Developing Techniques to Support Technological Solutions to Disinformation by Analysing Four Conspiracy Networks During COVID-19

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ABSTRACT

Given the role of technology and social media during the COVID-19 pandemic, the aim of this paper is to conduct a social network analysis of four COVID-19 conspiracy theories that were spread during the pandemic between March to June 2020. Specifically, the paper examines the 5G, Film Your Hospital, Expose Bill Gates, and the Plandemic conspiracy theories. Identifying disinformation campaigns on social media and studying their tactics and composition is an essential step toward counteracting such campaigns. The current study draws upon data from the Twitter Search API and uses social network analysis to examine patterns of disinformation that may be shared across social networks with sabotaging ramifications. The findings are used to generate the *Framework of Disinformation Seeding and Information Diffusion* for understanding disinformation and the ideological nature of conspiracy networks that can support and inform future pandemic preparedness and counteracting disinformation. Furthermore, a Digital Mindfulness Toolbox (*DigiAware*) is developed to support individuals and organisations with their information management and decision-making both in times of crisis and as strategic tools for potential crisis preparation.

MANAGERIAL RELEVANCE

At the organisational level, the spread of disinformation can lead to disruptions in business continuity planning, sporadic decision-making, exposure to high risk, and loss of trust and agility. Organisations need to be aware of the risks that come with using social media for communication because of the potential detrimental implications of disinformation. This is especially true during periods characterised by extreme uncertainty, such as global pandemics. To combat this issue, we recommend treating digital mindfulness as an essential foundation for vigilance and resilience at both personal and organisational levels. This study presents insights on detecting disinformation and fake news using social media analytics to identify key clusters and sharing patterns among conspiracy theory networks on Twitter. Our contribution to practice lies in our development of the *DigiAware Toolbox* and the *Framework of Disinformation Seeding and Information Diffusion* for understanding the ideological nature of disinformation networks which can be used in practice.

Index Terms: COVID-19, Disinformation, Fake news, Twitter, Data Analytics, Mindfulness

1. Introduction

We live in a digital transformation era where torrents of information surge unremittingly through various channels [1]. These are also precarious times for society because of the potential for false information to spread rapidly across the Internet [2]. There are two ways to label false information: misinformation or disinformation. Misinformation is false information where the sharer may not realise the content is incorrect [3]. Whereas if the information is intended to mislead, this is labelled as disinformation, with fake news representing a common form of disinformation [4]. Our focus in this study is based on understanding disinformation networks.

The COVID-19 pandemic has been accompanied by a colossal explosion of information (real and fake) on social media – which the World Health Organization has referred to as a "massive infodemic" [5]. As disinformation and fake news may be pervasive and expensive to control, people and organisations must proactively build awareness and resiliency against their negative effects [6].

The global COVID-19 pandemic has highlighted how effective information management and data engineering became even more critical during a crisis [7, 8]. We argue that to support information systems and technologies, mindfulness can also serve as core prevention and endurance strategy. Mindfulness refers to individuals' and organisations' alertness and agility in their information gathering in adapting to changing environments [9] and represents a core pathway to enhancing digital resilience.

Social media channels can serve as a platform for conspiracy theorists where 'popular' theories can rapidly cascade worldwide in a matter of minutes [3] with sabotaging ramifications [10].

Recent research during COVID-19, for instance, found that as few as 12 users could be responsible for much of the disinformation spread during the pandemic [11]. Implications of information asymmetries may be detrimental when individuals and organisations try to make sense of crises [12]. Wilson and Shifflett [28] utilise the phrase hybrid warfare to describe how any individual or group, such as QANON, can employ non-military means to attack and destabilise a government using social media.

At the individual level, extant work reveals that those who believe in distorted and unreliable health information are less likely to follow public health guidelines, with potentially serious implications for health management and policy [13].

At the organisational level, the spread of false information may lead to disruptions in business continuity planning [10]. Treating digital mindfulness as an essential foundation for vigilance and resilience at both personal and organisational levels, this study presents insights on detecting COVID-19 disinformation and fake news using social network analysis (SNA) to identify key clusters and sharing patterns among conspiracy theory networks on Twitter.

In December 2022, there were over 368 million monthly active users on Twitter worldwide [14]. Previous estimates have indicated that the age group of 24-34 is most dominant on the platform, with a 38.5% share of users [15]. Twitter is the most open social network and therefore lends itself well to studies of this nature [16].

This study draws upon data from Twitter related to four conspiracy theories prevalent during COVID-19, which were as follows:

1. **5G and COVID-19:** According to this conspiracy, 5G radiation is hazardous to human health and can modify or damage the immune system.

2. **Film Your Hospital**: This conspiracy claimed that the rumours of a pandemic and its impact on the healthcare system were manufactured and urged residents to film their local hospitals to demonstrate that they were empty.

3. **Expose Bill Gates**: According to this conspiracy, Bill Gates' aim in promoting vaccines was to secretly 'microchip' citizens and/or for other nefarious reasons.

4. **Pandemic Conspiracy**: The conspiracy asserted that COVID-19 vaccinations were neither created nor verified using rigorous scientific procedures. As part of a larger State conspiracy, the newly developed RNA technology is compromised and potentially modifies the human DNA.

The overall aim of this research is to develop a better understanding of the four conspiracy theories described above that were shared on Twitter between March to June 2020. More specifically, the study set out to address the following research questions (RQs):

  RQ1: What were the most shared tweets related to each of the four conspiracy theories?

  RQ2: What was the network shape of each of the four conspiracy theories?

  RQ3: What were the similarities and differences between the four conspiracy networks?

Based on the findings from RQ1-RQ3, the study had two main objectives:

  RO1: To identify the theoretical stages for conspiracy theories and counter measure strategies and conceptualise a framework of disinformation deeding and information diffusion

  RO2: To provide an overview of a proposed *DigiAware toolbox* to counteract disinformation

The study seeks to address a gap in knowledge related to the similarities and differences between multiple conspiracy networks on Twitter, categorising the ideology that drives them and developing strategies to combat them by drawing upon mindfulness [17]. We employed SNA to better understand the characteristics of the conspiracy networks, information sharing patterns and platforms, and the most popular tweets and narratives related to the conspiracies. Our

findings are used to develop theoretical insights into the ideological constructs of disinformation networks, and we develop a framework to understand the process.

Our study also conceptualises a Digital Mindfulness Toolbox known as 'DigAware' – an ensemble of tools that could be utilised to support individuals and organisations with their information management and decision-making. This Toolbox has the potential to be used not just in times of crisis but also during 'non-crisis' situations as a strategy tool for crisis preparation and prevention. Guided by previous work on crisis management and behavioural intention during crises, we seek to understand how COVID-19 content formed new health narratives, how users managed uncertainty, how these information behaviours shaped pandemic sense-making, and how this influenced behavioural responses. This knowledge could help to reduce the effects of future disinformation campaigns.

2. Literature Review

2.1. Overview of Recent Research

Several studies have explored the use of social media during the first phase of the COVID-19 pandemic. A systematic literature review published in Lancet Digital Health [18] found that previous research into COVID-19 and social media have focused on prediction [19], government responses [20], Infodemiology [21], mental health [22], analysing prevention education in videos [23], and examining public attitudes towards the pandemic [24]. Of the research examining data specifically on Twitter concerning conspiracy theories, previous research has analysed the film your hospital [25, 26], the 5G [13,14], and the plandemic conspiracy theories [3, 27]. Previous research [26] has also examined the role of automated accounts known as 'bots' within conspiracy networks and found that ordinary citizens were responsible for seeding and amplifying the conspiracy rather than bots. Very few studies related to Twitter have analysed

and compared the similarities and differences between multiple conspiracy networks on Twitter. Moreover, there is a lack of research examining the structure and shape of multiple conspiracy networks on Twitter [28]. This present research aims to contribute to the literature by comparing four conspiracy theory networks and developing a framework for understanding how these conspiracies are spread. By doing so, the study aims to develop the DigiAware Toolbox for counteracting the impact of disinformation.

2.2. Mindfulness as a theoretical Lens

Mindfulness is a centuries-old concept gaining popularity in response to digital challenges. We argue that mindfulness can be used as a support system for social media companies' information systems. The basic principle involves allowing "...one to pause amid the constant inflow of stimuli and consciously decide how to act, rather than react reflexively with ingrained behaviour patterns" [29, p.1]. The uncertainty surrounding COVID-19, its impact on families and healthcare providers, and the different efforts of quarantine, social isolation, and self-isolation have prompted many to observe a "mental health crisis" [30, 31]]. 'Mindfulness-based approaches appear well-suited to deal with the challenges presented by the time of unprecedented uncertainty, change, and loss,' conclude Antonova et al. [32, p.564]. The modalities of mindfulness include observational mindfulness, remembering mindfulness, right mindfulness, discrimination and wise mindfulness, including generation of insight [17].

Mindfulness is measured through self-reported questionnaires, interviews, observational/experimental measures [33], and a host of behavioural measures [34], all with different limitations. In the digital era, with its explosion of distractions and questionable information, mindfulness is viewed as offering a 'modern' rethinking and reflection opportunity (i.e., a time-out) to create awareness and provide insights [17]. Mindfulness practices have been

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shown to reduce stress and improve a person's sense of well-being and quality of life. Segev's research [35], in which he established a mindfulness course at an Israeli college using journaling and meditation, discovered that the practice significantly assisted pupils in dealing with the COVID-19 crisis.

Digital mindfulness is an attentional skill encompassing awareness of digital technologies, creating digital agility, and maintaining strong focus without distractions. Mindfulness training is reported to be one of the fastest-growing industries; more than 25% of companies in the United States are offering this training, and over 1000 smartphone apps are being used worldwide [17]. Digital mindfulness applications have been particularly prevalent in the health and well-being arena [36], with intermittent mindfulness practice through apps argued as leading to tangible benefits [37]. Research on educating for mindfulness has emphasised digital mindfulness-based programs and interventions (d-MBIs) via gaming [38], as well as alternate online experiences, use of reasons, group sharing, reflections on learners' discoveries, recognition for contradictions, and creating a safe and trusting environment [39-41]. Researchers have also examined mindfulness in relation to social media and well-being [42].

Limited peer-reviewed research has analysed the long-term effect of mindfulness exercises during the crisis. However, past studies demonstrate the benefits of regular mindfulness practises [43, 44]. The concept of mindfulness will be further drawn upon during the outline of the DigiAware Toolbox in section 5, discussion. The next section provides an outline of research related to disinformation and fake news.

2.3. Disinformation and Fake News

We are more likely to believe the information we have repeatedly been exposed to. This so-

called *illusory truth effect* implies that the more individuals and organisations encounter disinformation/fake news, the more it penetrates [45, 46]. Even when the information is blatantly false or when the source is not credible, continued exposure to such information still leads people to believe it [47].

Social media has facilitated digital access for individuals with diverse origins and interests [10] and can play a role in propagating both genuine and misleading information. Fake news can be used to discredit individuals/organisations and distort their views. Why do people share fake news? Recent work [48] found that sharing does not imply belief and that it may occur because people's attention is focused on factors other than accuracy.

A study published in the Journal of Business Research [49] conducted a literature review of fake news research published between 2012 and 2019. They found that the top five disciplines for research related to fake news included psychology, information technology/computer science, communication, interdisciplinary fields, and politics [49]. The authors found that previous research into fake news has focused on the dissemination process [50], the features of channels spreading fake news [51], outcomes/consequences [52], fabricated legitimacy [53], and attitudes [54]. Previous research in this area has also investigated fake news from a legal perspective [55], defence against neural fake news [56], and a large body of work has been investigating fake news during the COVID-19 pandemic [57].

Other more recent research on misinformation and accuracy, such as Pennycook [48], has found that while 16% of participants found a given headline accurate, 51% indicated they would share it. News diffusion through social networks has weakened the traditional information gatekeepers (e.g., media), allowing for virus-like propagation of content [58]. While in the old technology,

gatekeepers blocked many forms of disinformation, digital/algorithmic gatekeepers '..*succeed* by fuelling mistrust and doubt, as long as the clicks keep coming' [59]. Psychologically, online behaviour is guided by feelings of "in-group" belonging, which is stronger than fact-checking [60]. Social media also gives a social reward via immediate feedback (numbers of likes/shares), with Twitter users retweeting to show approval, argue, gain attention and entertain others [60]. This research finds that the accuracy of a claim is not a motivation for retweeting, suggesting that people may prefer to share popular or exciting messages over truthful posts.

One explanation as to why people are attracted to and share fake news is the 'novelty hypothesis', which argues that: "Novelty attracts human attention because it is surprising and emotionally arousing...It encourages sharing because it confers social status on the sharer, who is seen as someone who is "in the know" or who has access to "inside information" [60], p.49.

Using 2006-2017 data on 126,000 stories tweeted by approximately 3 million people over 4.5 million times, Vosoughi and co-authors [61] found that fake news is perceived as more novel than real news, with false stories diffusing faster, farther, deeper, and more broadly across a variety of news categories. Pariser [62] argues that customisation on websites and social media platforms creates a filter bubble by delivering only information that supports our views/preferences while isolating us from other/alternative information. According to Pariser's filter bubble theory [62], personalising search results and social media reinforces the content we already like, causing digital tunnel vision.

Relatedly, the Motivated Reasoning Theory suggests that emotionally biased reasoning is used to make decisions and maintain pre-existing attitudes, with defensive motivations (desire to protect a predetermined attitude) playing key roles in information processing and decision-

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making [63]. This implies that people's commitment to false beliefs may increase even when confronted with corrective information about the false belief [64]. Such entrenched commitment may be reflected via confirmation bias (we tend to seek information to confirm what we already believe in and neglect all the information that refutes it [65], illusory truth effect (inclination to believe false information upon repeated exposure to such information [66, 67], social desirability bias (tendency to post/tweet/comment in ways that make us look good/cool/favourable in the eyes of others [68]), as well as a host of other biases like overconfidence (overestimating how much we know and what skills/abilities we have [69]), framing (basing a decision based on the way the information is packaged/presented, rather than on the facts [70]), shared information bias (inclination to focus more on information shared by other 'group' members [71]), and recall bias (differences in accuracy/completeness of our recollections regarding earlier events [72]).

Extant studies show that people use reputation (familiarity/recognition), endorsement (credibility by others), consistency (shared/supported via multiple sites/sources), expectancy violation (appears/behaves as expected), self-confirmation (confirming one's beliefs), and persuasive intent (perceived intent of the source) as key heuristics when judging the credibility of a message [73]. Research on debunking (presenting a corrective message establishing the disinformation of a previous message) reveals that a detailed debunking message correlates highly with misinformation persistence, with debunking getting weaker when individuals generate reasons supporting the initial misinformation [74].

2.4. Digital Mindfulness for Crisis Management

Several novel conceptual and empirical health perspectives on crisis management during the pandemic were created [75, 76]. Crisis management is a phenomenon in which technological

and structural factors significantly impact the onset and resolution of crises. In his book, The Hype Machine, Aral [77] indicates the rising demand for social media and social collaboration technology. He goes on to show how hyper-socialisation and digital attacks have affected our lives (e.g., health, economics, and politics). As with many approaches to crisis management, the COVID-19 response has several similarities, specifically exposing people and organisations to unanticipated shocks [78], extreme volatility [79], and staggering uncertainty [80]. These studies define crisis management as responding to and handling a health emergency. There are several responses in which governments have used social media as part of a management response – for example, using Wikis as a collaborative health tool [81]. In addition, different aspects of smartphone apps helped improve the digitalisation of vaccine records and passes [82].

Digital mindfulness is a way of achieving and maintaining a sustainable balance between information requirements and digital overload. As a means of mitigating the potential rigidity of digital technologies, organisational mindfulness is seen as a requirement for information processing capabilities, and even more so in crises. We see digital mindfulness as a process requiring a reconsideration of behaviour in terms of routines, significance, and emotions. Drawing on the seminal behavioural of Jeffery Martin [83, 65], mindfulness is task-oriented, a circumstance in which the preservation of the self is intensified and facilitates a new shift in expectations and coping mechanisms. In this regard, adopting a digital mindfulness strategy is, we argue, a necessity for organisations as they strive to operate in uncertain environments for their staff [84, 66].

To date, our study is among the first to explore digital mindfulness in relation to the social media implications of an impactful pandemic causing great turbulence for individuals and organisations. False rumours and disinformation campaigns have a wide-ranging impact on

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individual and organisational choices, necessitating study on behavioural interventions to examine the spread of disinformation [61]. Since such negative effects are amplified during crisis situations, it is crucial that information management techniques incorporate flexible and resilience-building approaches. In this article, we claim that digital mindfulness-based behavioural techniques may offer an effective road ahead.

COVID-19 presents a particularly strong example of an explosion of disinformation, mental health crisis and, therefore, a raised requirement for practising digital mindfulness. Given the pandemic's far-reaching effects on several aspects of our lives, it has been challenging to process/filter this information and discriminate between what might be dangerous and what is true/reliable. Rapid dissemination of false information during times of uncertainty may have devastating effects on individuals, organisations, and society. We want to contribute to the area of information systems by using social media analytics to get insight into behavioural traits that can be utilised to design preventative measures and improve digital awareness. The next section (section 3) describes our methodology and research methods in depth. Section 4 details the results of our study, section 5 provides an overall discussion, and section 6 concludes our study.

3. Research Methodology

3.1 Research Method

The analytic technique selected in this study is SNA which was performed using the Microsoft Excel plugin NodeXL (release code: +1.0.1.428+). NodeXL is mostly associated with a quantitative research method used extensively in previous empirical work [85] . NodeXL is well-established in the academic literature. Recent research published in peer-reviewed journals using NodeXL has studied discussions around the sugar tax debate [86], the promotion of COVID-19 vaccines [87], and food poverty discussions [88]. The following sections provide further details

on the process of retrieving data and performing SNA.

3.2 Data Retrieval

Table 1 below provides an overview of datasets built using Twitter data alongside the keywords used to retrieve the data, the time periods examined, the number of unique Twitter users, and the number of tweets within the dataset. NodeXL was used to retrieve data from Twitter. NodeXL can connect directly to Twitter's Search Application Programming Interface (API). This API is further described in section 3.2.

Table 1. Overview of data retrieved

Dataset	Keywords used to retrieve data	Time-period Examined	Unique Twitter users	No of tweets*	No. of Retweets (% of the network)
Film Your Hospital	FilmYourHospital	13/04/2020 to 20/04/2020	11,333	22,785	12,905 (56%)
5G and COVID-19	5GCoronavirus	27/03/2020 to 04/04/2020	6,556	10,138	4,003 (39%)
#ExposeBillGates	ExposeBillGates	14/06/2020 to 17/06/2020	13,269	26,532	15,692 (59%)
Plandemic	Plandemic	08/05/2020 15:39 to 08/05/2020 21:10	18,339	27,957	13,211 (47.2%)

*(including retweets, replies to, mentions in retweets, mentions, and tweets)

The data collection period for each conspiracy theory falls after March 11, 2020, when the World Health Organisation (WHO) declared COVID-19 a Pandemic [89] and our data collection period ended on June 17 2020. We can capture the initial conspiracies being shared during the first few months of the pandemic. The conspiracies listed in Table 1 all had a high frequency of hashtag use, and our keywords were designed with this in mind. Data retrieval in NodeXL was able to

retrieve tweets matching the keywords used to obtain the data and retrieved any tweets that may have replied to or mentioned these tweets.

3.2 Twitter Search Application Programming Interface (API)

The standard Twitter Search Application Programming Interface (API) searches for recent popular tweets from the previous seven days and returns a sample of these tweets. This API is focused on retrieving the most relevant tweets and not a complete record. Given our interest in the most popular and amplifying content, this API was suitable for our research objectives. Our data retrieval was immediate whilst each of the conspiracies was popular in 2020; recent research using the Academic Track 2.0 may not contain a complete record of tweets.

3.3 Social Network Analysis (SNA)

Once data was retrieved within NodeXL, SNA was used to study the patterns of interactions between different users. Figure 1 below provides a simple visual representation of the method used within this study. Twitter users will be clustered into several different groups that form part of the larger network overall. Our study made use of NodeXL to analyse the network, which draws upon the Clauset-Newman-Moore algorithm [90], and we used the Harel-Koren Fast Multiscale layout [91]. The Clauset-Newman-Moore algorithm [90] is provided within NodeXL and can be used to identify community structures in large networks drawing upon edge relationships. Specifically, clusters are formed by identifying accounts that are more densely connected to each other. The relationships (edges) that are used to identify groups include retweets, replies, mentions in retweets, mentions, and tweets. So, for example, if a group of users often retweet and reply to each other, they would form a group (also known as a cluster) among themselves. The Harel-Koren Fast Multiscale layout [91] is a method for drawing out large graphs which are built within NodeXL.
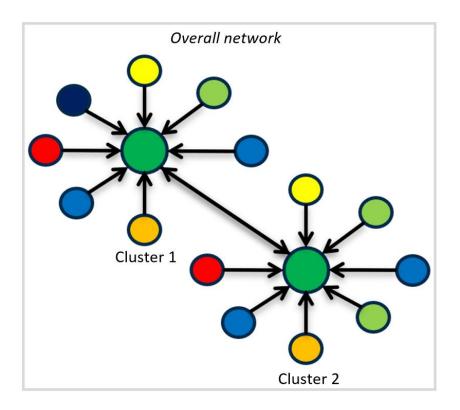
Figure. 1 Simple Representation of Network Clusters

Sources: Smith et al. [68] and the Social Media Research Foundation.

Just as groups might form in social settings, they can also occur on social media platforms such as Twitter. Previous research on Twitter may examine all users together, whereas SNA highlights that crowds and groups will form with various shapes and structures that would form the overall network. Previous research [92, 68] has analysed Twitter networks to identify six common types of shapes that may emerge within a network, as shown in Figure 2. Our study will draw upon the six common types of network shapes when interpreting disinformation networks. Figure 2 provides an overview of the different types of network shapes and structures that may occur.
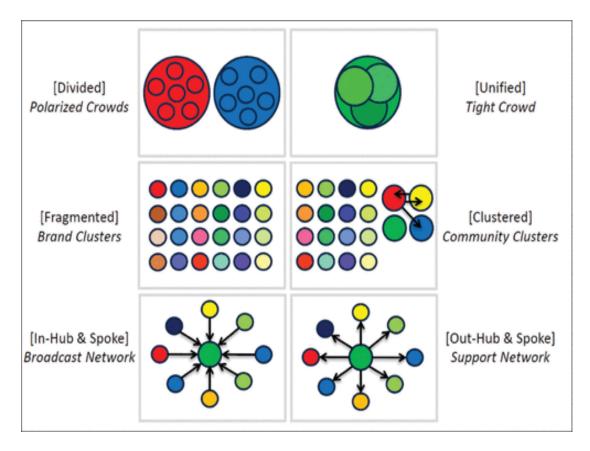
Figure 2. Six types of Twitter networks (simplified form)

Sources: Smith et al. [68] and the Social Media Research Foundation.

Figure 2 highlights the six groups that may merge on social media platforms such as Twitter. Polarised crowds occur when groups are densely connected to each other with few interactions with users between groups. Tight crowd groups occur when users have a high overlap and engagement. A brand cluster occurs when a topic has reached a point where social media users have high knowledge of it. The name is derived from the idea that large brands attract many individual tweets that do not contain interaction. Community cluster network shapes occur when there are many smaller pockets of discussions alongside a brand network. Broadcast networks occur when a user is retweeted with high frequency, and support networks are when users reply to others with high frequency. It is important to note that social media networks will not always fall into one type of network shape and that they may contain elements of multiple network

shapes and evolve over time. Furthermore, interactivity between different groups in network visuals can be observed by the links between users represented by lines connecting users. The darker and thicker lines indicate stronger relationships, and their thickness is determined by the number of times users mention each other.

4. Results

4.1 Identifying Popular Tweets Among the Largest Clusters

We identified the top English-language tweets, as shown in Table 2 below. We specifically focused on the top tweets contained in the four largest groups because of their influence and impact on the network overall. If the same tweet appears in the preceding group, then the next tweet is examined. Only tweets matching keywords used to obtain data are shown. Tweets were carefully reworded so that the author of tweets is not identifiable for anonymity purposes; therefore, the tweets in the table serve as a description of the content.

4.2 Identifying Popular Tweets

Table 2. Overview of most retweeted tweets across key clusters

Conspiracy Network	Group 1 Most Retweeted-Tweet	Group 2 Most Retweeted-Tweet	Group 3 Most Retweeted-Tweet	Group 4 Most Retweeted-Tweet
Film Your Hospital	I visited 2 hospitals that are supposed to be overrun but found that they were actually empty. Why are they lying to us? We need to become the news and get #FilmYourHospital trending. Please post pictures of your hospital!	Look at this empty hospital… [Video of empty ward] #EmptyHospitals #FilmYourHospital	I filmed my own hospital, and it was empty. View this video of the nurse just having her lunch like nothing's going on. The workers are just sitting around chilling. All looks fake to me! #FilmYourHospital	"The so called 'mainstream media' are reporting that the social media accounts driving the #FilmYourHospital campaign are followers of "QAnon,"
5G and COVID-19	What on earth is happening… Seriously #5GKILLS #5GCoronavirus	When people say that 5G causes COVID-19… [Link to humorous video] #5GCoronavirus	What people look like if they believe 5G causes COVID-19 Link to humorous picture] #5GCoronavirus	Microsoft Canada president says 5G is unsafe and not tested #5GCoronavirus [Link to video]
#ExposeBill Gates	How is Bill doing medicine without the proper license? And why do people listen to him? #ExposeBillGates [Link to infographic criticising Bill Gates]	Nice to see #ExposeBillGates as a trending topic! We need to keep the momentum rolling, lets keep posting those videos and memes!	This week I will release a video where I talk about Melinda Gates work on population control in Africa. #ExposeBillGates	As its #ExposeBillGates day, I am retweeting the #NoGatesVaccine affirmation. https://t.co/UQnVPnNsis [Video sharing views]
Plandemic	Please retweet, Obama is having secret meeting in Silicon Valley with the key players of this plandemic: Buffett, Gates, Fauci and the World Commission long after his Presidency ended!! [Link now deleted]	Please watch Plandemic! It's being censored everywhere! [Link to video]	YouTube is deleting the plandemic video. Not approved by the Thought Police. [Link to news story]	Love this debunking of that ridiculous plandemic [Link to video debunking plandemic]

Table 2 table taken alongside the respective visualisations of the networks from figure 3 to figure 6, provides insight into the most popular discussions occurring across these different groups. The network graphs can be considered analogous to a topographic map of a mountain range because they can illustrate points with the highest elevation [92, 68]. SNA allows us to determine the key groups and users within a conspiracy network and the groups occupying the most space.
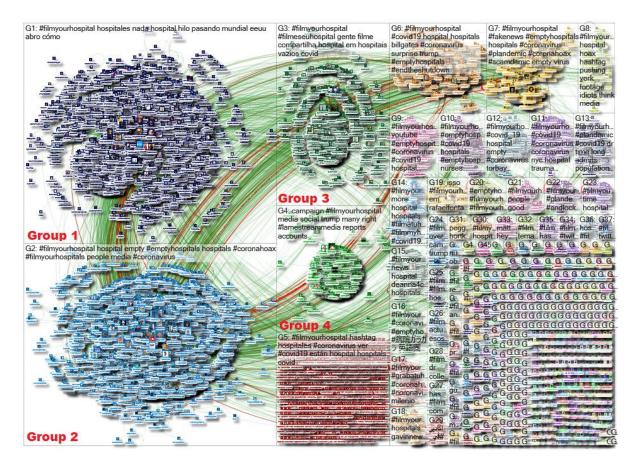
4.3 Film Your Hospital

Figure 3 below provides an overview of the network for the 'Film Your Hospital' conspiracy.

Figure. 3 Overview of the Film Your Hospital Network

In the network centred around the campaign for users to film their hospitals, two large broadcast clusters (group 1 and group 2) made up a large part of the network. Furthermore, the four largest clusters make up more than half of the network because of their size. Most users belonged to either groups 1, 2, or 3. In the time period that was sampled, over half of the network (56%) consisted of users retweeting one another. Table 2 provides an overview of the most popular tweets across these clusters. It appears that the campaign's main goal was to amplify content that claimed hospital wards were empty and to attack the media.
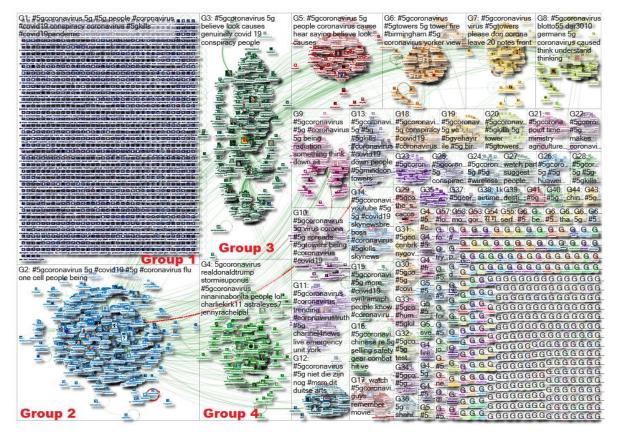
4.4 5G and COVID-19

Figure 4 below provides an overview of the network for the '5G and COVID-19' conspiracy.

Figure. 4 Overview of the 5G and COVID-19 Network

In the network of users conversing about the link between 5G and COVID-19, the largest cluster contained a group of users forming an 'isolates' group. This structure shows that a group of users were tweeting using the hashtag without mentioning each other. The most retweeted message in group 1 claimed that 5G was leading to deaths and the most popular retweet in group 4 tried to make a similar link. However, retweeted content in groups 3 and 4 questioned (with disbelief) whether users genuinely believed in the link and mocked those that did. Amplification was present within the network, with a 39% retweet ratio. However, much of the discussion centred around individual tweets and smaller conversations between users.
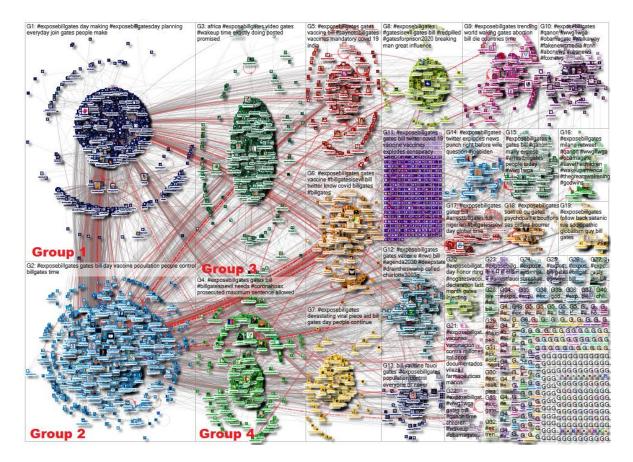
4.5 #ExposeBillGates

Figure 5 below provides an overview of the network for the '#ExposeBillGates' conspiracy.

Figure 5. Overview of the #ExposeBillGates network

In the network that aimed to 'expose' Bill Gates, there were two large clusters (Groups 1 and 2) followed by several smaller groups. The campaign had a high retweet ratio, with over 59% of the network, during the time examined consisting of retweeted messages. The popular tweets across all four networks either aimed to drive the respective conspiracy campaign further and/or put forward further conspiracies, such as Melinda Gates being involved in population control work and/or Bill Gates's involvement in vaccines.
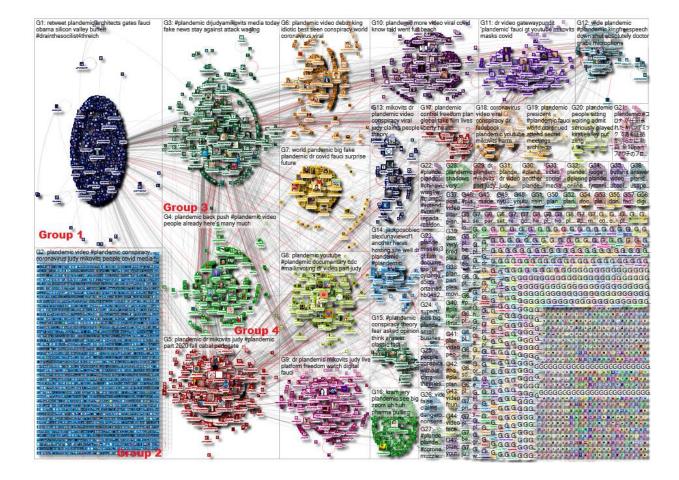
4.6 Plandemic

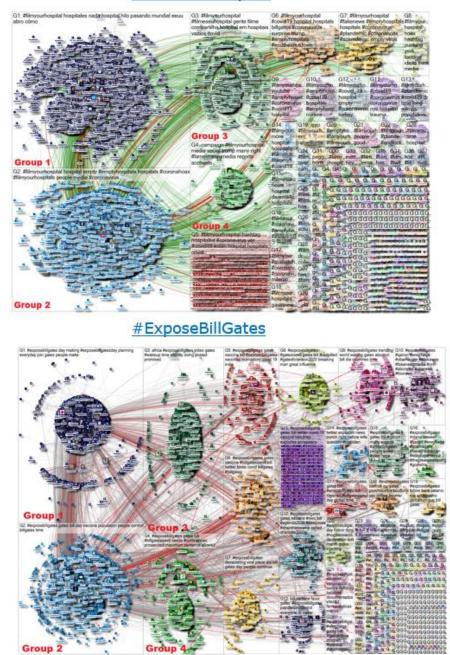Figure 6 below provides an overview of the network for the 'Plandemic' conspiracy.

Figure. 6 Overview of the Plandemic network

In the network related to the 'Plandemic' video, the largest group in the network (group 1) was a densely clustered broadcast network, followed by an isolates group (group 2) which contained users that were tweeting without mentioning each other. Across the four largest clusters, the most retweeted tweets consisted of various conspiracies, such as secret meetings between influential figures and the Plandemic video being censored. In group 4, the most retweeted tweet consists of a link to a video debunking the claims made within the plandemic video. Based on the time examined, the network of users had a ratio of 47.2% retweets, meaning that almost half of the tweets within this network consisted of a retweet. As tweets were being

retweeted so frequently in a short period of time, this indicates that there was a great deal of amplification.
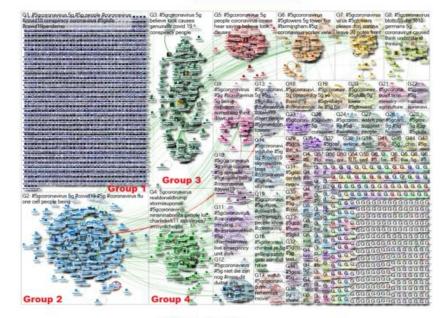
4.7 Four-way comparison

Figure 7 provides a four-way comparison of each conspiracy network examined in this study.
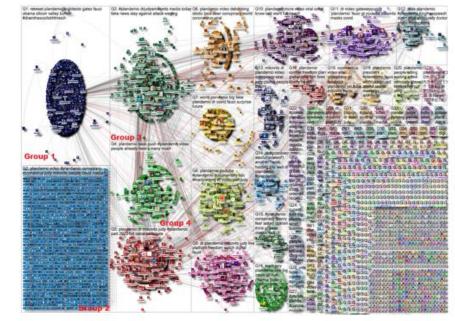
Figure. 7 Four Way Overview of Network Visualisations

Similarities among the conspiracy networks are that they have a high number of users retweeting content. Furthermore, it appears that large groups of users formed clusters within the network that dominates discussion and further amplifies content. The most retweeted tweets among the largest groups all shared the conspiracy. Users who believe in conspiracies may follow each other, which gives rise to large, highly connected discussions. Through sustained collective action, these users may set the tone for the overall topic and have a large influence in setting the narrative of a trending topic.

The networks of the 5G conspiracy and Plandemic conspiracy networks contained larger 'isolates' clusters, potentially attracting tweets from outside the conspiracy echo chamber. In the case of the 5G and COVID-19 conspiracy, these isolated users criticised and ridiculed the conspiracy. The Film Your Hospital and Expose Bill Gates networks had high interconnectivity across groups, whereas the 5G COVID-19 and Plandemic networks had less interconnectivity.

Ramanathan et al. [93] have examined trust in online networks in relation to e-commerce. They note that trust is one basis for generating online sales in the era of social media. They also note that electronic sellers would not only need to develop trust but also keep customers satisfied to enable future purchases.

Conspiracy theory networks, such as those around 5G, included e-commerce stores which were claiming to provide clothing and equipment to protect against 5G. These services may have garnered the trust of some users to make purchases.

The Film Your Hospital conspiracy was more centralised with two big, dense clusters, which, if removed, the network would be limited. Similarly, with #ExposeBillGate, a couple of large

groups were driving the discussion. These network visualisation findings, taken alongside the most popular tweets, have provided insight into the most common messages shared related to the conspiracies. The most popular messages in group 1 for each of the four conspiracies are reproduced below:

I visited 2 hospitals that are supposed to be overrun but found that they were actually empty. What are they lying to us? We need to become the news and get #FilmYourHospital trending. Please post pictures of your hospital! **(Film Your Hospital)**

What on earth is happening…Seriously #5GKILLS #5GCoronavirus **(5G COVID-19)**

How is Bill doing medicine without the proper license? And why do people listen to him? #ExposeBillGates, Link to infographic criticising Bill Gates. **(#ExposeBillGates)**

Please retweet, Obama is having secret meeting in Silicon Valley with the key players of this plandemic: Buffett, Gates, Fauci and the World Commission long after his Presidency ended!! (Link now deleted) **(Plandemic)**

It is also interesting to note that the fraction of new content was mostly low, and a few key messages were often repeated by users sharing the conspiracy, a type of 'call and response' pattern. Each of the network visualisations shown previously was comprised of several large groups that served to amplify a conspiracy theory. Influencers towards the centre of each of the broadcast groups were likely to have a cascading effect. the core group of users were generating interactions forming an audience and leading to the formation of additional clusters. These

clusters would then have to generate further interactions with an audience of their own. The users in the large groups would have been responsible for the conspiracy reaching wider audiences, and their tweets became amplified, which led to the formation of other groups within the network.

4.8 Summary of Results

Our previous work [94] has examined the beliefs and narratives within viral conspiracy theories in order to understand the potential motives for their dissemination. To further contextualise our findings, in table 3, we thematically categorised each of the conspiracies for their core ideology, their epistemological narratives, and the key types of messages that were being transmitted by citizens to misinform. The analysis was conducted by reviewing the most shared tweets and the results of the SNA.

Table 3: How Disinformation Foregrounds Ideological Authenticity

Disinformation Campaign	Ideological Conspiracy	Epistemological narrative (s)	Citizen Fabrication and Ideological Mis-enforcement
5G and COVID-19	Anti-Technocracy	Divert public attention from the scientific root cause of the COVID-19 pandemic while strategically misusing the context to fuel anti-technocratic sentiments.	5G radiation is harmful to human health. 5G radiations have the potential to alter the human genome. Alteration of the viral genome is the first evidence of that.
Film Your Hospital	Conspiracy through Alternative Reality	Bamboozle public opinion and perception of global health crisis by promoting falsified reality. Promote anti-government narratives against crisis communications.	State and media reporting of the increased risk of the pandemic and its impact on pushing the healthcare system to the brink of collapse is an organised myth. Citizen journalism exposes the reality of government and media fabricated stories in an attempt to misinform/mislead people.
#ExposeBillGates	Diminish Scientific Advocacy	Diminish the credibility of scientific advocacy by defaming key opinion leaders. Devaluing opinion leaders' reputations and credibility offer little authenticity to factual messages aimed at protecting society and people.	Social advocates like Bill Gates is a State-driven puppet. His sole intension of promoting vaccine uptake is to 'microchip' people with a 'mind controlling' device that diminishes democracy, promoting State autocracy.
Plandemic	Anti-Vaccine	Obscure the scientific validity of pandemic prevention and control measures, through wider vaccination programmes, by altering people's perception (and belief) in medical science developed through blurred pseudoscientific logic.	COVID vaccines are not developed or validated through rigorous scientific methods. The new RNA technology used is compromised, and it has the capability to alter the human genome as part of a wider State conspiracy.

We note how each conspiracy is linked to deeper ideological views. Previous empirical research [95, 96] has also identified and noted the role of ideology and beliefs in conspiracy theories. Our findings complement existing literature by identifying the ideology, narratives, and reasons for disseminating these conspiracies.

5. Discussion

5.1 Conceptualising Disinformation Seeding and Information Diffusion

Table 4 provides an overview of the four theoretical stages of conspiracy theory networks alongside the potential impact of each stage, the information diffusion characteristics, description, and the vital counter-measure strategies. These stages were conceptualised by taking into account the results of this present study and building upon previous empirical work [3, 26, 94, 97]

Conspiracy networks are conceptualised in terms of stages. In stage 1, information is often strategically seeded via malicious agencies, which may have several motives. A counter-measure strategy at this stage would include identifying and restricting such malicious agency disinformation seeding activities and could also involve the protection of web and social network security vulnerabilities. In stage 2, macro-social diffusion would occur. In this stage, it is important to note that a lot of content circulates across the Internet without receiving greater attention or diffusion. Here, disinformation is consumed by individual social agents with limited reach or influence. In stage 3, content with high inoculation capacity can often reach influential community clusters. When members of such communities assimilate or alter the nature of disinformation, the altered versions spread beyond those communities. Pseudoscience often gains momentum when key influencers get involved. The creation and circulation of broadcasting networks help to spread the rhetoric, making it difficult to stop. Stage 4 is where disinformation becomes adapted within the mainstream. More specifically, disinformation often challenges citizens' ideological beliefs when it becomes powerful social rhetoric. This can lead to polarisation, as wider belief transforms into behavioural norms or behavioural resistance, a post-trust world.

Table 4. Theoretical Stages of Conspiracy Networks and Counter-Measure Strategies

Stage	Impact	Information Diffusion Characteristics	Description	Counter Measure Strategy
Stage 1: Strategic Information Seeding	Low	Strategic inception	Malicious agencies plant pseudoscientific content across digital platforms, including popular social media.	Identify and restrict malicious agency disinformation seeding activities. Identify and protect web and social network security vulnerabilities.
Stage 2: Macro Social Diffusion	Low	Modular Diffusion	Many of these contents circulate in the constellation of digital platforms without receiving greater attention or diffusion. At this stage, disinformation content is consumed by individual social agents with limited reach or influence. Small sporadic modular communities can evolve, but their reciprocation index is generally.	Identify and restrict the circulation of malicious Disinformation and disinformation content using effective and organised fact-checking Identify malicious hashtags, keywords, and network structures to restrict the propagation of disinformation through sophisticated machine-learning techniques and algorithms.
Stage 3: Echo Chamber Amplification Effect	Moderate to Critical	Community Clusters Broadcast Networks Support Networks	Content with high inoculation capacity can often reach influential community clusters. When members of such communities assimilate or alter the nature of disinformation, it becomes more of a wider public overview. Such unstipulated moves can result in uncontrolled augmentation of the pseudoscience agenda when celebrities or key influencers get involved. Creation and circulation of broadcasting and supporting networks are the penultimate stages of disinformation becoming powerful social rhetoric.	Greater collaboration with media agencies and disinformation watchdogs in restricting personal fabrication and sociocultural assimilation of pseudoscientific logic. Greater education of the public and key influencers to restrict the rapid spread of disinformation Educate citizens about the fact-checking and time-lagged approach to intrinsically judge the quality of information consumed. Use nudging and restrictive reach methods to restrict the REACH of disinformation.
Stage 4: Mainstream Adaptation	Severe	Polarised Crowd	When disinformation becomes powerful social rhetoric, it often challenges citizens' ideological beliefs. As wider belief transforms	Actively engage in promoting scientific facts and truth via mainstream media.

			into behavioural norms or behavioural resistance, society fragments giving rise to polarised groups and a post-trust world.	Destabilise the network dynamics and information propagation mechanisms of echo chambers. Offer ideological relief to affected citizens and groups through strategic interventions.

Figure 8 provides a visual framework for understanding the process behind disinformation. Beginning from Stage 1 (Strategic Information Sharing via Seeding) as the entry point of the information and ending at either mainstream belief or behaviour resistance. The stages in between highlight the different steps often involved within disinformation conspiracy networks. The activities to promote conspiracy theories continue to change with new patterns of sociocultural behaviour and different techniques to seed disinformation across platforms. The amplification and echo chamber effect of conspiracy theories through the seeding and diffusion of information is also shown in Figure 8. The framework of disinformation seeding includes a series of amplification processes (moving from the top to the bottom) and can be described as follows:

Strategic seeding: This is a low-impact technique aimed to generate 'buzz' around a certain topic and capitalise on real-time controversial conversation points.

Micro assimilation: is a process of moderate impact that leverages social network connections to propagate a certain topic.

Personification: With high impact in the animation and obfuscation of the topic, which transforms the initial disinformation into a fully-fledged conspiracy theory.

Augmentation: The conspiracy theory issue is recognised and adopted by celebrities and important influencers. This process provides strategic and tactical methods for celebrities and influencers to engage with the conspiracy theory topic for competitive benefit.

Ideological politics: the end destination of the framework in which conspiracy theories become a part of sociocultural rhetoric and develop offshoots that sow new disinformation subjects while continuing to accelerate the momentum of the existing conspiracy theory.
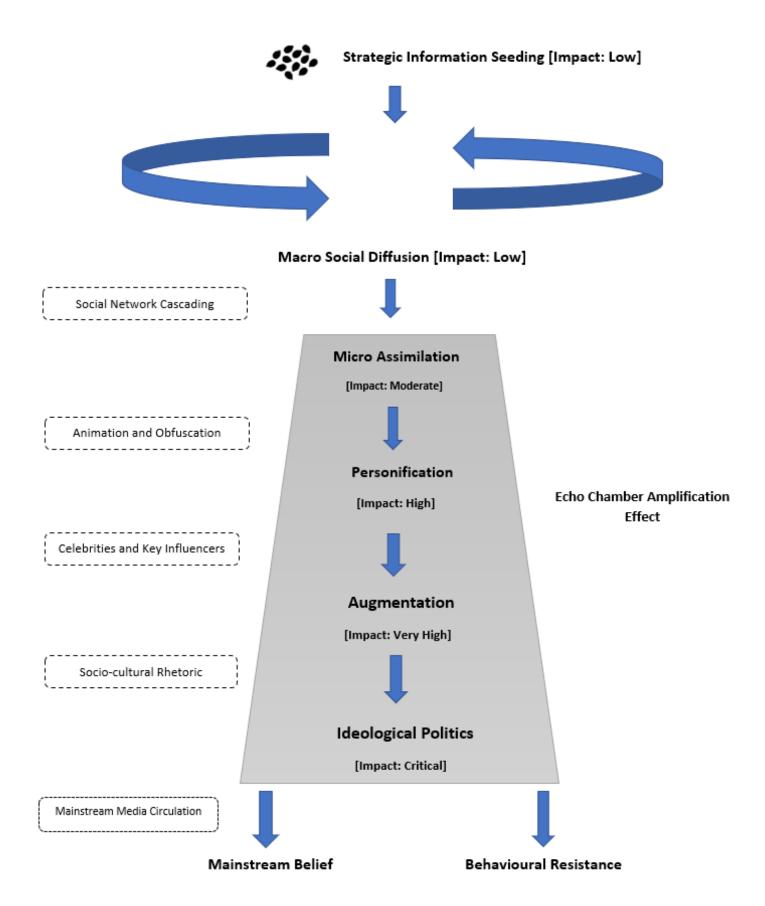
Figure 8. A Framework of Disinformation Seeding and Information Diffusion

Previous theoretical models have been developed in the literature that aim to describe the flow of fake news. For instance, the social diffusion model of misinformation and disinformation [98] and the disinformation behaviour framework [99] are two examples within the current literature. However, our conceptualisation of the framework is unique in the sense that it is based solely on disinformation and, at its core, contains the idea of information as being strategically seeded.

5.2 Creating a Digital Mindset

Public health authorities and governments are unlikely to have the resources to deal with each conspiracy during a major disruptive crisis such as COVID-19. Moreover, certain content expressing controversial or unpopular opinions may not directly contradict social media company policy to warrant removal. This means that not all conspiracy networks will be tackled by government or health interventions, and not all content can be removed by social media companies. Therefore, a key strategy to combat disinformation and fake news is to ensure the general public has the resources, knowledge, and digital mindset to critically reflect on the information they encounter and make a well-informed judgement call on the validity of the information. Henceforth, based on our SNA findings and previous research into disinformation networks [26, 97], we propose that health authorities, governments and practices make use of a Digital Mindfulness Toolbox (which we named as '*DigiAware*') in which the specifics of the Toolbox are refined and developed tailored towards a disinformation campaign and/or event.

Our understanding of the theoretical underpinnings and ideological constructs of the conspiracy networks alongside the network shapes and structures on Twitter has provided us with a deeper understanding of how these networks attract citizens to them. We use this insight to propose

DigiAware as a collection of resources to aid people and businesses in information management and decision-making. This Toolbox might be used as educational, training, feedback, and strategy support tools for crisis preparedness and prevention not just during times of crisis but also during "non-crisis"/business-as-usual circumstances.

The *DigiAware* Toolbox contains the following features, as outlined in Table 5.

Table 5. DigiAware Toolbox Elements and Key Features

Toolbox Elements	Features
Disinformation Checklists	For identifying disinformation, including reality checks to test for the veracity of information
Mindful Pauses	To stop the spread of questionable information
Biases tool	To create awareness for a variety of commonly encountered biases, such as • *overconfidence* (overestimating our skills/abilities/knowledge), *framing bias* (basing a decision based on the way the information is packaged/presented rather than on the facts) • *social desirability bias* (tendency to post/tweet/comment in ways that make us look good/cool/favourable in the eyes of others) • *confirmation bias* (tendency to search for information that confirms our preconceptions/beliefs while ignoring/rejecting all conflicting information) • *shared information bias* (inclination to focus more on information shared by others rather than one's own information) • *illusory truth effect* (propensity to believe false information upon repeated exposure to such information) • *recall bias* (differences in accuracy/completeness of our recollections, for example, regarding social media usage).
Risk perception tool	To nudge awareness for perceived risks of cascading sensationalised news stories balanced against immediate gratification from social approval proxies (e.g., number of likes and follower counts)
Nudging tool	For privacy-enhancing technology use via gamification
Scenario tool	To instil strategic thinking skills and competencies in envisioning alternative scenarios and repercussions of potentially harmful information.

The present study focused on identifying disinformation, including nudges to initiate awareness to test for the veracity of information. In creating the Digiaware Toolbox, we are responding to previous behavioural research concerning how social media disinformation correlates with constantly stimulated and overloaded minds. Our Digiaware Toolbox will help to inform interventions to prevent social media overload and encourage space for mindfulness. Given the indications for a relationship between social media disinformation and agitated mindsets in engaging with information, our toolkit intervention is aimed at increasing mindfulness and/or directly at strengthening social media self-control. In supporting a shift to a digital mindset, we seek to instil a new strategy to improve competencies in managing disinformation and creating opportunities to spot potentially harmful information.

5.4 Implications for Research

Our study investigated and found that four popular COVID-19 conspiracy theories were comprised of broadcast networks with a couple of key messages. Our empirical results and comparison of COVID-19 disinformation networks are likely to be of interest to other scholars working with social media data. In a real-world setting, a venue that facilitates individuals for profit, such as a pub or bar, might have responsibility for legal behaviour, such as monitoring and reporting abusive behaviour and removing customers if their behaviour violates policy or commits a crime. On a small-scale level, such behaviour is easy to identify. However, with social media, when thousands of discussions across various topics are taking place, identifying harmful content without restricting free speech becomes challenging. Moreover, disinformation can have negative health outcomes as people avoid vaccines, sidestep contact tracing apps, refuse diagnostic tests, and engage in behaviours that may help spread the virus, costing lives. Overall, the contribution of this study is:

- Acknowledging sociocultural change in the visibility, seeding and communication style of conspiracy theories.

- Creating a framework of disinformation seeding to understand the cause-and-effect relationship between information seeding and fully-fledged conspiracy theories.

- Development of the DigiAware Toolbox, making the response to disinformation more transparent and visible.

The authors intend for the DigiAware Toolbox's benefits to be reproducible by other researchers and implementable by organisations as part of a strategic response to conspiracy theories.

5.5 Results in Relation to Literature and Theoretical Background

This article offers a strategy called digital mindfulness that individuals and organisations may use to make optimal crisis management decisions. Digital mindfulness allows great emotional attention while the mind is quiet and uninterrupted. We have drawn on several interrelated concepts from crisis management, the risk of disinformation and the new approach of digital mindfulness [32, 83, 100].

With regard to current research around disinformation, our results identified key pieces of disinformation that were shared frequently across four separate conspiracy theories, how they were spread, the characteristics of the information sharing, and the structure and nature of the groups [10]. Furthermore, our results also highlighted the cascading effects that influencers might have in spreading disinformation. These results are compatible with our theoretical underpinning of digital mindfulness and digital resilience because a digital support system, like the DigiAware Toolbox, may help develop mindfulness and trust in health policy and counteract disinformation campaigns. Moreover, because disinformation may peak during an unfolding crisis, information management strategies must leverage agile and resilience-

building approaches using behavioural interventions proposed by the *DigiAware* Toolbox, providing an effective path forward. DigiAware Toolbox improves therapeutic expectations, difficulties (such as disinformation and deception), and user outcome attribution of mindfulness. Thus, the DigiAware Toolbox may assist a new approach to crisis management and integrative decision-making. Previous academic research during previous cases of pandemics and epidemics such as Ebola [101], swine flu (H1N1/09) [102], and the Zika virus [103] found that disinformation was present on the Internet such as on social media. However, conspiracies, bogus cures and theories are not a new phenomenon and were also occurring during the Black Death as far back as 1334 [104].

Identifying and qualifying the information shared on social media is essential, particularly when generating and amplifying fake news and deliberately false or deceptive information [105]. Fake news exhibits characteristic patterns of propagation and dissemination across social media in such a way that it propagates false information and is intended to influence audiences. As Olsazoski [106] observes, fake news has weakened public trust in governments and sparked social unrest. Classical psychological studies investigating reasoning observe two fundamental processes in the minds of individuals assessing the new information presented to them. Johnson and Ray [107] observe 'reality monitoring' that we can apply to how information is assessed on social media concerning the external and internal processes in making decisions about the validity of newly acquired information. For the authors, reasoning, imagination, and thought work alongside individuals' perceptions (past experiences, worldview) in conclusions made about information. Across social media, we see such perceptions altered through manipulating information concerning where it is posted and in what contextual stream. For example, the quality of information on social media is impacted by the types of expressive modes used (including text and visual elements), the legitimacy of sources (a verified account), and the

contextual stream in which the information appears (alongside advertisements, counter-information, and hashtags).

McCornack et al.'s [108] classic psychological work about deception shows how information can be manipulated through discourse frames at the intersection of content (what it is about) and cognitive load (production of knowledge) in the assessment of trustworthiness by the individual. Combining discourse analysis with cognitive processes, the authors propose that an individual's recognition that the deception production of information is inextricably linked to memory and incremental past experiences [108]. One can speculate that in the age of social media, the ability of individuals to assess the validity of information hinges on experiences of interacting with different types of information and how (or if) they choose to detect deception.

5.6 Implications for Society

Social media companies and other online spaces might not always be able to respond quickly in removing disinformation posts or networks, and they could go undetected. Therefore, the wider public can also play a role as a support function that complements digital solutions social media companies may use to detect disinformation. This is because if the wider public is more able to identify sources of disinformation and have the facility to make a judgement call on the accuracy of the information, this may reduce the amplification of conspiracies and rumours. In a recent review of the impact of disinformation, Metzger and Flangin [73] observed that people use credibility assessment to avoid 'deception, manipulation, and persuasion by disinformation in the contemporary media environment.' Therefore, it is important for individuals and organisations to have tools and resources that encourage mindfulness and reflection on what sources of information to trust. We argue that the *DigiAware* Toolbox could support individuals and organisations with their information management and decision-making.

6. Conclusion

In efforts to combat the damaging effects of disinformation, this paper proposed several ways in which disinformation could be detected and counteracted to enhance digital resilience and mindfulness and ultimately supported pandemic preparedness and information systems. Our overall aim of the research was to develop a better understanding of four popular conspiracy theories that were shared on Twitter. We achieved this by addressing several research questions. For RQ1, we identified the most shared tweets across the four conspiracies, the network shapes in RQ2, and the similarities and differences of the networks for RQ3. By conducting our analysis, we were able to fulfil our research objectives. To address our research objectives, we first sought to understand the ideological constructs behind disinformation networks and developed a framework to conceptualise disinformation seeding and information diffusion (RO1). Furthermore, we proposed the *DigiAware* Toolbox (RO2), which could help with disinformation-containment policies of public health agencies and governments worldwide.

Our current findings carry significant repercussions for designing an ensemble of tools, including (i) awareness and feedback mechanisms and (ii) effective behavioural nudges to minimise the sharing of disinformation. Extant work shows that providing fact-checks after headlines is more effective than before exposure in subsequent discernment of true headlines [109] and that simple reminders like judging the accuracy of a headline affect information sharing [53]. Digital mindfulness in its attentional forms is presented as a novel method for facilitating crisis management. The DigiAware Toolbox is intended to increase the flexibility to assess one's circumstance or job and create and execute solutions.

Our previous research has examined and thematically analysed conversations around Ebola [110], H1N1/09 (swine flu) [111], and the zika virus [112]. We have also examined discussions around face masks [113], vaccination campaigns [87], perceptions of mandatory vaccinations [114], blood clots [115], and rural health [116] during the COVID-19 pandemic. This present study builds upon our previous research into COVID-19 conspiracies [3, 26, 97] by contrasting four conspiracy networks and providing theoretical insights. Future research in this area may wish to analyse social media content around several platforms and identify how misinformation is spread. Designing a digital support environment to foster mindfulness will facilitate trust in health policies, counteract information distortions, and lead to an improved information-sharing structure that leverages decision-making strengths across all stakeholders. Further research could also investigate the relationships between mindfulness and other fundamental transformation processes in crisis management. Lastly, digital awareness also plays a crucial facilitative function in reducing the early propagation of disinformation, an essential aspect of crisis management. Our study has several limitations in that it examines conspiracy theories being shared at a specific time and seeks to analyse content on Twitter. Future research may wish to sample a broader time frame and incorporate content from multiple social media platforms.

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