia agenda setting may be relevant to understanding the circulation of science during the pandemic. First, research on political news demonstrated that publications in mainstream media both affect the topics discussed by social media users and impact the way these topics are being discussed (Kim et al. 2016). At the same time, Rogstad (2016) demonstrated that while a large portion of Twitter posts include references to mainstream media, Twitter users also cover some issues that do not receive as much attention on media, e.g., environmental topics. This might indicate the presence of an alternative agenda offered by social media platforms.

Second, research provides conflicting findings when it comes to "reverse agenda setting", i.e., the ability of social media to shape the agenda of mainstream media. A study by Valenzuela et al. (2017) suggested that Twitter might inspire news coverage of disasters by TV journalists. At the same time, Groshek and Groshek (2013) suggested that "the potential for SNSs [social networking sites] to directly shape media agendas does exist but only sporadically and on certain topics" (p. 24). More specifically, the researchers demonstrated the differences between Facebook and Twitter in their ability to predict traditional media agenda when it comes to the topics of culture and politics.

Finally, some researchers have examined the possibility of mutual influence between social and mainstream media (Conway et al. 2015; Wang and Guo 2015). For example, Conway et al. (2015) demonstrated that during elections, traditional media and Twitter "appear to have a symbiotic relationship that varies in intensity and duration depending on the issues being analyzed" (p. 374). The scholars highlighted "legitimacy" as one of the important characteristics of traditional media

that allow them to keep their position in the agenda setting process (Conway et al. 2015, p. 375). Similarly, in their study on media and public discussion of genetically modified mosquitoes, Wang and Guo (2018) suggested that Twitter and online media informed each other's agenda. Interestingly, the channels switched the roles depending on the stage of the debate with Twitter leading the discussion at the beginning and mainstream media taking the lead only later, "when the public became aware of the issue." (Wang & Guo 2018, p. 947). Moreover, the study demonstrated that while the channels affect each other's agenda in terms of volume of the discussion, they were independent when it comes to interpretation of the issue.

14.3.3 Mass Media Framing Theory

Framing theory, according to mass media and communication scholars, suggests that a speaker's or writer's choices in language and presentation about an issue influences the way an audience interprets the issue (Entman 1993; Scheufele 1999). As noted by Nisbet and Mooney (2007), frames "allow citizens to rapidly identify why an issue matters, who might be responsible, and what should be done" (p. 56). Cacciatore et al. (2016) discuss two dominant ways to approach understanding and definition of framing: a sociological definition (emphasis framing) and an equivalence-based definition. *Emphasis framing* refers to "manipulating the content of a communication" (Cacciatore et al. 2016, p. 8). From this perspective, framing "involves emphasizing one set of considerations over another" (Cacciatore et al. 2016, p. 10), i.e., focusing on a specific side of a discussed phenomenon. For example, when discussing face masks, one might focus on mask efficacy, individual freedom, or even the fashion side of mask wearing thus highlighting different aspects of the same issue. *Equivalence-based framing* refers to "manipulating the presentation of logically equivalent information" (Cacciatore et al. 2016, p. 8). Studying framing from this perspective, researchers often examine the effects of gain vs. loss frames (e.g., Kahneman and Tversky 1979). Gain frames refer to highlighting benefits of a certain action while with the loss frames, drawbacks of the lack of action would be highlighted. For example, for a gain frame, a journalist might suggest that wearing a mask might help someone to stay healthy. For a loss frame, the same information might be presented as a warning that the lack of a mask might lead to getting sick.

Interestingly, research has reached conflicting results when it comes to equivalence framing of preventive health measures. Updegraff et al. (2011) demonstrated a higher efficiency of gain frames over lack of messages for promoting the use of hand sanitizers during the H1N1 pandemic in 2009. A study by Nan et al. (2012), on the other hand, found that loss frames were more efficient in promoting H1N1 vaccine among people with lower levels of perceived efficacy of the vaccines. At the same time, Guidry et al. (2018) did not find a significant impact of either gain or loss frame messages on people's intention to get vaccinated against Zika. However, the study demonstrated the positive effect of gain frames on "intermediate" constructs

that might potentially lead to a higher likelihood of vaccination (e.g., perceived benefits of the vaccine). Finally, Adonis et al. (2016) tested the effects of gain vs. loss framing when communicating about cervical cancer screening via emails and found no significant differences in the preventive behavior among the groups receiving differently framed messages, including messages with a "neutral" frame. Overall, one might conclude that based on the existing scholarship, the effects of framing on preventive health behavior are context-dependent and oftentimes, mediated by various additional factors.

It is worth noting that the practice of framing scientific findings has received conflicting reactions in the academic community, with some scholars suggesting that it raised ethical concerns related to manipulating one's audience (Nisbet 2009). According to this perspective, framing might compromise "objectivity" of science communicated to lay publics. However, researchers also argue that framing is inevitable; all messages are framed in some way, including those communicating scientific information (Sprain 2018). Indeed, when discussing scientific issues like mask efficacy, both journalists and social media users are forced to present information from academic articles in a brief, condensed manner. They have to select and emphasize certain aspects of the studies that they are citing, and especially when the study is ambiguous, they have to accentuate either gains or losses of the recommended behavior for a broader audience. In other words, they must engage in framing of scientific findings.

The aspect of framing related to selecting information from scholarly articles and providing one's audience with interpretation and implications of the studies informs our chapter. In the debate over mask wearing, this selection process could take the form of either type of framing: emphasis or equivalence. In the category of emphasis framing, journalists and social media users might select certain pieces of information but not others, e.g., "this study found no evidence that masks prevent exposure." In contrast, an equivalence-framing interpretation could lead to statements like, "according to this study, if you do not wear a mask you are much more likely to contract coronavirus." The specific type of framing is not so important to our research; rather we highlight these different categories as to illustrate the different kinds of framing that might appear in media and social media reports on scientific studies of masks and infectious disease.

14.3.4 Summary

Informed by the scholarship discussed above, the current exploratory study aims to answer the following questions:

RQ1: What were the trends and relationships in the volume of discussion of the scholarly articles on mask efficacy (1) in online media and (2) on Twitter?

RQ2: How is the science of masking presented online?

RQ2.1 How did the interpretation of the articles as pro- or anti-mask by online media differ from the interpretation of the articles by Twitter users?

RQ2.2: To what extent do traditional and social media communicators retain qualifications and limitations when communicating studies on mask efficacy?

14.4 Methods

14.4.1 Sampling

To answer our research questions, we collected a corpus of discourse about mask use from Altmetric, a tool that provides information about the number of mentions of a scholarly article across multiple media, including public policy documents, blogs, mainstream media, social media, and other platforms (Altmetric 2020). More specifically, we looked at the circulation of the science of masking in online media. In order to do this, we selected six articles on mask efficacy published before the pandemic. The process of selecting the articles included two steps: (1) a comprehensive search for the articles on mask efficacy through the library and Google search using such key words as "mask", "mask efficacy", "cloth covering" as well as search through the references of the studies that were found first and (2) selection of the top popular articles based on their Altmetric scores as of May 2020. The Altmetric scores are based on a number of factors and reflect "the amount of attention that [a study] has received" (Altmetric 2020). Based on our search, six articles quickly emerged as some of the most circulated:

- Article 1: van der Sande et al. (2008): Tests on volunteers of a variety of mask types revealed that all provided some protection, with wide variations among individuals and types.
- Article 2: Rengasamy et al. (2010): Tests of the penetration of particles through readily available materials showed them to provide only marginal protection in contrast with N95 masks.
- Article 3: MacIntyre et al. (2015): Health care workers in Vietnam experienced increased influenza-like illness when wearing cloth masks in comparison to their normal regime, and lab tests revealed cloth masks to be much more porous than medical masks.
- Article 4: MacIntyre and Chughtai (2015): A review article noted the paucity of studies and called for more research.
- Article 5: Dato et al. (2006): Physical testing showed an 8 layer t-shirt mask provided a measurable level of protection, although less than an N95 mask.
- Article 6: Davies et al. (2013): A variety of tests performed on masks that might be made at home showed they provided limited protection, and led the authors to conclude that they should be used only as a last resort.

After selecting the research articles, we collected mentions of the studies online. For this project, we focused on mainstream media publications and Twitter posts appearing in English. The mainstream media database on Altmetric is composed of

media mentions collected from more than two thousand media outlets (Altmetric 2020). The publications are collected based on the presence of a link to the study of interest. The database also includes reprints of media publications that may or may not contain the link. So, the search mechanism is based on the link, scholarly identifiers (such as DOI) and a text mining algorithm. Twitter data includes tweets containing a link to the study. For this project, we relied on the Altmetric Explorer tool and a script for data collection that uses Twitter API.

14.4.2 Time Frame

We collected the mentions that appeared from January 1, 2020 to April 14, 2020. The time frame was chosen for two reasons. First, we wanted to understand better how social understanding of masks shifted during the period of rising awareness and information flows in the first few months of the Covid-19 pandemic. Second, we were concerned about the politicization of the mask debate at the later stages of the pandemic and the extent to which those characteristics would introduce confounding variables that were outside of the scope of our study. Ultimately, the time frame is based on (1) the dynamic of the volume of the public discussion which we initially assessed based on the number of tweets mentioning masks and (2) on the need to include part of the discussion after the change in the mask position of CDC (10 days after health officials recommended wearing the masks).

14.4.3 Measures and Analysis

Each of our research questions required its own approach in terms of measures and analysis. To answer Research Question 1, we started with the data from Altmetric that provided two different measures of volume: the number of mentions within media publications and the number of mentions with hyperlinks to the articles on Twitter. In Table 14.1, we report the descriptive statistics for each of research articles on both these metrics. We also report the number of days, out of the 105 days in our study period, in which there were *any* mentions of the articles as raw numbers and percentages.

These descriptive data already tell us that the six articles received different amounts of attention in media reports and Twitter posts. For example, Research Article #6 received them most media coverage (322 mentions over 105 days), but Research Article #3 received the most Twitter mentions (18,593). In contrast, Research Article #5 received fewer media and Twitter mentions, but received fairly consistent attention–at least one mention per day for 104 days–across the study time period. The descriptive data demonstrate just how variable mentions by media outlets and by social media users can be.

Table 14.1 Descriptive statistics for overall media mentions and Twitter mentions

Research article	Media mentions overall			Twitter mentions overall		
	Mentions	% of Total	Unique days	Mentions	% of Total	Unique days
Article #1	117	15.92	40	3,312	11.39	56
Article #2	73	9.93	15	399	1.37	69
Article #3	181	24.63	36	18,593	63.92	76
Article #4	20	2.72	10	238	0.82	73
Article #5	22	2.99	10	2,523	8.67	104
Article #6	322	43.81	25	4,024	13.83	69
All Articles	735	100.00	61	29,089	100.00	104

With our aim of understanding the relationship between a media mention and a Twitter mention for each article, we needed to look at the data in a longitudinal format. To prepare these descriptive data for an analysis over time, we transformed the data in two ways. First, we transformed the unit of analysis from the six different articles into each unique day from January 1 to April 14, 2020. Based on these 105 days, we reorganized the data to reflect the different points in time when each article was receiving attention. With these data reorganized, we can report the average daily mentions in both media and Twitter across the 105 days (see Table 14.2).

Second, we encountered a high level of variability and skewness in these variables, and these abnormalities raised several questions. Could we consider media mentions to be equivalent, on a ratio-level measurement scale, to Twitter mentions? The answer here seems to be "no." The number of media publications likely to mention one of these research articles, out of all media publications, would seem intuitively to be substantially less than the number of individual Twitter users likely to mention these articles. We decided the best way to investigate the relationship between media mentions and Twitter mentions within each of the six research articles was to standardize each of the variables, which normalizes them in a way that they can be more

Table 14.2 Descriptive statistics for daily mentions in media and in Twitter mentions

Research article	Daily media mentions			Twitter mentions		
	Mean	Median	SD	Mean	Median	SD
Article #1	1.11	0.00	2.70	31.54	1.00	59.56
Article #2	0.70	0.00	2.50	3.80	1.00	6.54
Article #3	1.72	0.00	5.84	177.08	2.00	918.08
Article #4	0.19	0.00	0.87	2.27	1.00	6.61
Article #5	0.21	0.00	0.86	24.03	2.00	75.66
Article #6	3.07	0.00	8.90	38.32	1.00	106.55
All Articles	7.00	1.00	16.45	277.04	19.00	970.54

comparable. Importantly, we also considered each article to be somewhat independent in its likelihood of garnering attention from both media outlets and Twitter users. Therefore, we completed the standardization process within the measurements for each article, subtracting the mean value for each article's mention variable (Table 14.2) from the mean and dividing by the standard deviation. The resulting variables will allow us to plot and to understand the relationships between the variables over time with much more clarity than if we plotted the raw numbers. In other words, we were able to analyze more clearly the relationship between media and Twitter mentions *within* the individual articles while also drawing inferences *across* the six articles in terms of the patterns of those media/Twitter relationships.

Our second research question necessitated a different approach to the data. In this section of our inquiry, we were more interested in understanding the content of the mentions–how the articles were being used to support or oppose the use of masks in the Covid-19 pandemic. In this section, each mention was treated as the unit of analysis. Since we were interested in the content of the mentions, we did not analyze duplicates (i.e., reprints for media and retweets for Twitter mentions). For media publications (n = 234), we operationalized mention as the paragraph mentioning the article along with one paragraph before and one paragraph after the paragraph mentioning the article. Including two extra paragraphs provided us with the context necessary for coding the communicator's interpretation of the results of the studies. For Twitter content (n = 4,775), we use the entire text of a tweet.

The publications and tweets were coded based on their interpretation of the scholarly articles, i.e., whether they are used as evidence supporting a specific position regarding mask efficacy or usage (anti-mask, pro-mask, the science is unclear/conflicted about mask efficacy, or the mention does not provide enough information to interpret the position, e.g. because it only contains a link to the study). The publications and tweets were also coded for the presence of qualifying language, i.e., whether the interpretation of the articles was presented with any level of uncertainty or limitation regarding the results, scientific recommendations, or mask efficacy (no qualifying language, qualifying language). Media mentions were also coded for the communicator's overall position regarding mask efficacy based on the headline and the first two paragraphs (positions as above). We did not code the tweets for the overall position because we assumed that it would oftentimes overlap with the interpretation of the studies due to the character limit imposed by the social network.

To secure reliability, the entire dataset was coded separately by the authors in segments, with disagreements periodically resolved through discussion until interpretive convergence was achieved (Saldaña 2016). Descriptive statistics were run using Excel to answer the research questions.

14.5 Results

14.5.1 Volume of the Discussion

Our first research question focused on a closer look at the trends and relationships between the attention paid to research articles about mask efficacy in two different science communication environments: online news websites and the social media platform Twitter. As outlined in the Methods section, we assume for our analysis that mentions of these six articles in either environment arise independently. The assumption allows us to examine the relative relationship–based on standardized variables–between news and social media mentions for each article in turn.

The trends and relationships for Article #1 (human testing of a variety of mask types) are depicted in Fig. 14.2. The first mention of this research article occurred on day 31 within our data set, January 31, 2020, in online news media, followed by several more mentions in that news environment. From day 61 (March 1st) through day 91 (March 31st), the article was mentioned off-and-on in media publications while its Twitter mentions increased dramatically. The mentions of this article peaked on day 94 (April 3rd, when an announcement from CDC was expected) in media publications before diminishing in both environments by mid-April. The relationship between the two trends indicates that the amount of attention on Twitter outpaced media attention throughout most of the 105 days of our study period.

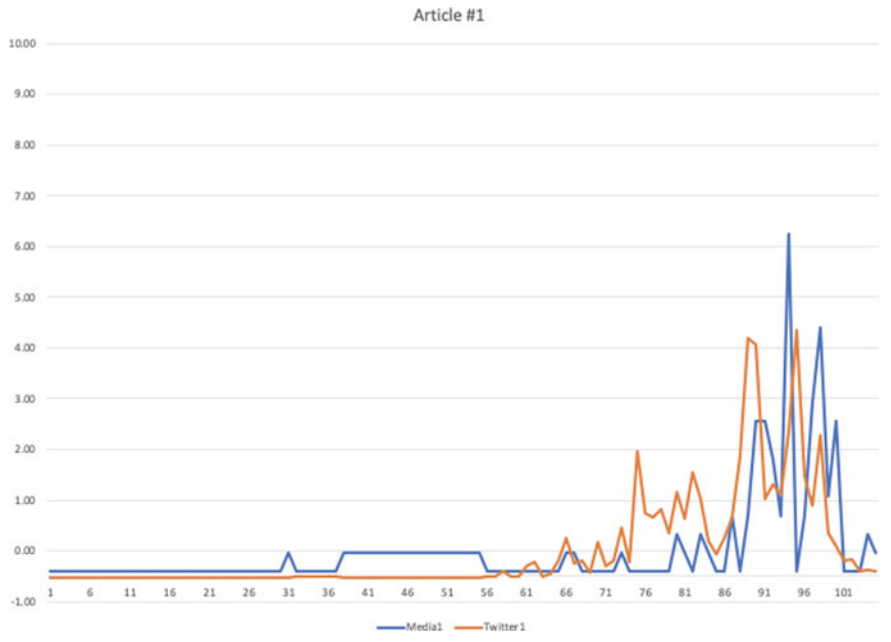

Fig. 14.2 The trends and relationships for Article #1

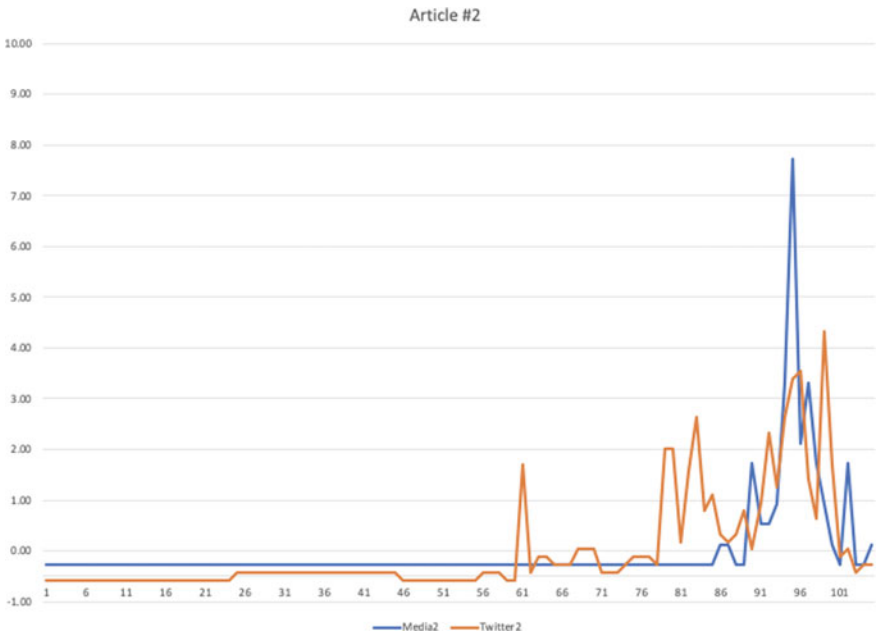

Fig. 14.3 The trends and relationships for Article #2

The trends and relationships for Article #2 (physical testing of potential mask materials) are shown in Fig. 14.3. This study of mask efficacy first received attention on Twitter in late January and continued to gain attention on the social media platform, with several discrete peaks, until day 87 (March 27th). At that point, attention shifted from Twitter to media publications, where it suddenly increased and peaked on day 95 (April 4th), followed by the biggest peak on Twitter on day 99 (April 8th). The data patterns for this research article indicate a larger amount of attention from Twitter preceding the peak in media mentions.

The trends and relationships for Article #3 (experimental study of effects of differing mask use by healthcare workers in Vietnam; Fig. 14.4) were quite different from the first two, featuring longer periods of low attention punctuated by two main peaks. This research article gained its greatest share of online news attention at two different points in time. The first peak was by day 29 (January 29th), followed by a very quiet period, until a resurgence in mentions peaking on day 94 (April 3rd). This research article only received a large amount of attention on Twitter in a more limited time period, between days 82 and 93 (March 22nd and April 2nd). For this research article on masks, online media showed the greater attention first, with virtually no complementary attention on Twitter, followed by a peak in both information environments by early April.

Article #4 (a review) received little average attention per day across the 105 day period. There were two notable peaks on Twitter, the first spanning days 30 and 32 (January 30th and February 1st) and the second, larger peak isolated to day 61

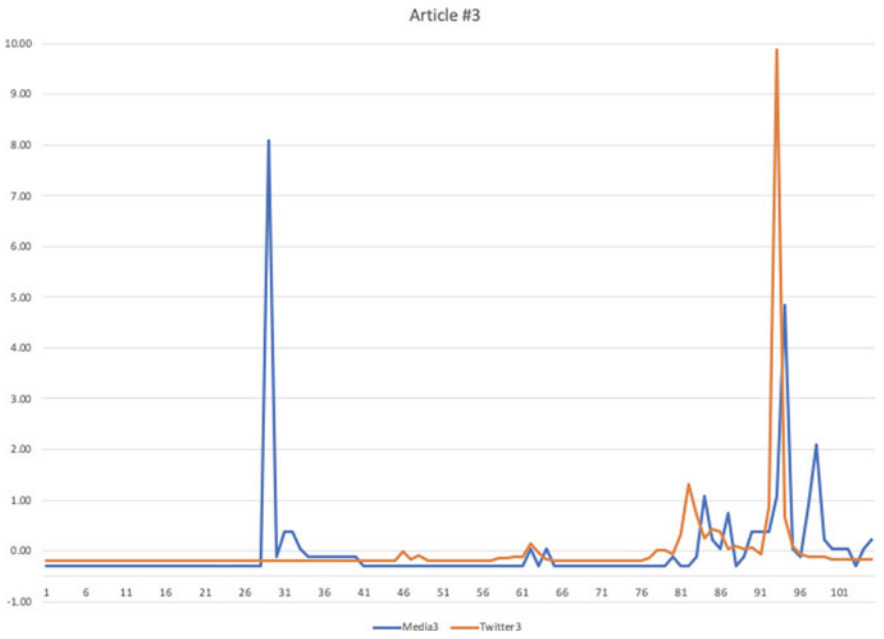

Fig. 14.4 The trends and relationships for Article #3

(March 1st). There was a small peak in attention in online news on day 56 (February 25th)–immediately preceding the bigger peak of attention on Twitter. The larger peak in online news occurred on day 98 (April 7th) with no corresponding attention on Twitter (Fig. 14.5).

The trends for Article #5 (physical testing of a t-shirt mask) are shown in Fig. 14.6. The Twitter attention was relatively limited between days 79 and 81 (March 19th and March 21st). Online news attention was a little more spread out, with two peaks: day 88 (March 28th) and days 102 and 103 (April 11th and 12th). For this research article, Twitter attention occurred and peaked very late in the study period followed by the steadier attention from online news media.

Finally, Article #6 (a multi-methods study with human and physical testing of different masks), like the previous article, received most attention very late in the study period–in fact, this article received no attention at all until day 77 (March 17th). Twitter attention grew quickly, peaking on day 88 (March 28th). Media mentions followed closely behind, peaking on day 91 (March 31st). The parallel growth and decline in attention in both information environments is notable. Attention was first gained on Twitter and very nearly matched in its intensity and decline in the following days in online news media (Fig. 14.7).

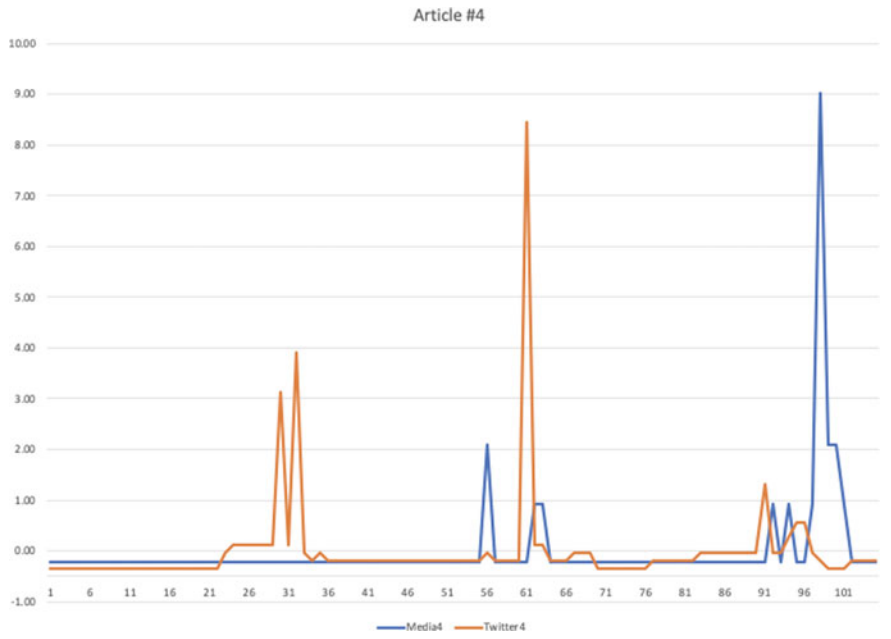

Fig. 14.5 The trends and relationships for Article #4

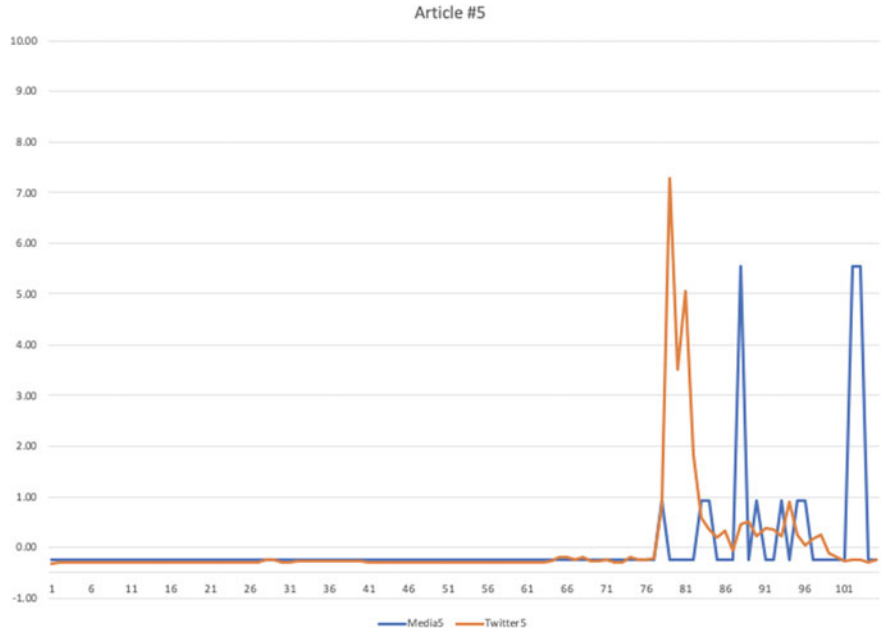

Fig. 14.6 The trends and relationships for Article #5

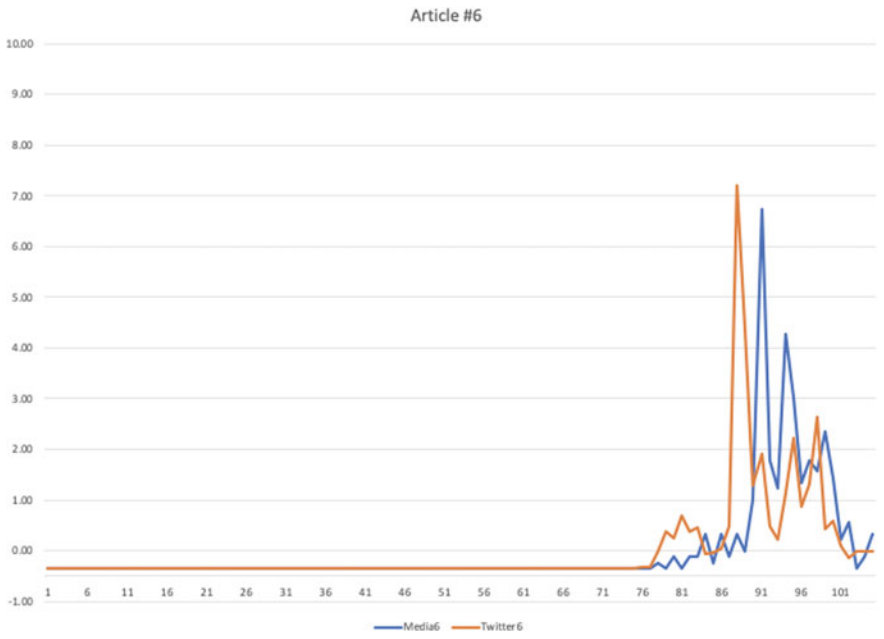

Fig. 14.7 The trends and relationships for Article #6

14.5.2 Content of the Mentions

For our second research question we looked at the differences in interpretation of the research articles by media and Twitter communicators. As mentioned in the methods section, we looked both at the interpretation of the results (a position regarding mask efficacy/usage assigned to the study) and at the presence of uncertainty in such interpretations.

Interpretation of the articles. Overall, the majority of the scholarly articles of interest appeared in pro-mask media publications (62%), followed by publications without a determinable stand regarding masks (28%), and publications suggesting that science does not provide a clear answer (8%). Interestingly, only 2% of the media publications expressed a clear anti-mask stand (see Table 14.3). When it comes to the interpretation of the research articles themselves, 73% of the media publications interpreted the target articles as providing evidence supporting the pro-mask position, 13% of the publications used them as evidence supporting the anti-mask position, 12% of the publications did not communicate a clear stand when citing the articles, and 1% used them to demonstrate that science is not clear and/or is conflicted about mask efficacy. When it comes to interpretation of the studies themselves, 73% of the citations on media used the scholarly articles as pro-mask evidence, 13% interpreted them as evidence against masks, 1% suggested that science was conflicted, and 12% provided no determinable stand (see Table 14.4).

Table 14.3 Overall position on facemasks of media publications

	Pro-mask	Anti-mask	Unclear/Conflicted science	No determinable stand	Total
Article #1	23	0	3	8	34
	(68%)	(0%)	(9%)	(24%)	(100%)
Article #2	12	0	1	4	17
	(71%)	(0%)	(6%)	(24%)	(100%)
Article #3	15	1	4	20	40
	(38%)	(3%)	(10%)	(50%)	(100%)
Article #4	3	1	1	0	5
	(60%)	(20%)	(20%)	(0%)	(100%)
Article #5	5	0	0	1	6
	(83%)	(0%)	(0%)	(17%)	(100%)
Article #6	87	3	9	33	132
	(66%)	(2%)	(7%)	(25%)	(100%)
Total	145	5	18	66	234
	(62%)	(2%)	(8%)	(28%)	(100%)

Table 14.4 Interpretation of the studies by the media

	Pro-mask	Anti-mask	Unclear/Conflicted science	No determinable stand	Total
Article #1	32	0	0	2	34
	(94%)	(0%)	(0%)	(6%)	(100%)
Article #2	13	2	0	2	17
	(76%)	(12%)	(0%)	(12%)	(100%)
Article #3	4	22	1	13	40
	(10%)	(55%)	(3%)	(33%)	(100%)
Article #4	2	2	1	0	5
	(40%)	(40%)	(20%)	(0%)	(100%)
Article #5	5	0	0	1	6
	(83%)	(0%)	(0%)	(17%)	(100%)
Article #6	115	5	1	11	132
	(87%)	(4%)	(1%)	(8%)	(100%)
Total	171	31	3	29	234
	(73%)	(13%)	(1%)	(12%)	(100%)

Table 14.5 Interpretation of the studies by Twitter users

	Pro-mask	Anti-mask	Unclear/Conflicted Science	No determinable stand	Total
Article #1	599	7	5	409	1020
	(59%)	(1%)	(0%)	(40%)	(100%)
Article #2	42	28	1	109	180
	(23%)	(16%)	(1%)	(61%)	(100%)
Article #3	109	677	19	1027	1832
	(6%)	(37%)	(1%)	(56%)	(100%)
Article #4	7	3	3	18	31
	(23%)	(10%)	(10%)	(58%)	(100%)
Article #5	424	2	15	474	915
	(46%)	(0%)	(2%)	(52%)	(100%)
Article #6	406	22	6	363	797
	(51%)	(3%)	(1%)	(46%)	(100%)
Total	1587	739	49	2400	4775
	(33%)	(15%)	(1%)	(50%)	(100%)

As explained in the methods section, we only determined the interpretation of the articles, not the overall position, when working with the Twitter data. On Twitter, most of the citations were cited in tweets without a determinable stand regarding masks (50%). Roughly one-third of the tweets (33%) cited the studies as those supporting a pro-mask position, followed by anti-mask interpretation (15%). Only 1% of the tweets suggested that science was conflicted regarding mask efficacy (see Table 14.5).

As demonstrated in Table 14.4, Article #1 (human testing) was mostly cited by the media as evidence for a pro-mask position (N = 32). It was also cited twice without indicating a clear position that the article was supposed to support (N = 2). While the majority of tweets also cited the article as pro-mask evidence (N = 599), a number of citations did not specify the position that the article supported (N = 409), some tweets used the article to demonstrate that science was conflicted about mask efficacy (N = 5), and some even interpreted it as anti-mask (N = 7).

Similar to the first article, media mostly cited Article #2 (physical testing) when supporting a pro-mask position (N = 13). However, the article was also used as anti-mask evidence (N = 2) and in citations without a clear position (N = 2). Interestingly, Twitter users mostly cited the same article without providing a clear interpretation (N = 109). Moreover, the article got a number of pro- (N = 42) and anti-mask (N = 28) citations. One tweet also cited the article as evidence suggesting that research is conflicted about mask efficacy (N = 1).

More than a half of media publications citing Article #3 (experimental study showing that healthcare workers wearing cloth masks exhibited more influenza-like symptoms than the control group using normal practices) presented it as evidence against mask efficacy (N = 22). Some media also cited the article without clearly

specifying the position that it supports (N = 13), as evidence for mask usage (N = 4) and as evidence that research was conflicted about mask efficacy (N = 1). Just like in the case of Article #2, Twitter users mostly cited Article #3 without specifying a clear position that the article supports (N = 1027), followed by citations used as anti-mask evidence (N = 677), pro-mask evidence (N = 109), and claims that science was conflicted about mask efficacy (N = 19).

Article #4 (literature review) presents an interesting case where the article was used as evidence for (N = 2) and against (N = 2) masks in the same number of publications. The article was also cited as evidence of conflicted science (N = 1). Most of the citations on Twitter did not provide enough information to decide the author's interpretation of the article (N = 18). The article was also presented as evidence for mask efficacy (N = 7), against mask efficacy (N = 3), and as evidence demonstrating that science is conflicted (N = 3).

Media mostly cited Article #5 (t-shirt mask) as evidence supporting mask efficacy (N = 5). The article was also cited without expressing a specific position (N = 1). On Twitter, the article got almost equal number of mentions without expressing a specific position (N = 474) and pro-mask mentions (N = 424). The article was also used to demonstrate that science is conflicted (N = 15), and as anti-mask evidence (N = 2).

Finally, Article #6 (multi-methods testing) received most media citations as pro-mask evidence (N = 115). It was also cited without a clear position (N = 11), as anti-mask evidence (N = 5), and as evidence of conflicted science (N = 1). Twitter users mostly cited the article either as pro-mask evidence (N = 406) or without expressing a specific position (N = 363). The article was also mentioned as anti-mask evidence (N = 22) and as evidence of conflicted science (N = 6).

Expression of uncertainty. Not only did Twitter users and mainstream media demonstrate differences in interpretations of the articles but they also presented those interpretations differently (see Table 14.6).

Most of the media publications (N = 31) cited Article #1 with qualifying language thus suggesting some uncertainty regarding the claims about mask efficacy. Only one publication cited the study without qualifying language (N = 1). While the article was frequently cited by Twitter users along with qualifying language (N = 458), a large proportion of tweets also referenced the study without expressing uncertainty regarding mask efficacy (N = 153).

Similarly, all the media mentions of the Article #2 and Article #4 included qualifying language. On Twitter, Article #2 was cited both within the tweets expressing uncertainty (N = 57) and tweets without qualifying language (N = 14). Article #4 mostly received mentions along with qualifying language on Twitter (N = 12) but also was cited without language indicating uncertainty (N = 1).

Most of the media mentions of Article #3 included qualifying language (N = 25) with only two mentions not expressing uncertainty (N = 2). On Twitter, the same article received a number of mentions both with (N = 596) and without (N = 209) qualifying language. The same was true for Article #5 which was mostly cited along with qualifying language by the media (N = 4). One media citation of the article was without expression of uncertainty (N = 1). Twitter mentions of this article include both tweets with (N = 176) and without qualifying language (N = 265).

Table 14.6 The presence of qualifying language on mainstream media and Twitter

	Media			Twitter		
	Present	Not present	Total	Present	Not present	Total
Article #1	31	1	32	458	153	611
	(97%)	(3%)	(100%)	(75%)	(25%)	(100%)
Article #2	15	0	15	57	14	71
	(100%)	(0%)	(100%)	(80%)	(20%)	(100%)
Article #3	25	2	27	596	209	805
	(93%)	(7%)	(100%)	(74%)	(26%)	(100%)
Article #4	5	0	5	12	1	13
	(100%)	(0%)	(100%)	(92%)	(8%)	(100%)
Article #5	4	1	5	176	265	441
	(80%)	(20%)	(100%)	(40%)	(60%)	(100%)
Article #6	116	5	121	349	85	434
	(96%)	(4%)	(100%)	(80%)	(20%)	(100%)
Total	196	9	205	1648	727	2375
	(96%)	(4%)	(100%)	(69%)	(31%)	(100%)

Table 14.7 The presence of qualifying language in media mentions based on the position assigned to a study

	Pro-mask mentions			Anti-mask mentions		
	Present	Not present	Total	Present	Not present	Total
Article #1	31	1	32	0	0	0
	(97%)	(3%)	(100%)	(0%)	(0%)	(0%)
Article #2	13	0	13	2	0	2
	(100%)	(0%)	(100%)	(100%)	(0%)	(100%)
Article #3	2	2	4	22	0	22
	(50%)	(50%)	(100%)	(100%)	(0%)	(100%)
Article #4	2	0	2	2	0	2
	(100%)	(0%)	(100%)	(100%)	(0%)	(100%)
Article #5	4	1	5	0	0	0
	(80%)	(20%)	(100%)	(0%)	(0%)	(0%)
Article #6	110	5	115	5	0	5
	(96%)	(4%)	(100%)	(100%)	(0%)	(100%)
Total	162	9	171	31	0	31
	(95%)	(5%)	(100%)	(100%)	(0%)	(100%)

Finally, media mostly cited Article #6 along with qualifying language (N = 116). Only five mentions of the article in mainstream media did not express uncertainty (N = 5). Twitter users, on the other hand, cited the article with (N = 349) and without (N = 85) expressing the uncertainty.

As demonstrated in Table 14.6, out of the media publications that did communicate some position (pro-mask, anti-mask or unclear/conflicted science), 96% used qualifying language in the paragraphs citing the research articles indicating some level of uncertainty regarding mask (in)efficacy. Interestingly, there were no media publications that would cite the research articles as evidence against masks without using qualifying language (see Table 14.7). In other words, whenever journalists suggested that the research articles of interest demonstrated mask inefficacy, they would communicate some level of uncertainty regarding this position. While most of the media publications citing research articles as those supporting a pro-mask position also used qualifying language, some of them cited the research articles without communicating uncertainty. This includes Article 1 (N = 1), Article 3 (N = 2), Article 5 (N = 1), and Article 6 (N = 5) were also cited as evidence supporting a pro-mask position without being accompanied by language communicating uncertainty.

While Twitter users were also more likely to use qualifying language when communicating one of the three position-based interpretations, the percentage of tweets citing the research articles without qualifying language was higher than the percentage of media publications (31% and 4% respectively). When cited as pro-mask evidence on Twitter, five out of six articles would have citations used without qualifying language (see Table 14.8). Moreover, Twitter users would not hesitate to

Table 14.8 The presence of qualifying language in Twitter mentions based on the position assigned to a study

	Pro-mask mentions			Anti-mask mentions		
	Present	Not present	Total	Present	Not present	Total
Article #1	446	153	599	7	0	7
	(74%)	(26%)	(100%)	(100%)	(0%)	(100%)
Article #2	38	4	42	18	10	28
	(90%)	(10%)	(100%)	(64%)	(36%)	(100%)
Article #3	101	8	109	476	201	677
	(93%)	(7%)	(100%)	(70%)	(30%)	(100%)
Article #4	7	0	11	2	1	3
	(100%)	(0%)	(100%)	(67%)	(33%)	(100%)
Article #5	160	264	424	1	1	2
	(38%)	(62%)	(100%)	(50%)	(50%)	(100%)
Article #6	327	79	406	16	6	22
	(81%)	(19%)	(100%)	(73%)	(27%)	(100%)
Total	1079	508	1587	520	219	739
	(68%)	(32%)	(100%)	(70%)	(30%)	(100%)

cite articles as evidence against masks without expressing uncertainty. In the case of Twitter, 30% of the anti-mask citations were published without being accompanied by qualifying language, as opposed to 0% in media publications.

14.6 Discussion

The current chapter explored the circulation of scientific knowledge in the mask debate during the Covid-19 pandemic. More specifically, we looked at the longitudinal trends of citing six popular articles to see how the studies gained attention of mainstream media and Twitter users. We also examined trends in interpreting the studies from the perspective of the assigned position and (un)certainty expressed along with this position by mainstream media and Twitter users.

14.6.1 Independent Agendas on Mainstream Media and Twitter

The articles of interest circulated on mainstream and social media in several different ways both in terms of where the articles first appeared (mainstream vs. social media), and the dynamic of distribution (steep peaks vs. relatively low yet constant attention). While some articles were first mentioned on Twitter and then got picked up by the mainstream media, others received mainstream media attention first and only after that, began to be noticed by Twitter users. In other words, our results show that neither news media nor Twitter are securely in the lead when it comes to disseminating scientific studies. Although this does not directly demonstrate that either mainstream media or Twitter users shape each other's agenda, it might indicate the mutual influence revealed in previous research (Conway et al. 2015; Wang and Guo 2015) or at least the existence of separate agendas that remain relatively independent. These complexities raise questions about the implications of possible interdependence of mainstream and social media agendas when it comes to scientific information during a pandemic. Who decides what studies get cited and amplified? Why are some peaks in one type of media followed by increased attention in another media type, while others are not? Should journalists monitor and address scientific information disseminated by social media users, or should they aim to preserve their gatekeeping role, emphasizing only the studies they assess to be valuable? "Treatment" of the online infodemic will require a deeper understanding of the interactions of specific media within the broader science communication environment.

Another interesting finding is related to the dynamic of the dissemination of the research articles. Our study showed that while some articles on mask efficacy were receiving smaller yet constant attention on mainstream and social media throughout the three-month period, others demonstrated sharp increases in public interest that

might or might not be followed by a sharp decline. From the perspective of agenda setting theory, it raises questions about the most productive attention model in terms of promoting scientific knowledge during infodemics accompanying health crises. If the media do dictate what to think about (McCombs 2005), what would be more beneficial for promoting health interventions such as masks? Would it be better if relevant scientific articles remain on the agenda for a longer period of time but with lower levels of mainstream and social media attention, or if they receive higher levels of attention but within a short period of time? More importantly, is this a real dichotomy? Is there a way to make sure that research is disseminated and discussed both with high volume and while the issue (such as mask use) remains relevant?

14.6.2 Various Ways to Interpret the Same Articles

When it comes to interpretation of the studies, several interesting trends emerge across the articles. First, we found that the same research article could be cited as supporting both pro- and anti-mask positions, both on Twitter and by mainstream media. This result highlights the flexibility of interpretation of scientific studies. Needless to say, this raises significant concerns about information flows and the spread of scientific (mis)information online during a pandemic. Where Al-Rakhami and Al-Amri (2020) suggest that communicators should "contribute to sharing credible content from reputable sources on the web" (p. 155,969), our results reveal that credible content alone is insufficient. Even the best sources–scientific studies–can be variably interpreted. Both traditional and social media communicators must not only share, but also frame the content they are sharing. Since such framing may affect audience's understanding of the science and their willingness to take preventive measures to protect their own as well as public health (Nan et al. 2012; Nisbet 2009; Sprain 2018; Updegraff et al. 2011), communicators who want to sustain the science communication environment need to take care in conveying accurate interpretations of the sources they are disseminating. This raises a number of questions related to scientists' and science communicators' responsibilities when it comes to framing studies. What should a researcher do when their audience grows during a health crisis, and a study originally directed at their scientific peers is now circulating among lay publics actively seeking information? Since framing of their findings will inevitably happen (Sprain, 2018), would it be beneficial for society to have scientists frame their own research, e.g., through carefully crafted plain language abstracts? In this case, for example, two of the research teams which had authored target articles had to step up and publish additional guidance to emphasize that despite the qualified language of their conclusions, their studies in fact supported widespread use of cloth masks during the pandemic (Davies et al. 2020; MacIntyre et al. 2020).

Second, our results show that Twitter communicators frequently mention a study without making explicit any conclusion to be drawn from it, often simply posting a link. This paucity of reasoning is especially in contrast to the greater degree of explicitness of media communicators. On the one hand, this might be explained by

technological affordances of the social network: the limited number of characters per tweet does not make room for elaboration. It is also likely that audiences can at times infer a communicator's position on the issue from other evidence in the tweet thread, not included in our data. Even so, however, it appears that Twitter is not promoting among its audience the kind of explicitness and reasoning required for sound decision-making in a pandemic. One might speculate that such lack of elaboration might further exacerbate the issue of infodemic as Twitter users are contributing to overwhelming amounts of information regarding health interventions without ensuring proper understanding of what that information means. We would, however, warn against interpreting this result as an attempt to demonize social media. More research is needed to determine the level of sophistication in argumentation that Twitter users rely on when dealing with studies, and the effects of various levels of sophistication on public perception of science and one's willingness to enact health interventions.

14.6.3 Twitter Users Are More Confident in Their Interpretation of Research

Finally, our results show that Twitter communicators are less likely to include qualifications when interpreting studies compared to media communicators. This difference is especially salient in the case of anti-mask interpretations; where the media would always use qualifying language, about one-third of the tweets provided their anti-mask interpretation of the studies with no indicators of uncertainty. The finding brings up the old concerns related to oversimplification of science (Gustafson and Rice 2020; Jensen 2008; Retzbach and Maier 2015). Moreover, the issue gets a new twist in the social media environment. While the original concern focused on journalists' oversimplifying scientific findings or the lay public, now we deal with simplification done by the lay publics themselves. Given the number of people seeking information about the pandemic on social media (Ali et al. 2020), this again might be a problematic practice contributing to infodemics. At the same time, our study demonstrated that the vast majority of media publications did use some sort of qualifying language when presenting the results of the studies. This gives hope for a productive discussion between scientists and the lay public when mediated by the traditional gatekeepers. Taken together, these trends raise questions about the need for the scientific community to consider both journalists and a broader audience when communicating their findings.

14.6.4 Limitations

While we believe that our chapter opens up a promising discussion on the topic of circulation of scientific information during a pandemic, the study has several limitations. First, the study only focuses on media articles and tweets published from January 2020 to mid-April 2020. In other words, we did not study the issue after it was politicized, which likely changed patterns in media use and interpretation. Second, we did not examine the transmission of mis- or disinformation. All of our target studies were legitimate, peer-reviewed research published before the pandemic. In that sense, our study represents a "worst case scenario," showing how even the best information can receive variable attention and support diverging viewpoints. The analysis of "the dark side" of the mask debate would have likely revealed additional, perhaps divergent, patterns in public use and interpretation of scientific information.

14.6.5 Future Possibilities

In addition to the results on our research questions, our data points the way to additional lines for investigation. The specific techniques communicators use to frame the studies beyond merely tilting towards a pro- or anti-mask position deserves additional attention. Even in the brief format afforded by Twitter, communicators could emphasize particular aspects of the study they mentioned. For example, an intriguing example of framing scientific results came up in the discussions of different kinds of protection provided by the masks. While some users focused on mask efficacy in terms of *protection of the wearer*, others emphasized the *source-control efficacy* of masks (i.e., protection of others from the wearer); yet others suggested that "*protection goes both ways.*" (A1_t104). The same trend could be observed in media publications. For example, when interpreting Article #6, one media publication emphasized the source-control potential of the masks, "*According to public health experts, fabric or cloth masks are not intended to protect the wearer from getting infected, but prevents them from spreading the virus*" (A6_m19). The same article was used as evidence against masks by a publication emphasizing protection of the wearer, "A 2013 U.K. study that looked at masks made from cotton T-shirts found that the homemade masks were not effective protection in a flu pandemic" (A6_m23).

Sometimes, the processes of emphasizing certain aspects of the research findings would take an extreme form of omitting the part of the conclusions that did not fit the speaker's position. An interesting example of this practice also came from Article #6 which originally provided the following conclusion: "Our findings suggest that a homemade mask should only be considered as a last resort to prevent droplet transmission from infected individuals, but it would be better than no protection." (Davies et al. 2013, p. 413). While some media publications and tweets provided the full quote, others included only half–either the "last resort" or the "better than

nothing" phrase. In other words, the ambiguity of the conclusion allowed both mainstream media and Twitter users to select what part of the sentence they would focus on, thus framing the study as evidence for or against the masks.

Another intriguing example of different ways of framing the same information occurs when interpreting specific numbers drawn from the studies. For example, when discussing Article #3, a number of Twitter users cited the reported 97% penetration rate as evidence of the ineffectiveness of masks: "*Mandy, Penetration of cloth masks by particles is almost 97%. This is instilling a false sense of security which is dangerous… Cloth is unacceptable.*" (A3_t1319). But another user asserted the opposite perspective, suggesting that "*3% reduction is 3% reduction. this is a game of small incremental improvements that add up*" (A3_t1730). Like an optical illusion, the same result can be seen both as 3% protection and as 97% penetration, depending on the position. Interestingly, while the media would oftentimes explicitly take a side when interpreting the studies, some Twitter users could simply post the numbers thus encouraging others to decide if the offered protection is enough.

These observations open up a promising discussion on the ways media and lay publics interpret scholarly articles. More research is needed to identify the reasons behind opposite ways to interpret the same results. We would encourage exploring factors that relate to scientific pieces (e.g., ambiguous conclusions), science communicators (e.g., science literacy, personal characteristics) and the context (e.g., stage of the pandemic).

14.6.6 New Environment Comes with New Challenges

In this exploratory study, we have examined online circulation of ambiguous research on mask efficacy in the early months of the pandemic. We have documented a complex science communication environment, with the quickly changing scientific evidence, growing number of actors having direct access to scientific research, more channels for communicating science, and higher speed of information dissemination. While it might be easy to place blame on lay publics or health officials for failing the mask response at the first stages of the pandemic, our chapter demonstrates that the issue is more complex and requires a comprehensive approach to ensure successful public response to future health crises. In the situation of a pandemic, health guidelines may and most likely, *will* change thus confusing both journalists and lay publics. In fact, mask-related guidelines are changing even as we are writing this chapter with CDC now recommending two layers of masks (CDC 2021). With the growing movement for open science, lay publics will be likely getting more information directly from scholarly journals, and the higher levels of internet penetration will only increase the amounts of scientific information coming from media and fellow internet users. We suggest that within this context, the findings of our study call for reconsideration of science communication practices that would allow for a productive public discussion and timely implementation of health interventions during a pandemic.

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