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Assessing Infodemic in the Post-COVID-19 Risk Communication and Governance

Shabana Khan[1], Jyoti Mishra[2], Nova Ahmed[3], Ifti Azad Abeer[4], Prachi Mittal[4], Saeem Hossain Shanto[4], Khushboo Mundada[4], Priyanka Haldiya[4], David Johnston[5]

[1]Director, Indian Research Academy, Delhi, India, Email: shabana.khan@indianresearchacademy.org kshabana1@gmail.com
[2] University of Leeds, UK
[3] DIAL, North South University, Bangladesh
[4] Indian Research Academy, Dhaka, Bangladesh
[5] Joint Centre for Disaster Research, Massey University, New Zealand

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Contents

Abstract

Apart from various gaps in emergency response, the infodemic arising from excessive and hazardous risk communication compounded the losses incurred during the pandemic. The infodemic not only led to confusion and chaos among citizens but also impeded decision-making at different levels. The study thus aimed to assess the infodemic for the post-COVID-19 risk communication and governance across the three countries - Bangladesh, India, and the United Kingdom. This research employed a mixed-methods approach, utilising quantitative and qualitative data methods. In addition to a comprehensive literature review and an assessment of infodemic-related content published in leading national newspapers of selected countries, interviews were conducted with 105 key stakeholders to understand the ground realities, management challenges, best practices, and policy gaps. The findings indicate an increasing trend of the infodemic across three countries that needs urgent attention. The study recommends developing comprehensive policies integrating disaster risk communication and measures to address infodemic to reduce disaster losses, particularly those resulting from information disorder.

Key words

Infodemic, disaster risk communication, governance, COVID-19, policy implications

Acronyms

AI	Artificial Intelligence
BCCI	Board of Control for Cricket in India
BeSD	'Behavioural and Social Drivers
COVID-19	Coronavirus Disease 2019
GAD	Generalised Anxiety Disorder
HCD	Human Centred Design
HCI	Human Computer Interaction
HCW	Health Care Workers
HPV	Human papillomavirus vaccine
INGOs	International Non-Governmental Organizations
LGBT	Lesbian, gay, bisexual and transgender
LGBTQIA+	Lesbian, gay, bisexual, transgender, queer/questioning, intersex, asexual
NCR	National Capital Region
NGOs	Non-Governmental Organizations
NLP	Natural Language Processing
PAHO	Pan American Health Organisation
PSS	Perceived Stress Scale
Q&A	Question and Answers
RCCE	Risk Communication and Community Engagement
SDG	Sustainable Development Goals
SDT	Self-determination Theory
SFDRR	Sendai Framework for Disaster Risk Reduction
SISM	Social Impact of Social Media
SOP	Standard Operating Procedures
STOPS	Situational Theory of Problem Solving
UK	United Kingdom
UN	United Nations
USA	United States of America
WB	World Bank
WHO	World Health Organisation

1.

Introduction

The COVID-19 risk communication faced multiple challenges, not only due to the limited information about the disease and high uncertainty, but also because of the infodemic, which soon became a global hazard faced by both developed and developing countries (Khan et al., 2022). Infodemic refers to the excessive flow of information during a crisis that spreads quickly, making it challenging to distinguish credible information from false or misleading content (Eysenbach, 2020). It can be challenging to manage the infodemic during disaster risk communication, as this process requires exchanging information back and forth to facilitate an effective public response. The World Health Organisation [WHO] defines risk communication as "the real-time exchange of information, advice and opinions between experts, community leaders, officials and the people who are at risk and is an integral part of any emergency response" (WHO, 2017). The infodemic and risk communication thus can influence each other in different ways.

The infodemic posed a massive challenge to managing diverse public responses across communities and nations after the standard global warning of COVID-19 by the WHO in 2020. It exposed diverse vulnerabilities worldwide, requiring urgent attention, actions and resources to avoid further loss during the pandemic. While studies looked into varied causes and impacts of infodemic across countries during health emergencies, a gap exists for studies addressing various challenges and governance issues of infodemic when communicating disaster risks. Similarly, while studies have outlined differences in risk communication across countries, a need to explore various characteristics, intensity, magnitude, and response measures for their impacts and interconnections with risk communication remains unaddressed. The problem gets further complex with everyday technological advancements and their integration into various aspects of life and development in diverse contexts with a limited knowledge base. In such a scenario, addressing infodemic in general and risk communication in particular is difficult due to diverse socio-cultural and policy contexts across countries. This study, therefore, aims to assess the infodemic in Bangladesh, India, and the United Kingdom for post-COVID risk communication and governance. It looks into challenges, impacts, best practices, and risk communication procedures observed across the three countries to distinguish policy gaps and possible solutions.

Despite global advancement in research on the infodemic and its management, it continues to be a significant challenge for most countries (WEF, 2020). A few questions that need attention and drive the objectives of this study are: How did respective governments manage the issue of the infodemic and address its ill impacts on different vulnerable groups? What were the key gaps and differences in policies applied during COVID-19 across nations, and what were the best practices that can guide post-COVID-19 risk communications and governance? Answering these questions also requires an understanding of how the risk communication process varies for crises across these countries with diverse development, socio-cultural, and policy contexts.

Objectives of the Study:

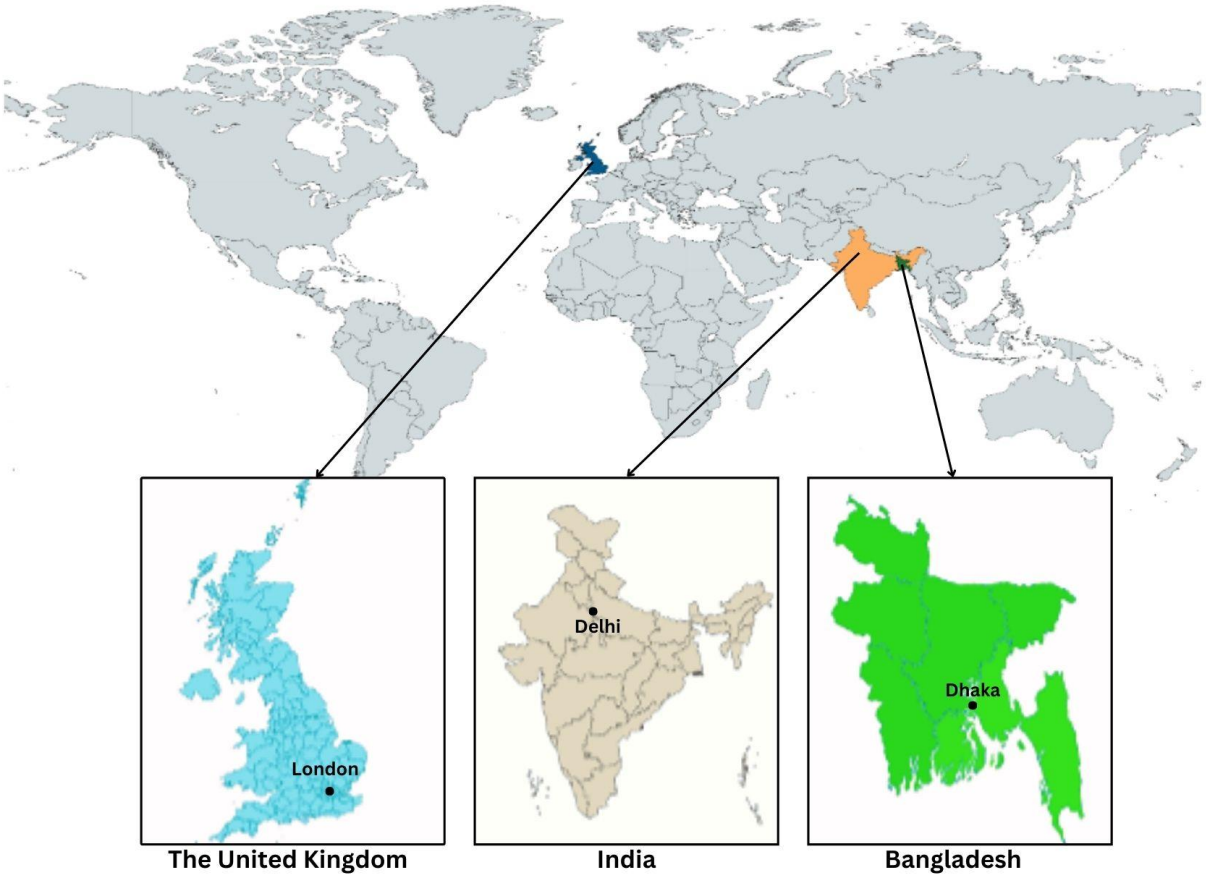
The research is guided by three objectives aimed at assessing the state of the infodemic in Bangladesh, India, and the United Kingdom. These objectives include:

1. Mapping the state of infodemic in the selected countries of Bangladesh, India, and the United Kingdom, highlighting the key issues, impacts and measures applied during different waves and phases of COVID-19
2. Identifying the main challenges and best practices observed in managing the infodemic and the related vulnerabilities across the three countries.
3. Reviewing and evaluating key policy gaps and providing suggestions for future disaster risk communication and governance.

Study Area

This research aims to study the infodemic in Bangladesh, India, and the United Kingdom (Map 1.1). In addition to the presence of team members, these countries were selected due to access to local knowledge, data and understanding of the Infodemic issues and governance contexts. Besides, these countries also offered diverse socio-cultural and policy contexts with a shared interlinked history that could help to dig deeper into similarities and differences in managing the issues of the infodemic and risk communication.

Map 1.1. Location of Bangladesh, India and the United Kingdom on the World Map



Bangladesh: Bangladesh is a densely populated developing country. It experiences frequent natural disasters and is also a victim of climate change, with a low-lying coastal belt that spans the Bay of Bengal. With limited natural resources, technology became essential to manage the pandemic. Subsequently, it experienced significant mobile phone penetration and usage in urban and rural areas. The government incorporated the nation's digital engagement policies under 'Digital Bangladesh.' Excessive use of technology thus increased both communication and miscommunication of risks during the pandemic. The impact of the infodemic was high among the illiterate and less literate population, who became the victims of false claims and promises. It also created new challenges for the governance system, which had to manage access and miscommunication led by the increasing use of gadgets.

India: India, as the largest democracy in the world and the second most populated country with a similar movement of 'Digital India', provides a rich ground for spreading the infodemic and its adverse impacts. Its growing GDP and economic development have resulted in a rapid penetration of information and technology in all sectors, including education, health, industries, and community development. Its varied climate, geography, and socio-cultural diversity are susceptible to various natural and social hazards and are likely to be further exacerbated by climate change. In a democratic set-up, top-down risk communication faces several challenges due to the prolific growth in social media use for different purposes. The COVID-19 risk communication thus resulted in excessive fear, leading to mass migration of workers from cities to rural areas, resistance to quarantine and avoidance of protective measures. Failures of various measures to control the situation also demanded further inquiry into the process and policies for addressing less-known disaster risks.

The United Kingdom: The United Kingdom, in contrast, is an economically developed country. It has a constitutional monarchy and a parliamentary democratic framework of rule, which suggests more advanced policies for governing risk communication with greater control of information and technology. However, despite its significant economic strength, the country equally struggled with the infodemic during COVID-19. The country has a diverse population composition with varied socio-cultural backgrounds that add to the challenges of handling pandemic cases and risk communication. Although the nation is generally equipped with technology and resources to address various challenges of the infodemic, it had to face mass protests for 5G and the vaccination drive that produced reverberations of public concerns. A high dependency on technology for risk communication enhanced the intensity of the infodemic with massive information dissemination. Evaluating the infodemic and governance issue thus can bring insights to compare and share lessons learnt or evolve beyond what is known.

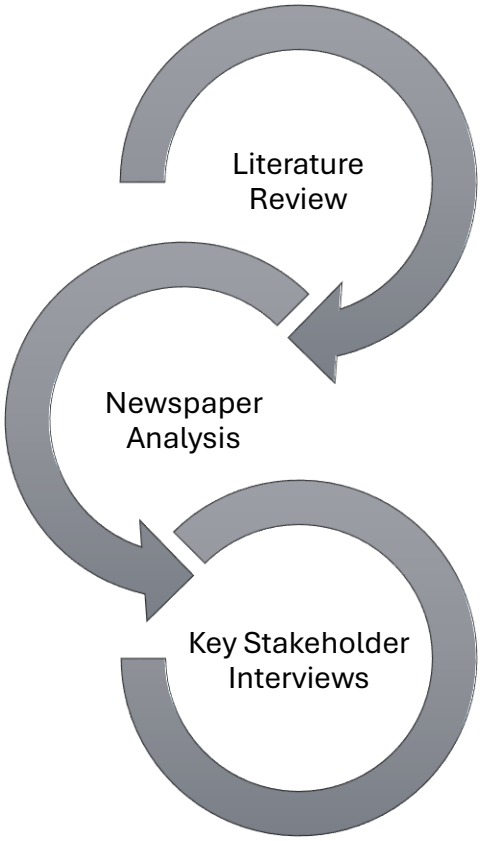
Methodology:

Study Design: The study employed a mixed-methods approach, combining qualitative and quantitative methods to collect data and assess infodemic patterns, impacts, related challenges, and policies addressing the infodemic and risk communication for existing and emerging risks. The research data collection and analysis involved three stages: 1) Literature review, 2) Secondary data extraction from national newspapers and 3) Key stakeholder interviews for primary data collection and analysis (Figure 1.1).

Literature Review: A comprehensive literature review of published literature addressing risk communications and infodemic helped to distinguish key gaps and response measures based

on the theories and practices of risk communication. The literature repeatedly presents the unforeseen impacts of the infodemic on people from varying backgrounds beyond health (Khan et al., 2022; Bhushan, 2024). However, most studies view and assess infodemic separately from risk communication. Thus, a comprehensive literature review of studies looking into infodemic and risk communication and those based on activity theory helped draw interlinkages and identify the methods used for infodemic and risk communication

Figure 1.1. Research Design to Assess Infodemic



Newspaper Analysis for Mapping Infodemic: Secondary data is collected from the national newspapers of the three selected countries to assess and map the infodemic scenario across them. These newspapers were selected based on their national outreach, highest readership, and data accessibility. They include The Daily Star from Bangladesh, Times of India from India, and The Metro from the United Kingdom (Figure 1.2A).

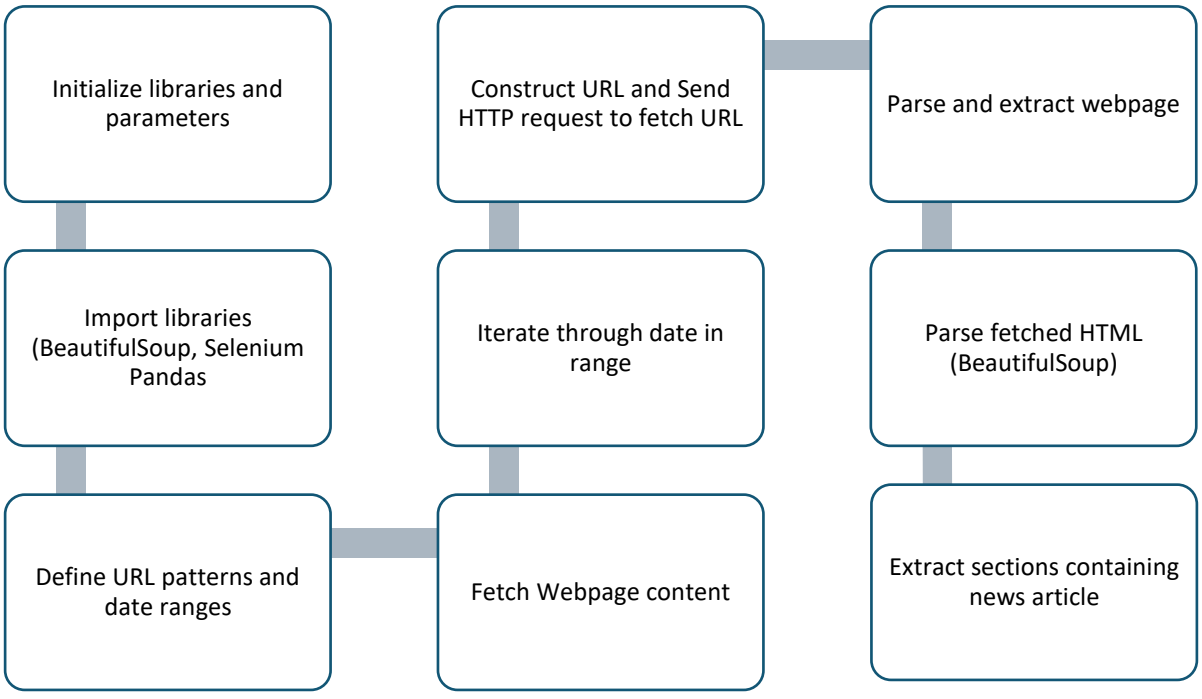
The data was collected from 1 January 2020 to 30 June 2024 for all three selected newspapers. The web scraping method was used for data collection, using three significant steps: initialising, fetching the webpage contents, and then parsing through those contents, as seen in Figure 1.2B. The news contents are extracted using infodemic keywords, as listed in Figure 1.2C. A list of keywords was created based on the literature review.

The keywords helped extract possible infodemic related content from the three national newspapers. In total, 12,74,979 news items were collected from the three countries, making it difficult to evaluate them manually. This data is then cleaned for infodemic news and incidents to map the infodemic scenario (Table 1.1).

Figure 1.2: Selected Newspapers, Process of Data Collection and List of Keywords

A. Selected Leading Newspapers for the Study

B. Process of Data Collection



C. List of Infodemic and Other Keywords Used

Infodemic Keywords				**Other Keywords**
Blame	Conspiracies	Conspiracy theories	Defam (defamation, defame)	Election
Disinformation	Distortion	Fabrications	Fake news	Lockdown
False assertion	False information	Hate speech	Hoax	*Vaccine*

Notes: defam stood as a preamble for defamation and defame.

Inaccurate	Inaccurate information	Misinformation	Myths	*Science*
Opinions	Propaganda	Pseudoscience	Rumours	
Unfounded claims	Unsubstantiated claims			

The data cleaning process consisted removing unnecessary words for analysis, including whitespaces, punctuations, non-alphanumeric characters, and leading and trailing punctuation marks. It was done in Panda's Python library. The collected data from the newspaper was stored in a structured JSON format. The data included articles containing infodemic keywords, headlines, images, and related article information, which were stored in structured JSON format and organised by date.

Table 1.1. Total News Items and Infodemic News Items Extracted for Mapping Infodemic Scenario Based on the Selected National Newspapers

Year	Time frame	Number of Months	Total News Extracted (Infodemic News) Bangladesh	India	The United Kingdom
			The Daily Star	The Times of India	The Metro
2020	January - December	12	25776 (1828)	177332 (7629)	87714 (5128)
2021	January - December	12	31669 (2171)	176208 (8452)	79562 (5200)
2022	January - December	12	29625 (1776)	176692 (8389)	80862 (5868)
2023	January - December	12	29079 (1878)	176952 (10641)	71920 (5030)
2024	January - June	6	12574 (746)	90805 (6795)	28209 (2095)

Source: The Authors.

Natural Language Processing (NLP) based algorithms were used to analyse data, followed by visualisation techniques. The data were organised and categorised based on various insights, such as location and temporal information. The frequency of keywords is also used. The major incidents, such as national-level decision-making or elections, were considered around the timeline during the analysis phase. The data acquired was then visualised using standard charts, word clouds, and other techniques to represent the data and its characteristics. The data analysis used libraries from the Python programming language, such as Pandas, matplotlib, string or Word Cloud.

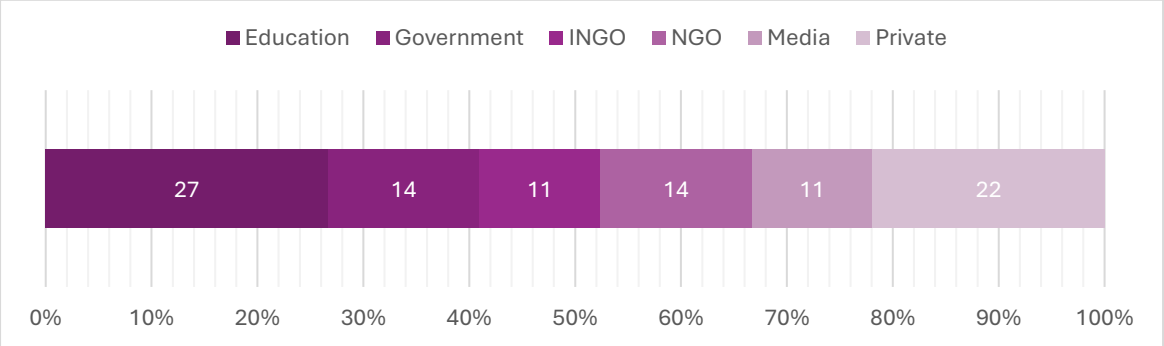
Key Stakeholder Interviews: Primary data is collected to identify and verify infodemic, related issues, vulnerability, best practices and policies used for managing infodemic and risk communication across the three countries. For this, semi-structured schedules were designed to interview stakeholders from different sectors and contexts to share their perceptions, experiences, and suggestions while maintaining the comparability of their views and experiences. Apart from the key stakeholders in each country, including Bangladesh, India and the United Kingdom, global experts and policymakers were also interviewed to explore the diverse nature of issues faced during information dissemination, public receptivity, the local impacts and responses to infodemic, their personal experiences and response measures applied during and after COVID-19.

The schedule included open-ended, closed-ended, and Likert scale questionnaires. The open-ended questions focused on prompting the stakeholders to share their perceptions, experiences, suggestions, and concerns regarding infodemic and risk communication

governance. Sharing diverse opinions was not bound by the specific questions, and respondents were encouraged to keep them relevant to the issues of infodemic, risk communication or even information dissemination in a few cases. The closed-ended questions, however, aimed to regulate the flow, keep the discussion relevant to both the topic and the participants' exposure, and provide quantifiable responses. For example, questions focused on whether they experienced an infodemic, collaborated with other organisations to manage it, had policies addressing these issues, and so on. Follow-up questions helped to gain deeper insights. The Likert scale questions prompted their rating of contributing factors of infodemic, the impact of infodemic, and the effectiveness of infodemic management of different organisations. The questionnaire was designed to be easy and intuitive for the respondents. A pilot test of ten respondents was conducted before implementing the schedule, and the repetitive or unclear questions were either removed or reframed depending on their significance to the study.

The key stakeholders were recruited using purposive sampling to have more pertinent participants for the study. In total, 105 key stakeholders were interviewed across three countries (90) and global experts (15). The participants were recruited from various sectors, including education, government, international non-governmental organisations (INGO), media, non-governmental organisations (NGO), and private sectors from each country (Figure 1.3). In contrast, most international participants were from INGOS involved in multiple countries during and after COVID-19. Individual sectors, such as education and private, dominated the sample, with almost one-fourth of participants.

Figure 1.3: Distribution of Total Sample Participants



Most participants were responsible for administrative roles, meaning they had to play the most active roles in their organisations' risk communication and infodemic management. Also, many were researchers in risk communication or infodemic, providing a more comprehensive view of the overall scenario. Government employees and people associated with NGOs were the ones who actively dealt with risk communication and disaster response, which enabled them to provide actual field-level and country-level insights. Media participants from newspapers and news channels enriched the study's findings by sharing their hands-on experience while dealing with news dissemination, as they are the ones who deal directly with day-to-day news professionally. The interviews were conducted both online and in person. The respondents were provided with the project details, consent forms and detailed notes for the study. The online interviews were conducted through video conferencing platforms (e.g., Google Meet, Zoom, and Microsoft Teams). The interviews typically lasted 45 to 70 minutes.

The collected data were translated, transcribed and assessed quantitatively and qualitatively to present a holistic picture of the infodemic in each country. A thematic analysis approach was used to analyse the data. The coding process, facilitated by NVivo, involved assigning codes. This structured coding and thematic analysis was done to explore the findings concerning the research objectives. Besides, descriptive statistical techniques helped assess and present the findings quantitatively for better data comprehension.

Ethical considerations were at the forefront of the research process. Through a comprehensive consent form, participants were informed of the study's objectives and their rights. They were assured of the confidentiality of their information and their right to withdraw from the study at any time. Sensitive or proprietary information was kept private, and participants could keep specific responses off the record and access the form where we uploaded the data. To acknowledge their time, the interviewers thanked them verbally and appreciated their valuable insights.

Scope and Limitations of the Study:

The study addresses one of the most complex issues of this time, which still needs to be fully understood and addressed to prevent damage. The timeframe of the study thus emerged as a significant challenge, necessitating an in-depth examination of its various components. The efforts were directed towards fulfilling the identified objectives. Due to time constraints, newspaper content extraction was limited to June 2024, while many significant infodemic-related issues emerged in Bangladesh and the United Kingdom afterwards. Covering them in the study would have been optimal, but it would have derailed the study from its original objectives, and hence, they were not covered in this study.

The newspaper analysis covered the top national English-language newspapers published in each of the three countries to provide an overview. Due to limited time and budget, the study was unable to capture the infodemic that appeared in local newspapers, which are often published in local and regional languages. It likely impacted the nature of the infodemic reported, assessed and responded to in the study. Thus, covering them would require another study with a longitudinal timeframe in mind.

The key stakeholder interviews were conducted from July 1 to November 15, 2024. Despite the urgency of the issue, significant hesitation and delays were observed in getting a consensus and participation for the study due to its political nature. The inflated situations in the selected study areas increased the resistance to discussing the issue in depth. Bangladesh experienced one of the most significant movements in its history, called the ‘July Movement’. It began as a protest for fair recruitment policies in government jobs and ultimately led to the country's government being overthrown. The movement was held mainly during July and the first half of August, significantly driven by the abundance of information exemplified by the participants repeatedly during the interviews. The scenario provided a newer reference point for the infodemic in the country, which was not assumed during the planning phase of the study. A similar situation also arose in the UK, where the country experienced several riots due to misinformation, affecting the survey response.

Although these events coincided with the study timeline by chance, they significantly impacted the participation of key stakeholders. Many of the listed and potential participants opted out due to chaotic situations, where their participation could have personally or politically impacted them. Additionally, comparing the nature of the infodemic and the

perceptions of the key stakeholders of the three countries limited the inclusion of the voices of the general audience, or the people directly affected by the risk communication practices. To reduce the impact of this limitation, we interviewed people from academic institutions and doctors directly in contact with people who provided a detailed view of the impact of the infodemic among general audiences.

The seven sections of the working paper address various objectives of the study. The introduction sets up the context and objectives of the study, gives details of the study area, methodology, and outlines the scope and limitations of this research. It is followed by a a comprehensive literature review that provides an overview of the research focusing on the infodemic and risk communication in general and those addressing the selected areas of study in particular. Section 3 addresses the conceptual frameworks developed and applied for managing infodemic and risk communication. It also introduces the activity theory as a lens to assess the two and address the gaps. This is followed by Section 4, which maps the distribution, causes, and impacts of the infodemic across the three countries. Section 5 examines the governance issues as observed, experienced, and responded to by key stakeholders across the three countries. Section 6 discusses the overall findings from the lens of activity theory. Finally, the paper concludes with the study's findings and recommendations.

2.

Literature Review

Assessing the infodemic for the post-COVID-19 risk communication and governance required a comprehensive review of literature on the infodemic, COVID-19, and risk communication, as well as studies that focus on the selected study sites, namely Bangladesh, India, and the United Kingdom. Understanding the key gaps and responses concerning the infodemic and risk communication in time and space was essential for the post-COVID-19 governance and policy solutions.

An overview of the literature shows that studies on the infodemic are relatively recent in origin. The earliest studies by Eysenbach explored the field of "infodemiology" to identify and monitor misinformation (Eysenbach, 2009, 2011). Eysenbach (2011) not only defined but also highlighted the advantages and limitations of this approach in public health and policy research. His ideas on the applications of infodemiology centred on predicting disease outbreaks, tracking status updates, identifying relevant publications, assessing health information disparities, monitoring health campaigns, extracting user health data, and developing automated tools for information dissemination and knowledge sharing. Many subsequent studies on the infodemic focused mainly on health-related misinformation.

Reyna (2012) examined the risk perception and communication associated with vaccination decisions. The study used a Fuzzy-Trace approach to evaluate decisions based on the background of knowledge, mental representation in the form of verbatim and gist, and values retrieved and applied to represent the context. It brings a notable finding that anti-vaccination sources offer a more coherent gist of vaccination than official sources, which fail to explain the inevitable adverse consequences. It is critical because the rapid spread of information about adverse effects affects the decision-making of the vulnerable population, who may choose not to vaccinate for fear of side effects. The author notes that a verbatim could have multiple gists, which are subjective interpretations and result in fuzzy preferences in decision-making depending on culture, social identity, gender, worldviews, knowledge, life experiences, prejudices and belief in plausibility. As anti-vaccination messages, though, connect rare and unexplained diseases, a rapid spread of emotionally charged personal narratives through the internet allows them to reach faster than official messages. The theory also gives access to change the approach of information processing, i.e. how information is presented (verbatim or gist) or arranged (so that gist appears first) because the bottom-line meaning of facts and details tends to differ. Accordingly, the status quo of people without vaccination could be improved.

Wardle (2017) identified seven types of mis- and disinformation in the context of fake news, which include satire or parody ("no intention to cause harm but has potential to fool"); false connection ("when headlines, visuals or captions don't support the content"); misleading content ("misleading use of information to frame an issue or an individual"); false context ("when genuine content is shared with false contextual information"); impostor content ("when genuine sources are impersonated" with false, made-up sources); manipulated content ("when genuine information or imagery is manipulated to deceive", as with a "doctored" photo); fabricated content ("new content is hundred false, designed to deceive and do harm"). The author has also identified Ps that motivate these seven types of misinformation

and disinformation, including poor journalism, parody, provocation, punk, passion, partisanship, profit, political influence and propaganda (Wardle, 2017). The author notes that the method of dissemination is equally important and that people tend to be less likely to be critical of visuals. The infodemic could thus emerge from multiple sources, resulting in misinformation and disinformation that can take various forms.

Wang et al. (2019) examined the spread of misinformation on social media for its implications on health by using a systematic literature review. The authors note that the misinformation dates back to the initial days of printing and scientific medicine, while the internet brought a quantum change with communication amplification. They found that the most studied topics for misinformation include infectious diseases, vaccination, Ebola, Zika Virus, nutrition, cancer, fluoridation of water, and smoking, and the standard methodology employed included content analysis, social network analysis, and drawing findings on disparate disciplinary paradigms. The authors postulate that misinformation is mainly created by individuals with no official or institutional affiliation and dominated by negative opinionated tones that induce fear, anxiety and mistrust in institutions, which is partially related to the credibility of information sources and varies with individuals' personal experience, literacy and socio-demographic characteristics. They also draw that most theoretical frameworks come from psychology and network science. However, there is potential for collaboration across fields to develop more effective and customised interventions that counter misinformation.

The infodemic gained a significant boost during the COVID-19 pandemic due to its severe impacts on people worldwide. Casero-Ripollés (2020) examined the effects of COVID-19 on news consumption and its perceived credibility among citizens, using secondary data from an online survey conducted before and after the outbreak. The author finds a significant 62 per cent rise in information consumption, especially on television, following the COVID-19 outbreak. A notable increase in news consumption was also observed among younger citizens aged 18-29 after the emergency declaration. The news media's credibility increased with the improvement in coverage of the pandemic. The study emphasises that information is a fundamental driver and outcome of a healthy democracy. Therefore, an enhanced consumption of news has potential benefits for democracy through reduced inequality and increased access and participation of citizens in public affairs. It notes that not only did the media gain credibility and trust, but citizens also gained confidence and improved their ability to detect fake news after the outbreak.

Jamieson and Albarracin (2020) studied the type of media used to consume misinformation during the SARS-CoV-2 pandemic in the United States. Based on a probability phone survey of 1008 respondents, the authors employed multiple regression analysis to ensure the accuracy of information about disease lethality and media, controlling for political party, ideology, education, age, and gender. The study finds that the mainstream print media correlated with accurate beliefs and information for protection, while conservative media correlated with conspiracy theories. The study also recommends the need for proactive communication for prevention, finding which misinformation to debunk, creating a baseline for monitoring social media interventions, intervention in conservative media, and taking down the paywall on SARS-CoV-2 coverage.

Pian, Chi, and Ma (2021) systematically reviewed the causes, impacts and measures of infodemic. The study notes that social media is the leading platform for disseminating misinformation. Thus, a positive relationship is observed between media usage and rumour spread, which is also found to be responsible for people's psychological issues. It mainly

occurred due to low levels of health literacy, rapid publication and pre-print services, and other factors related to ideology, information needs and overload, civil literacy, armchair scientists, inappropriate map usage, distrust of government, financial incentives, lack of supervision, and widespread lockdowns. In terms of impact, apart from psychological issues, inappropriate protective behaviour, loss of trust in government and health institutions, violence, misinterpretation of scientific data, racism and xenophobia, cessation of public services, increase in tobacco or alcohol use and panic purchase are observed. Accordingly, measures were suggested to address these through education and training, division of roles and responsibilities for government and organisations, censorship of social media platforms, and the provision of multi-dimensional, tailored health information and strategies for different stakeholders. The study also gives sixteen recommendations for risk communication, which cover various aspects of messages, the role of the organisation, the nature of communication, management, monitoring, and implementation of risk communication to address the infodemic effectively.

Rzewski and Nowicki (2020) studied the prejudice and xenophobic reactions experienced by Asian medical students, such as fear and panic, during the COVID-19 outbreak in Poland. It is interesting to note that although the survey was conducted in February 2020, before the first case of COVID-19 appeared in Poland, nearly 61 per cent of the surveyed students confirmed experiencing prejudice and more frequently by those who wore masks (71 per cent) in comparison to those who did not (28 per cent). These prejudices were observed in public transport, streets, restaurants, shopping and health services. The authors thus suggest that universities and national and international authorities adopt more proactive responses to address these issues through effective policies and intercultural communication in addressing public health risks.

Noguchi et al. (2023) investigated the relationship between COVID-19 vaccination uptake and the information received by Tokyo residents from nine media outlets, seven providers, and four types of content through an online survey. The authors found that although people generally did not think their perception was influenced by the information received, some peculiar associations emerged in the data for positive and negative associations. They also noted a stronger association of variables with different age and gender groups. They thus recommended providing information tailored to different age groups and sexes to motivate vaccination carefully. They also observed that family and relatives played an essential role in influencing vaccination in the younger population. At the same time, older people depended more on TV and print media and their behaviour was partly influenced by the previous attempts to promote vaccination.

Along with impacts and types, many studies also focused on managing the infodemic. Eysenbach (2020), as an infodemiologist, suggested four pillars of managing infodemic, which includes (1) Infoveillance – information monitoring; (2) building literacy and literacy capacity of health and science; (3) encouraging knowledge refinement and quality improvement process with fact-checking and peer-review; and (4) timely and accurate knowledge translation by minimising distorting influences of politics and commerce. The author presented the Information 'Cake' Model, having four layers depicting the sheer quantity of information on the World Wide Web, wherein the top layer is science, followed by policy and practice, news media and social media, which has the last and largest segment. Eysenbach noted that the problem is not limited to misinformation in the top layer but its translation into recommendations to different stakeholders in other layers.

Several methods and tools have also emerged in the literature to address the infodemic, ranging from advanced technological solutions to legal and regulatory enforcement (Tasnim et al., 2020). Porat et al. (2020) used the Situational Theory of Problem Solving (STOPS) to study issues relating to infodemic from a vaccination safety perspective. They suggest fighting the infodemic with sustainable behaviour change. They used self-determination theory (SDT), which presents how few guidelines can promote sustainable behaviour changes, such as ones required during the pandemic, like wearing face masks for well-being as (1) creating autonomy supporting environment, (2) providing options for users, (3) applying bottom-up communication mode; (4) creating solidarity; and (5) being transparent about knowledge uncertainty.

PAHO (2020) created a knowledge tool to raise awareness about the nature, impacts, and responses to the infodemic. It suggests various response options, such as dos and don'ts, to avoid an infodemic. Various measures adopted by the WHO, such as fact-checking and misinformation management, infodemic measurement and analysis, evidence synthesis, knowledge translation, communication and amplification of message, also include risk communication, which suggests a continued and modifying nature of risk communication, which is essential to address both the primary and secondary hazards. Various efforts made by the WHO, such as "myth busters', live Q&A interviews with experts on websites and social media, engagement with social media and digital companies to filter false messages, engaging influencers and conducting media listening and sentiment analysis, also centred around helping people to understand various risks and responses to the pandemic.

Tangcharoensathien et al. (2020) developed the framework for managing the COVID-19 infodemic based on the crowdsourced WHO technical consultation. The authors note that the extraordinary interdependence of the pandemic's socio-behavioural dimensions creates both a threat and an opportunity to shape views and behaviours. They also note that while infodemiology requires a transdisciplinary approach that integrates applied mathematics, social and behavioural sciences, communication and information sciences, data sciences, and digital health as a scientific discipline, its research priorities are driven by health policy-making needs.

Pulido et al. (2020) studied the Social Impact of Social Media (SISM) methodology for overcoming fake news in health. They studied social media messages on platforms including Facebook, Reddit and Twitter to uncover the nature of interactions that occurred around misinformation vs. those based on health evidence. They found that the type of information shared governs interactions on social media. For example, false health messages and interactions were particularly aggressive, lacking a strong scientific basis. They tended to be open dialogues involving opinions, while social media messages sharing actual or potential impacts on health were respectful and transformative, with both quantitative and qualitative evidence. They also observed that contextualising information with evidence is essential to overcoming fake news. The authors recommend adopting bottom-up approaches by incorporating citizens' voices, including those of vulnerable groups, into science and social dialogue on public health, and extending research on other public health issues to understand how citizens use and share information.

Ali (2022) systematically reviewed misinformation and its potential impact during COVID-19. The author studied 15 randomly selected research articles on misinformation as a significant concern during epidemics and the pandemic. The author finds that the use of social media platforms is closely linked to the dissemination of misinformation and fake news. The study

highlights that misinformation promoted through individual accounts on social media hinders access to more reliable information, which causes Xenophobia, LGBT rights violations and psychological disorders. The author also notes that with greater accessibility of both print and digital media, it is challenging to control misinformation and thus recommends improved global policies along with key strategies to address misinformation.

Wilhelm et al. (2023) studied the methods and results of the WHO conferences to measure the burden of infodemic, an issue that they observed is here to stay. They emphasised that the multi-faceted nature of the infodemic requires a standardised measure to quantify the impacts of the infodemic and harmonise divergent approaches systematically and robustly. It is essential, as the limited research focuses more on the data-driven types of misinformation rather than measuring the association between misinformation exposure and individual attitudes and responses. The study finds that the iterative human-centred design (HCD) approach applied by WHO following the purpose-outcome-process model helps facilitate the participation of diverse stakeholders.

Studies also note that the nature and impacts of the infodemic varied for countries with different levels of development, socio-cultural, economic, and political contexts. The following section thus reviews the studies focusing on the infodemic in the selected countries, including Bangladesh, India, and the United Kingdom. It highlights the key differences, gaps, and measures applied to address infodemic and risk communications in these nations.

Infodemic Studies in Bangladesh

The infodemic garnered significant attention during the pandemic in Bangladesh, prompting numerous studies that explored related issues from various angles. Al-Zaman (2021) examined information dissemination by users in the Bangla language on Facebook using an automated Crowd Tangle tool from March to December 2020, by accessing publicly available pages. It shows a trend of information overload since the amount of shared information was high during the initial spread of the pandemic in March and April, which slowly decreased over time. They analysed the data numerically and found that social media users had a more positive outlook on COVID-19 vaccination.

Haque et al. (2022) examined potential information sources for the infodemic during the pandemic through a survey conducted from January to May 2022. The study addressed some widespread misinformation that circulated during the pandemic. The study asked the users to respond to that information on a Likert scale, where most participants were young (aged 18 to 30) and most of whom had received an undergraduate education. Around 40 per cent of participants disagreed with the misinformation, while several users chose an option not to agree or disagree with the information. It was interesting to find that people's education played a statistically significant role in relation to misinformation, except for one instance, which concerned the origin of COVID-19 in a lab. This quantitative study shows relationships to the misinformation rather than focusing on other details of the information, such as how it impacted or the sources of misinformation.

Uddin et al. (2021) conducted an exploratory study examining students' perspectives on how internet access enables them to identify fake news and provide relevant information as a potential solution to addressing fake news. The study finds that among students aged 15-25 with internet access from various educational platforms, male participants were more effective at detecting fake news than female participants. It notes that the urban participants

performed better than non-urban participants, and students from science backgrounds performed better than others in such detection. Another study by Atikuzzaman (2022) specifically focused on social media usage for sharing and spreading fake news among university students. The research employed an online survey of 264 university students who are social media users. The study showed that most students (around 60 per cent) shared about receiving fake news over social media, referring to the reason for sharing information without checking its validity. The participants reported being very confident in detecting fake news.

Patwary et al. (2021) investigated the impact of the infodemic on the mental health of the population in the geographic context of Bangladesh. In an online cross-sectional survey conducted between April 17 and May 1, 2020, among 744 adults, the study examined the source of information and potential links to anxiety and stress. The three dominant sources of information included: a. health media (i.e. information from Governmental or international health agencies, b. social media (i.e. social networks and online news portals), c. traditional media (i.e. newspaper, TV, radio). The mental health conditions were measured by standardised methods of measurement, such as generalised anxiety disorder (GAD-7) and perceived stress scale (PSS-4). The researchers divided the responses for different levels of trust and found that perceived trust in social media positively correlated with anxiety. They also noted that all the information sources positively correlated with anxiety and were negatively associated with perceived stress. The participants' demography played an important role; for example, among the low-educated participants, there was a high level of trust in social media, while the urban demography showed higher trust in health media and regular media. The study thus established that the perception of information sources or misinformation can impact mental well-being.

Sultana et al. (2021) conducted an ethnographic study spanning over nine months in 2020, involving 90 villagers. Several participants did not have formal schooling, while more than half had no formal schooling, only primary schooling, or secondary level schooling. Additionally, 42 participants were not smartphone users. The study identified four categories of unverified and confusing information from various sources, including a. medical and healthcare, and b. socio-political, c. religious and moral, d. economic. The study revealed how and where participants received conflicting information, such as two doctors discussing different approaches to treating COVID-19, with one recommending the use of malaria medication and the other remaining silent. Rumours and misinformation were deliberate in a few cases; for example, a person referred to having COVID-19 in the village because someone had a political conflict with that person. There was religious misinformation, such as doing wudu (ablution, washing oneself) to prevent COVID-19. The misinformation was also related to economic concerns, such as the spread of COVID-19 by Tilapia fish.

Kanozia et al. (2021) studied vaccination hesitancy by exploring the issue in India, Bangladesh, and Pakistan. They explored the possible reasons behind vaccine hesitancy, including a lack of clear, transparent, and accessible data on vaccination safety and efficacy. The research examined the factors contributing to vaccine hesitancy using secondary data sources. They presented the vaccination status and shed light on the factors that impact people's vaccine decisions. The authors noted a few such factors based on the concurrent literature. They mentioned false information, lack of sufficient and transparent information, lack of trust in government and public agencies, religious aspects, and structural barriers. The authors emphasised the need to debunk the misinformation, disinformation, and conspiracy theories

around the COVID-19 vaccine. They encouraged the fact-checking entities to take a more significant role in dealing with scenarios and called for the collaborative development of policies to reduce the number of misinformation people come across in digital public forums.

Tonmoy and Islam (2023) conducted an online survey among public university students in Bangladesh to explore their information-seeking behaviour during the COVID-19 pandemic. A survey of 270 students revealed that an increased demand for various types of information led to a shift in information sources during and after the pandemic. Most students struggled while seeking information and encountered misinformation. Regarding information behaviour pattern changes, the authors found a significant increase in students' social media usage for information seeking, where some significant relationships were also observed in the data between students' demographics and their understanding of choosing the COVID-19 information sources. They suggested developing new mechanisms to handle misinformation based on the knowledge of information-seeking behaviour. They emphasised the need for universities and other relevant stakeholders to arrange workshops and training to increase digital literacy among the students.

The effect of the infodemic on the psychology of the people of Bangladesh has also been studied by Mahmed et al. (2023), who explored how the infodemic created psychological pressure, its effect on decision-making and the ways to address the infodemic. They utilised both primary and secondary data for the exploration. They analysed 310 usable questionnaire data using statistical techniques. They tested three independent variables: fabricated news, rootless news, and fictitious belief, and one dependent variable, psychological impact. They found that confusion among people around fake news on social media has depressed them and influenced their decision-making. These types of scenarios instilled fear in people, preventing them from taking any action. The authors found that the distress of COVID-19 disease-related challenges had been intensified by various rumours and led people to many types of wrong decisions that contributed to further suffering. The study also recommended several remedies to address the infodemic, including conducting large-scale awareness-raising programs. They suggested holding these awareness-raising programs in places of worship, which can facilitate a collective effort among people.

Islam et al. (2024) explored the impact of wrong information on social media on the mental health of its users. They studied social media posts related to COVID-19 through a cross-sectional survey using both structured and semi-structured questionnaires, involving 1200 social media users, to understand their psychological health. They assessed depression, anxiety, and stress among the participants and found that 27.8 per cent of the participants spread facts, while 7.4 per cent spread myths and misinformation about the pandemic. Meanwhile, one-fourth and one-third of the participants shared the concerning and obstinate posts. The authors found that around three per cent of the participants had severe insomnia. However, they did not find any significant association between circulating misinformation on social media and depression, stress, or anxiety. They recommended using fact-checking facilities. The regulations on the potential spread of misinformation have also been deemed necessary and timely, and they are highly needed to reduce the circulation of wrong information on social media.

Kamruzzaman et al. (2024) investigated the RCCE scenario in Bangladesh during the COVID-19 pandemic by exploring the impact of social context in RCCE. They conducted a study in four Bangladesh districts using data collection methods such as key informant interviews, focus group discussions, and in-depth interviews involving 100 participants. Their qualitative

analysis of the collected data revealed that the government, NGOs, and development partners tried to raise awareness comprehensively. However, limitations due to the lack of social science and public health approaches nullified them. They also identified technological and geographical lapses in risk messaging, infrastructural barriers, and cultural norms that acted as impediments. The inability to engage the communities actively resulted in making these efforts a one-way approach that was not complemented by the target population, nor did they receive them well enough to adopt them. The authors suggested increasing the focus to increase community ownership in these awareness-generating approaches, which can address the gaps they identified in implementing the RCCE strategies during the pandemic.

Infodemic Studies in India

Guess et al. (2020) studied the effectiveness of digital media literacy in addressing the infodemic in the United States and India. They observed that in contrast to the dominant discourse of infodemic in political, economic and psychological antecedents, digital literacy has received less attention in research. The authors note that the digital media literacy campaign implemented in 14 countries reduced the perceived accuracy of both mainstream and false news, with a greater impact on the latter in urban areas. Rural India showed no effects due to limited social media usage. The authors, although they supported the use of digital media literacy, identified a few caveats -1) the modest effect size of digital media literacy, 2) the decay in effect over time from a diminishing trend in the United States to a statistically invisible impact over time in India, 3) adverse effect on the perceived accuracy of mainstream news, 4) ignorance or lack of attention towards tips to spot false news.

Sharma et al. (2020) studied the role of mass media in health communication during a pandemic. They emphasised the need for robust health journalism based on evidence-based news, research and development in India. As mass media informs and educates people, there is a need for news and information literacy. The authors suggest that various mass media platforms, including newspapers and television, should enable fact-checking functions to debunk fake news or misinformation on health subjects. They also emphasised the need for regular communication between media, health experts, researchers and policymakers to improve news quality and avoid infodemic.

Bhattacharya et al. (2021) studied the panic induced by the COVID-19 infodemic among social media users in India. Using opportunistic sampling and a citizen science approach, the authors studied 1075 social media users from 30 countries, mainly from Asia (91 per cent) and India (87 per cent). The authors argue for region-specific analysis of panic among social media users because not all topics receive equal attention in all regions, e.g. the popularity of hydroxychloroquine, a controversial drug on Twitter, was limited to a few countries as expectations of panic varied in space. The study notes that the association between panic level and age and gender was significant, but not for the level of education, location, and profession. It also mentions that people experienced stress and anxiety due to lockdown protocols, and therefore, a significant association appeared between mental health and panic and between mental health and productivity.

Gavaravarapu et al. (2022) studied the influences of infodemic on the perception and practices of food and nutrition among Indian internet users. The study evaluated the trend from 27 Jan 2020 to 30 June 2021 by using 34 popularly searched keywords, which the authors classified into five categories: immunity, eating behaviour, food safety, food scares and concerns, and

COVID scare. It notes a significant rise in immunity boosters, vitamin supplements brands, and Ayush kadhai, which also aligns with the affirmation of most respondents who agreed to depend on social media for doctors and health professional information. The study notes that more than 60 per cent of the respondents relied on multiple sources for information on food and nutrition. While the majority depended on websites of health organisations (74 per cent) and frontline health workers or doctors (70 per cent), a significant proportion of people also relied on television news (47.2 per cent), online search engines (46.8 per cent), social media platforms (44.8 per cent) and peer group (37.4 per cent). Thus, the authors cautioned about the careful design of media and health literacy messages.

Sharma et al. (2022) evaluated the information-seeking behaviours of healthcare workers (HCWs) during COVID-19 by using a purposive sampling method for a cross-sectional study of 250 respondents from tertiary care hospitals dedicated to COVID-19. The authors observed that the search across the four most used social media apps, including WhatsApp (40 per cent), Facebook (23 per cent), YouTube (19 per cent), Twitter (five per cent) and Instagram (13 per cent) focused on surged on COVID-19 cases, failure of medical facilities like oxygen scarcity, bed shortage, mortality news and vaccination. They also found a mixed response from people, where 72 per cent observed a positive contribution of social media in generating awareness, and 88 per cent agreed with its role in generating fear and panic among people. They also argued for the urgency of further research on the impact of the infodemic on the mental health conditions of HCWs.

Khan (2023) studied the human-induced crisis of COVID-19, which occurred due to gaps in risk communication and capacity building, and manifested as an infodemic, mass migration, and accidental deaths, in addition to infectious diseases, in India. The study notes that despite various efforts from the government to create awareness and address misinformation, the infodemic was rampant due to inadequate attention paid to risk communication in the existing national disaster management planning and response. It reflects in the chaos, panic, and reflexive response of the public, as well as the extreme control measures applied by the government. The author argued for comprehensive risk communication planning and capacity building, which involves assessing information provision for specific events, responses, and various risks associated with diverse public responses, taking into account varied vulnerability and socio-cultural factors.

Upadhyay et al. (2024) investigated the role of fake news in exacerbating the pandemic scenario during the COVID-19 outbreak and the reasons behind the spread of fake news. It also examined the effectiveness of the WHO's efforts in managing fake news and the role of AI in fact-checking and information regulation on social media. The authors employed a qualitative research methodology and conducted semi-structured interviews with 30 fact-checking experts. The authors asked the respondents about their perception of infodemic, fact-checking, and tools and technologies used. They note the respondent’s assertion of the role of the infodemic in complicating the pandemic scenario. The illusory truth (e.g., repeated exposure to the same news leading to the perception of reality) through content sharing on social media led to the amplification of fake news and contributed to the infodemic. The respondents of the study affirmed the WHO’s role in combating fake news. They found that the volume of data and the lack of readiness of the appropriate algorithms are the biggest impediments to dealing with fake news using AI.

Rajkhowa et al. (2024) mapped the public sentiment towards HPV vaccination and infodemic associated with the vaccine based on the ‘Behavioural and Social Drivers (BeSD) framework

through geospatial, content, and sentiment analysis. They analysed over 1,000 tweets related to vaccination information using word frequency, sentiment analysis, geospatial analysis, and content analysis. The study found that the sentiments towards the HPV vaccine were mixed, and the misinformation about it primarily focused on its safety, efficacy and ethical considerations. The study also suggested that uncertainty regarding the vaccine was a primary contributor to the infodemic surrounding it. It emphasised the necessity of customising the messaging terminology when formulating communication strategies. It advocated for immediate action to halt the spread of misinformation by implementing efficient educational programmes and risk communication strategies.

Saleem and Jan (2024) investigated the infodemic in India by looking at different strategies and policies for promoting health literacy and effective communication worldwide. They found that the masses sought trustworthy sources of information during the pandemic crisis, and official sources served as pillars of public trust. However, the challenge posed by the situation surpassed effective communication and exposed the need for health literacy among the population. The study emphasises that the health literacy of the individuals is the primary factor in shaping their behavioural changes, a long-term phenomenon by nature, which makes it challenging to shift the scenario positively. The authors also discussed various models and approaches for behaviour change and emphasised generating public awareness to induce health-promoting behaviours through a comprehensive approach.

Infodemic Studies in the United Kingdom

Cushion et al. (2021) investigated misinformation in public knowledge and media environments, as well as its management by the UK government. They analysed the content of 1259 television news items and the news diary of 200 participants over six months during the first wave of the pandemic. The study notes that the spread of misinformation also depended on editorial choices, as more respondents could spot the fake news and, in some instances, misinterpret the impact due to regular coverage of certain places or content. At the same time, less attention was paid to the information environment, which provided limited opportunities for people to understand the government's performance in meeting their targets or handling the overall pandemic. The authors note that the debate on misinformation or disinformation depends on the information environment that dictates what information people are exposed to. They also mentioned that people's responses might differ according to their relevant knowledge, which could vary across countries, along with their level of compliance with national measures and how they relate to their governments during the crisis.

Etta et al. (2022) investigated how infodemic relates to factors such as the number of cases, containment measures, and media coverage to comprehend the engagement of Facebook users for their sources of information. By studying six million posts shared on Facebook in 2020, the authors categorised all the posts into two categories, reliable and questionable, based on the perceived credibility of the news outlet being referred to in the post. To examine the relationship between the confirmed number of cases, containment measures, and media coverage, the authors used regression analysis. Notably, a significant portion of posts in circulation were deemed credible sources of information in the UK. However, users interacted with the suspicious posts more often. The authors also demonstrated that factors associated with a pandemic, including the number of cases reported, average restrictions, and amount of media coverage provided, can serve as proxies to measure the development of the infodemic.

The research established, through an analysis of Facebook post data, that the extent of the pandemic and the stringency of COVID-19 rules significantly affected the level of infodemic.

Trethewey (2020) addressed how health sector-related misinformation can be dealt with and emphasised the role of evidence-based interventions and interdisciplinary efforts to combat the issue. The author conducted a literature review and social media analysis to explore different strategies for tackling misinformation, such as careful dissemination of research findings, fact-checking, and social media campaigns. The research found that clear communication is required while disseminating medical research findings to prevent misinterpretation or exaggeration in the media. To improve the accuracy and maintain the authenticity of the information shared on the media, especially social media, fact-checking, and peer-review processes should be followed. It also found that targeted campaigning is an effective strategy for reaching relevant audiences without propagating the risk of misinformation. The study emphasised the need for platform- and audience-specific strategies and provided a conceptual framework for addressing misinformation. The framework endorsed collaboration among various parties, including health organisations, researchers, and digital platforms.

Roozenbeek & van der Linden (2022) focused on psychological solutions to reduce the spread of health-related misinformation and its vulnerability. They reviewed three high-profile psychological approaches to countering misinformation in the public health domain. The approaches included fact-checking misinformation after it spread, raising awareness among people about the accuracy of the information, reducing misinformation sharing, and building psychological resistance through inoculation. They discussed the pros and cons of each of the approaches mentioned above. People can continue to believe misinformation even after it has been corrected, which limits the effectiveness of the fact-checking approach. The small effect size of the awareness generation also affects the efficacy of accuracy primes. At the same time, inoculation interventions can often be challenging to scale, making it impossible to predict what misinformation can go viral. Subsequently, the authors concluded that pre-emptive and post-hoc approaches should complement each other depending on the context to develop a robust approach to tackle the issue of misinformation in the health domain.

Lockyer et al. (2021) investigated people’s COVID-19 beliefs and interactions with misinformation during the pandemic, as well as their attitudes towards vaccination. They conducted a qualitative study in Bradford, UK, to explore people's perceptions and conducted in-depth phone interviews with 20 people from diverse ethnicities and areas. The participants of the study shared a variety of misinformation experiences and emphasised the confusion, hesitations, and stress caused by that misinformation. The authors conducted a reflexive thematic analysis of the participants' responses and found that the avalanche of information surrounding the pandemic left many people overwhelmed and confused. The study indicated safety concerns, negative stories, and personal knowledge as the most prominent factors contributing to vaccine hesitancy. Such hesitancy was amplified by the exposure to misinformation through social media. The authors expressed their concerns regarding the implications of widening health inequalities in the country. They called for addressing the issue through local decision-making and systematically monitoring misinformation circulation on social media.

McKechnie et al. (2022) studied British and Irish newspapers over the past two decades, between January 2000 and December 2020, and assessed the accuracy of curative claims reported in the newspapers. With the help of two sizable databases, they searched for articles

purporting new treatments or cures by 2020. The authors focused on the origin of the claims and their contexts to classify them as met, partially met, or unmet. The study suggests the need for caution when reporting scientific progress, research results, and discoveries in the media. In medicine, there are instances where the claims made are either unreasonably exaggerated or relatively underserved. The study argues for a moderation of press releases and an appropriate framework for disclosure. The researchers endorsed the importance of clear communication based on existing evidence to win the confidence of the public, especially in times of health emergencies, to avoid the creation of unrealistic expectations.

Loomba et al. (2021) investigated the impact of COVID-19 vaccine-related misinformation on people's intent to take vaccines. They conducted their study in the UK and the USA, where they primarily evaluated the effect of exposure to misinformation on vaccine hesitancy and acceptance across different socio-demographic categories. The study conducted a randomised controlled trial involving participants from both countries. Vaccine-related misinformation was conveyed to them, along with controlled content, to assess how they reacted to it and how it affected their willingness to take the vaccine and recommend it to others, as well as the impact on their trust in institutions. Consequently, it was found that socio-demographic characteristics impact the chances of a person falling prey to misinformation. The paper emphasised the need to formulate strategies to address the spread of misinformation and increase vaccine uptake among the most at-risk populations. The authors asserted that measures aimed at raising health literacy and trust in public institutions or meeting some specific demographic challenges are necessary to neutralise the impact of misinformation. They pointed out how crucial it was to design messages that would be effective against misinformation and foster acceptance of vaccines during public health emergencies.

Gies et al. (2024) conducted a study to investigate how UK university students coped with infodemic incidents brought about by the COVID-19 pandemic. The study provides insight into students' perceptions of the information and how they verified it, given the prevalence of misinformation. The researchers collected qualitative data using semi-structured interviews with 34 university students during the COVID-19 pandemic-induced lockdown in the summer of 2021. Using the thematic content analysis method, it explored how students interact with information by adopting concepts of trust, consumption, and evaluation of information. This suggests a need to strengthen media and information literacy, as well as self-efficacy, to address the future infodemic. The research indicates the roles of such systems as regulatory measures to counteract the abuse of the online space and foster the seeking of reliable information. Authors considered the dimensions of media literacy and the creation of safe online environments as essential factors for counteracting misinformation and facilitating informed public involvement in health issues of a crisis nature.

Infodemic, Risk Communication and Governance:

Chatterjee et al. (2020) studied the COVID-19 risk assessment tool for its dual application of risk communication and governance. The authors note that, in contrast to most risk assessment tools that focus on tracking patients or diagnosing issues based on symptoms, RIKA India comprehensively assesses risk based on health, behaviour, exposure, and social policy, utilising a user-friendly data collection method that does not require personal data, such as a mobile number or location. The authors observed a significant digital divide in the country, with only eight per cent of respondents from the informal settlements, which are not

only highly vulnerable to infection but also lack the resources to adapt. They further reiterate that the app offers last-mile connectivity and helps to increase awareness and identify critical areas of intervention.

Fletcher et al. (2020) found the coronavirus pandemic to be a communication crisis, characterised by a limited understanding and an increased need for effective communication during the crisis to support decision-making. As communication by government and institutions is interlinked with political processes and public use of media and digital platforms, its nature, speed and quality affect the overall response of society. Based on six online panel surveys conducted from mid-April to late June 2020, this study found significant temporal inequality in COVID-19 news, as well as variations in demand and availability across online and offline news sources. Significant differences were observed in news use across age, gender and household income. The authors also note that these inequalities and misinformation influence the response to the crisis. However, they found no evidence of social media increasing news inequalities. They also suggest that social media can potentially reduce news inequalities, but caution needs to be practised due to narrow differences.

Erosion of trust due to infodemic recurrently appears in the literature, which is crucial to address from the perspective of risk communication and governance. Bunker (2020) observed that the digital disruption through mobile phones has benefited various resource-sharing companies and social media platforms through greater access to track, predict and exploit individual data. In the age of post-truth, fake news and infodemic, it has also promoted dissonant mental models and disrupted shared situational awareness by propagating misinformation. The author notes that the dissonance between mental models of crisis management agencies and ordinary people makes it impossible to maintain a consistent view and communicate effectively, as inconsistencies in what constitutes reality arise, thereby making crisis response management difficult. It is concerning when, on the one hand, user data is used as a commodity or resource, including situations of misinformation or fake news. However, legal and ethical issues emerge when using APIs for countries wishing to use them for contract tracing or providing advice. The author argues that the centralised managed communications of social media urgently require methods and solutions to build and encourage trust among actors who use them.

Min et al. (2020) explored the role of knowledge and negative emotion in guiding the relationship between trust and preventive behaviours based on a cross-sectional survey in China during the pandemic. The authors reinforced that trust in government is a determinant of preventive behaviour. They observed that more people followed recommended actions than excessive preventive measures, which occurred in areas where a combination of high trust in the government and low levels of negative emotions was observed. As a positive relationship is observed between trust and excessive preventive behaviours among people with low COVID-19 knowledge, the authors suggest increasing people's knowledge through health information campaigns to reduce the negative emotions of fear.

Article 19's (2020) policy brief addresses the need to effectively govern misinformation and 'hate speech' during the coronavirus pandemic from a legal perspective, focusing on freedom of expression. It notes that the right to health is intimately linked to the right to information and freedom of expression, and the UN Committee on Economic, Social and Cultural Rights stresses information access as a critical component of the right to health. However, in the crisis, governments recurrently use repressive laws to control misinformation that influences the flow of information, freedom of expression and the role of media and social media. It also

outlines recommendations for the governments, states, media, and social media to address misinformation without curbing the right to information and expression.

A range of issues and challenges that emerged from the infodemic were not just limited to misinformation, rumours, and breaches of rules or regulations but also resulted in violence, suicides and riots that increased the overall loss across communities, societies and nations (Khan et al., 2022). Khan et al. (2022) classified COVID-19 communication observed in different countries into infodemic, ideal, and inadequate risk communication. The study finds that the nature and impacts of the infodemic varied across countries during the first, second, and third waves. It also notes that inadequate community engagement and compromised roles and rights of the public as key stakeholders created gaps in risk communication and response, thus suggesting a participatory approach for addressing risk communication and infodemic.

Khalaf and Shehata (2023) studied the relationship between exposure and trust in information sources among citizens of Oman. The study was designed following the questionnaire and findings of other studies, which observed a positive correlation between people who believed in conspiracy theories and misinformation having relatively high levels of anxiety and vice versa. In response to their survey, they found that trust in the information source is negatively related to conspiracy thinking and misinformation beliefs. However, this pattern is also influenced by the location and education level, along with factors such as age, gender, pre-existing beliefs, self-efficacy and dissatisfaction with government actions, as reported in other studies. The authors also note that misinformation affects the psychological and mental health of people due to the high anxiety and stress associated with it. The study also found that the source of information varied across regions. The authors recommend that policymakers provide accurate information through both digital and traditional media to prevent the spread of conspiracy theories and misinformation.

Khan, Fears and Caussey (2023) reviewed regional variations in vulnerability to infectious diseases, mainly COVID-19 and policy implications for climate change and health. The study shows significant variations in policy focus, including risk communication. It notes that in the presence of insufficient public awareness, there are disease-specific health policies and greater emphasis on technology transfer in Asia, while in Europe, due to misinformation and polarisation of views with broad economic implications, policy focus includes health risk communication, improved data integration along with surveillance and monitoring of health consequences. It thus emphasises that the regional differences in vulnerability and policy focus have implications for global policies, which need attention and research for regional and local adaptations.

Okada et al. (2023), in a longitudinal study of the association between trust in COVID-19 information sources and infection prevention behaviours, found that physicians and patients are trusted and should be considered for influencing behaviour during the pandemic. They also observed differences in the behaviours trusted by different stakeholders, such as physicians for social distancing, masks, and washing hands with soap and patients for social distancing, ventilation, masks and hand sanitisers. The authors also noted a negative association between preventive behaviour and trust in the government to avoid closed spaces. The authors also observed deviations in the level of trust for different stakeholders. They found that physicians' trust remained consistently high due to their high engagement in preventive behaviours, while it declined for other stakeholders. They found that the presence of uncertainty in risk communication results in confusion and decreases trust in governments. In

contrast, trust in personal information about infected patients and acquaintances increased over time.

To conclude, in contrast to risk communication studies, infodemic studies are reasonably recent. Attributed to its origin in the health field, most studies on infodemic tend to focus or revolve around public health and health emergencies. Many of these studies depend on secondary data, technology and literature reviews. Along with the infodemic, the nature of studies are also found to vary across countries, which suggests a need for local assessment of infodemic and customised risk communication inside the global frameworks.

3.

Conceptual Framework for Assessing Infodemic for Risk Communication and Governance

The significance and applications of risk communication for human survival can be traced back to early civilisations, dating back to the Babylonians in 3200 BC (Krimsky & Plough, 1988; Kasperson & Stallen, 1991). However, it wasn't until the late 20th century that risk communication started to gain attention in the literature (Kasperson, 1986; Covello et al., 1986; Kasperson et al., 1992). The need for improved risk communication to facilitate effective governance of health and environmental risks emerged with the rise of public concerns stemming from varied perceptions of risks (Covello et al., 1989). Due to its various implications, the National Research Council (1989) recognised the need to pay greater attention to risk communication. It noted that successful risk communication requires a blend of both technical expertise and communication proficiency to avoid false or incomplete messages or manipulation of facts on the one hand and a lack of sensitivity to address the capacities, interests and needs of the audience on the other hand.

Risk communication has now been established as a full-fledged multidisciplinary field of study (Khan, 2023). It has been studied for varied natural and human hazards; for diverse risk perceptions, attitudes and beliefs; for issues of trust, modelling, bias or efficacy; for diverse contexts of community, media and governance; and across different disciplines such as sociology, psychology, geography, decision-sciences (Balog-Way et al., 2020). Disaster risk communication (DRC) is critical for the communities to prepare, plan, respond, recover, adapt and become resilient to various hazards and climate risks they are exposed to (GAR, 2022; Khan et al, 2024).

Disaster risk communication is a complex process that is influenced by and, in turn, influences both perception and response (Eiser et al., 2012). It modifies the perceived uncertainty, learning, experiences, heuristics, trust, and sociocultural relationships across scales, which can determine disaster outcome (Khan et al., 2017). Khan et al. (2017) noted that risk communication is not just an information tool but also a creative process, wherein various factors that shape risk perception are influenced by risk communication and thus affect response both directly and indirectly. As the complexity of a crisis is extreme due to an immediate threat and excessive fear, it is essential to plan disaster risk communication.

Sheppard et al. (2012), in their detailed literature review of risk communication, found that despite some significant advancements of research in this domain, its application remains limited to warning and plans for disaster preparedness, response, and recovery. Several reports have recurrently recorded gaps observed between early warning and disaster risk communication because synergies between the two are often inadequately planned, strategised or applied, resulting in misinformation and decline in public trust (World Bank 2018, UNDRR, 2022).

Literature thus repeatedly emphasises careful planning and design of risk communication to address varied community needs with open, accurate and consistent communication (Zhang et al, 2020; UNDRR, 2022; Khan et al, 2022). During the COVID-19 pandemic, the problems of disaster risk communication multiplied with the Emergence of the Infodemic. It became a primary concern in the 21st century due to the excessive use of social media by a significant

proportion of the population worldwide. The World Health Organisation (WHO) formally acknowledged and adopted the term infodemic during the COVID-19 pandemic and emphasised the potential hazards that information, or rather the overabundance of information, can have (Tangcharoensathien et al., 2020; Kanozia et al., 2021).

While disaster risk communication is identified as the foundation for preventing and mitigating a crisis, the COVID-19 infodemic not only undermined disaster risk communication but also intensified the situation with a range of unintended impacts (Khan et al. 2022). The Global Risk Report 2024 notes that the leading short-term risk that the world faces is allied with misinformation and disinformation (World Economic Forum, 2024). Misinformation and disinformation, in general, carry the potential for damage; however, when associated with any significant hazard or pandemic, they could intensify the grip of loss, which is not only life-threatening but could also cripple emergency response and destabilise economic and political systems. As misinformation and disinformation are critical elements of an infodemic, making disaster risk communication immune to these has become a priority for effective disaster risk governance.

Definition of Infodemic

The term, 'Infodemic' was first used by David J. Rathkopf in his article "When the Buzz Bites Back" during the SARS outbreak (Rathkopf, 2003). He described it as a rapid and far-reaching spread of accurate and inaccurate information during a public health crisis. According to the World Health Organisation:

"*An infodemic is too much information, including false or misleading information in digital and physical environments during a disease outbreak. It causes confusion and risk-taking behaviours that can harm health. It also leads to mistrust in health authorities and undermines the public health response. An infodemic can intensify or lengthen outbreaks when people are unsure about what they need to do to protect their health and those around them*" (WHO 2024).

An earlier reference to the issue of misinformation spreading like an epidemic is found in Gunther Eysenbach's work on Infodemiology (Eysenbach, 2002). Eysenbach defined infodemiology as: "*the science of distribution and determinants of information in an electronic medium, specifically the Internet, or in a population, with the ultimate aim to inform public health and public policy*" (Eysenbach 2009).

Most studies have examined the infodemic from the perspective of public health crises and associated risk communication. Despite its influence and impact on other risk responses, limited studies have defined or assessed it from the disaster perspective. Therefore, to explore the role of infodemic in risk communication and governance, a broad definition is adopted to address its multi-dimensional impacts beyond disease outbreaks or public health crises.

"Infodemic can be defined as a hazardous situation arising from the rapid intermixing of risk communication with distorted, erroneous, fake, inaccurate, and unreliable information due to excessive and unregulated sharing of public concerns, impacts and fear-based responses through different means of online and offline communication in the environment of heightened uncertainty following a natural, social or health hazard at the local, national or global scale."

This broader definition extends the enquiry of the infodemic beyond COVID-19 and other health impacts. In the era of climate change and increasing natural hazards, it is essential to address the infodemic ongoingly for the effectiveness of disaster risk communication.

Mapping the Infodemic

Infodemic could arise from multiple sources, ranging from unintentional errors to fabricated fake news shared either to help or take advantage of the situation. The information shared during an infodemic could vary significantly in nature. However, certain forms are more discussed than others in the literature. The infodemic may develop from misinformation, disinformation, fake news, false or misleading content or context, prejudice, and xenophobic reactions (Wardle 2017, Rzewski and Nowicki 2020). Thus created, it can induce confusion or derail the public response. Therefore, mapping the infodemic requires identifying various erroneous information and associated processes that trigger and fuel it. A list of different types of content discussed in the literature that contribute to the infodemic is compiled in Table 3.1.

Table 3.1: Type of Contents Contributing to Infodemic

Type	Meaning in the context of information
Blame	To hold responsible; accusing someone or something responsible for any negative consequences without mentioning evidence or without providing enough justification.
Conspiracy	The act of conspiring together; a plan constituted by any individual or group to implement any harmful, or illegal, or wrongful act which is often covered strategically from mass people.
Conspiracy theory	A theory that explains an event or set of circumstances as the result of a secret plot by usually powerful conspirators.
Deepfake	An image or recording that has been convincingly altered and manipulated to misrepresent someone as doing or saying something that was not actually done or said.
Defame	To harm the reputation of by communicating false statements about; the act of harming the reputation of a person through the malice of false or misleading information.
Defamation	The act of communicating false statements about a person that injure the reputation of that person.
Disinformation	False information deliberately and often covertly spread (as by the planting of rumours) in order to influence public opinion or obscure the truth.
Distortion	The act of twisting or altering something out of its true, natural, or original state or the act of distorting.
Fabrication	The act of fabricating false information with the intention of deceiving or misleading people.
Fake News	Not true, real, or genuine information previously unknown fact or situation.
False assertion	An assertion that is untrue and doesn't have any proof adduced to it but is nevertheless presented as an infallible fact.
False information	Any data or statements that are false in nature and claim to be true either on purpose or by accident.
False news	Falsified or misleading or deliberately untrue information which is in the form of news and is created in order to deceive or influence the audience.
Hate speech	Speech expressing hatred of a particular group of people.
Hoax	To trick into believing or accepting as genuine something false and often preposterous.
Inaccurate	Something which is false or vague and does not correspond with the reality, universe, or world around us.
Inaccurate information	Incorrect information or incorrect content either provided deliberately or otherwise.
Misinformation	Incorrect or misleading information.

Myth	A usually traditional story of ostensibly historical events that serves to unfold part of the world view of a people or explain a practice, belief, or natural phenomenon.
Opinion	A view, judgment, or appraisal formed in the mind about a particular matter.
Propaganda	The spreading of ideas, information, or rumor for the purpose of helping or injuring an institution, a cause, or a person.
Pseudoscience	A system of theories, assumptions, and methods erroneously regarded as scientific.
Rumour	A statement or report current without known authority for its truth.
Unfounded claim	A claim which lacks a sound basis.
Unsubstantiated claim	A claim which is not proven to be true.

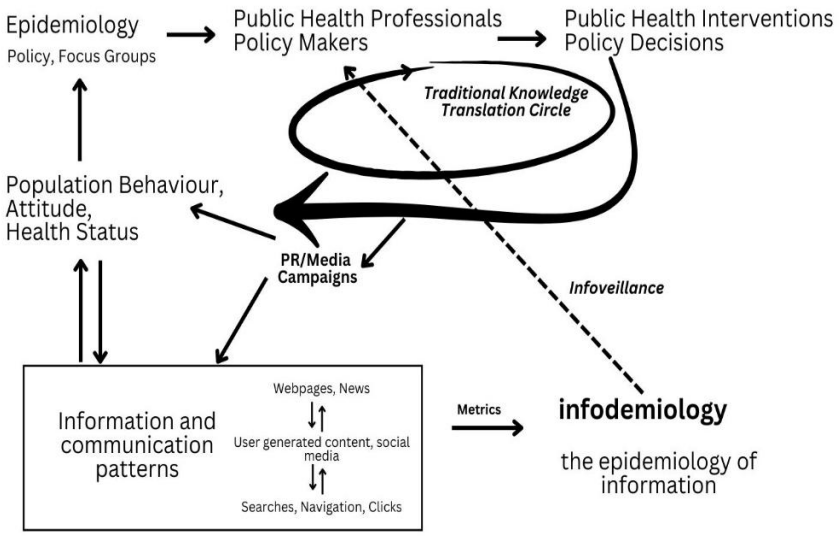
Based on Merriam-Webster Dictionary, 2023.

An infodemic can have any or a combination of the abovementioned contents in varying proportions, but enough to create confusion and chaos. These contents may have a variety of impacts, ranging from irritation to fear, confusion, delay, hatred, violence, and damage to property and infrastructure. Depending on the nature and intensity of misinformation, an infodemic could not only disrupt disaster response but also intensify secondary hazards. It is thus essential to address the infodemic for the effectiveness of risk communication.

Infodemic and Risk Communication Governance

Several models and frameworks have emerged to address concerns related to infodemic and disaster risk communication. Eysenbach provided a foundational framework for infodemiology for understanding the dynamics of information and communication affecting people's behaviour during a health crisis for public health professionals and policymakers to support them with public health interventions and decision-making (see figure 1, Eysenbach, 20011).

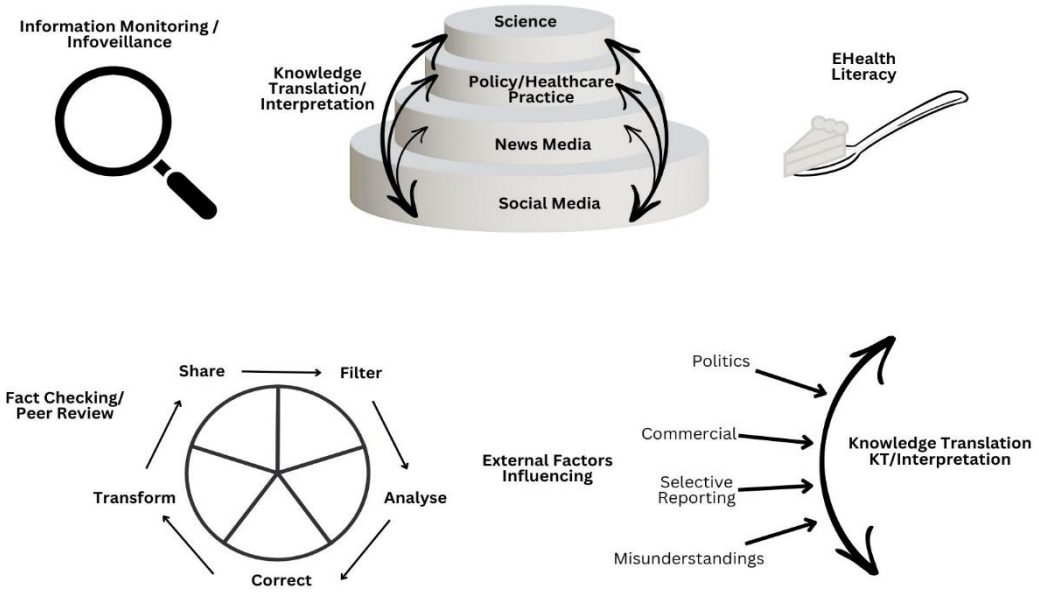
Figure 3.1: Infodemiology Framework



Based on Eysenbach, 2011.

The initial model of infodemiology had fewer concerns about the infodemic and focused more on leveraging the information systems for better health decisions. Later, Eysenbach (2020) developed the Information 'Cake' Model, which comprises four pillars of infodemic management (Figure 3.2). These include (1) Infoveillance – information monitoring; (2) building literacy and literacy capacity of health and science; (3) encouraging knowledge refinement and quality improvement process with fact-checking and peer-review; and (4) timely and accurate knowledge translation by minimising distorting influences of politics and commerce.

Figure 3.2: The Cake Model



Based on Eysenbach, 2020.

The model depicts that the sheer quantity of information on the World Wide Web, primarily through social media, forms the base of the cake, which is then filtered through news media for informing policy and healthcare practices. The final top layer is that of science. Eysenbach noted that the knowledge translation and use across these four layers are influenced by external factors such as politics, commercial interests, selective reporting, and misunderstanding, which also makes information monitoring, fact-checking and health literacy essential to reduce distortion in information in any form. The model also indicates a cyclic flow and interaction of information across the four layers of cake that should go through filtering to avoid distortion. The model thus provides a coherent structure to manage the integrity of information accuracy. However, in an ever-increasing volume of information and participation of stakeholders with varied concerns, languages and challenges, particularly when a disease outbreak is associated with other secondary local hazards, information monitoring may not always capture misinformation or disinformation, which could affect decision-making, create chaos and messy responses as observed in the COVID-19 (Khan et al. 2022).

Scales et al. (2021) further investigated the use of epidemiologic model to counter misinformation by focusing on three elements – real-time surveillance, accurate diagnosis and rapid response. They suggest that sensitive surveillance systems should be triggered at the inflexion point of the infodemic curve before misinformation goes viral. They also recommend further study of social media data and deceptions to control misinformation and disinformation, and infodemiologists can play a crucial role in raising awareness about dangerous deceptions.

The WHO emphasised the need to address the infodemic and shed light on the unforeseen rise of all kinds of information regarding the pandemic. It also developed a comprehensive framework identifying the ways people can help in the fight against the pandemic amid the overwhelming information abundance, as presented in Figure 3.3.

Figure 3.3: Strategies People Can Use to Combat Infodemic

<table>
<tr><td>Trust WHO</td><td>Identify evidence</td><td>Avoid fake news</td><td>Support open science</td></tr>
<tr><td colspan="3">Determine if the information really adds up, even if it’s from a secure source and has been shared before</td><td>Report harmful rumors</td></tr>
<tr><td>Protect privacy</td><td>Open (quality) data</td><td colspan="2">If you can’t confirm the information’s source, its usefulness, or whether it’s been shared before…
better not to share</td></tr>
<tr><td colspan="2">Confirm that the information has been shared before by other people</td><td colspan="2">Participate responsibly in social conversations</td></tr>
<tr><td>Continue collaborating</td><td colspan="2">Share information responsibly</td><td>Confirm the source, in particular the threads on WhatsApp</td></tr>
<tr><td colspan="3">If the information is not confirmed, it is better not to share it</td><td>Keep learning</td></tr>
</table>

Source: PAHO, 2020, p. 4

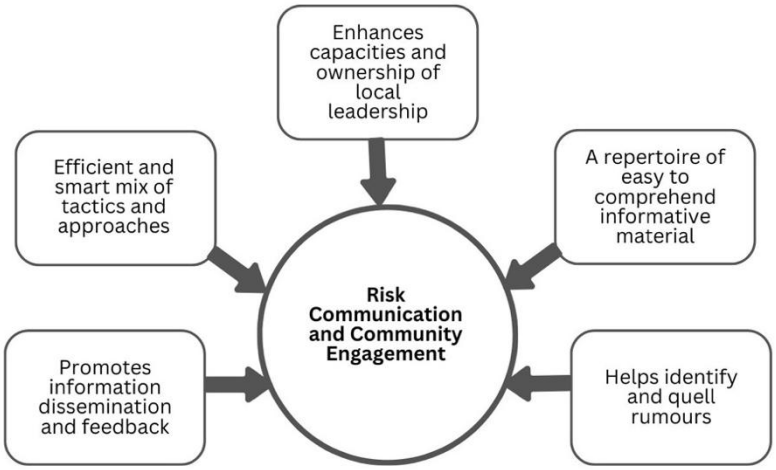
WHO also proposed Risk Communication and Community Engagement (RCCE) for countries to apply with a set of toolkits and resources. While exploring the risk communication in India during the COVID-19 pandemic, Khan (2023) illustrated the risk communication model applied in India, wherein risk communication and community engagement (RCCE) involves information dissemination, tactics and approaches, capacity building, informative materials, and rumour identifications (Figure 3.4). It showed that RCCE should be such that it promotes information dissemination and feedback mechanisms with an efficient and intelligent mix of tactics and approaches to enhance the capacities and ownership of local leadership. The model emphasised the importance of having a repertoire of easy-to-comprehend informative material to help identify and quell rumours. It emphasises the information aspect of risk communication while involving communities in the process.

The WHO (2024) also identified four key activities in infodemic management for better health practices. These include:

1. Listening to community concerns and questions
2. Promoting understanding of risk and health expert advice

3. Building resilience to misinformation
4. Engaging and empowering communities to take positive action.

Figure 3.4. Risk Communication and Community Engagement (RCCE) Model as Applied in India



Based on Khan, 2023.

The emphasis on health practices and concerns, which is the focus of WHO, limits the application of these models and practices to other hazards in the current form. Besides, heavy dependence on a global organisation for all necessary information for managing local hazards can be limiting for those seeking help with the less prominent issues with limited awareness.

As social media has been recurrently noted as the prime cause of the infodemic, a few models have been developed to address the challenge through information technology. Ozbay and Alatas (2020) proposed two-step method to detect fake news on social media through supervised artificial intelligence algorithms. Ayoub, Yang and Zhou (2021) also proposed to combat COVID-19 infodemic by using natural language processing models. Most of these models are focused on information error rather than its influence on risk communication and public response.

In contrast, a few models of infodemic also discussed the bottom-up approaches. Porat et al. (2020) argued the need for sustainable behaviour change to mitigate the varied impacts of COVID-19, including mental health, stress and depression. They applied the concepts of Self-Determination Theory (SDT) from psychology and human-computer interaction to develop the guidelines for public health communication. They noted that there is sufficient evidence to prove that by enhancing the experience of autonomy, competence, and relatedness, people can internalise and sustain behaviours of health and well-being. Besides, as COVID-19 requires long-term behavioural changes, greater engagement and intrinsic motivation sustainable behaviour change through bottom-up communication.

The scope of infodemic occurrence and its impact has gone way beyond the public health domain, especially during and after the COVID-19 pandemic. A few studies have outlined the far-reaching consequences of infodemic on social, economic and political systems. Three critical hazards, as identified by the World Economic Forum (2024), include

1. Possible disruption of electoral processes in economies,

2. Distrust in information and polarised views resulting in civil unrest and confrontations,
3. Risk of repression and erosion of human rights as authorities trace false information and risks of inaction.

The assessment of infodemic and risk communication thus required a broader framework to assess various known and several unknown aspects of the infodemic. For this, the Activity Theory was chosen to guide the enquiry. Activity Theory is a conceptual framework used in social sciences, education and human-machine interaction to describe or study human activity amid socio-cultural and organisational complexity. The theory emerged from the works of the Soviet psychologist Vygotsky in the 20th century (Roth & Lee, 2007). Vygotsky argued that human actions are not simply reactions but actions with meaning conditioned by cultural tools, language or symbols. Leontiev, who built upon Vygotsky's ideas, advanced the framework further by explaining activities, actions and operations as its components. Engestrom (1999) further notes the internationalisation of the activity theory in the late 20th century, attributed to the fact that various social transformations were challenging to explain based on mere division of labour. He distinguished various conceptual dichotomies that govern the outcome of the activity.

Later, the author also elaborated on the evolution of the activity theory across four generations, starting from mediated action (First generation) to a collective activity system (second generation) to interconnected activity systems (third generation) and finally to heterogenous work coalitions for solving wicked issues (Engestrom and Sannino, 2021). These models (Figure 3.5) are highly pertinent to the problems of risk communication and associated infodemic, which have evolved into the most critical issues that the world is facing today.

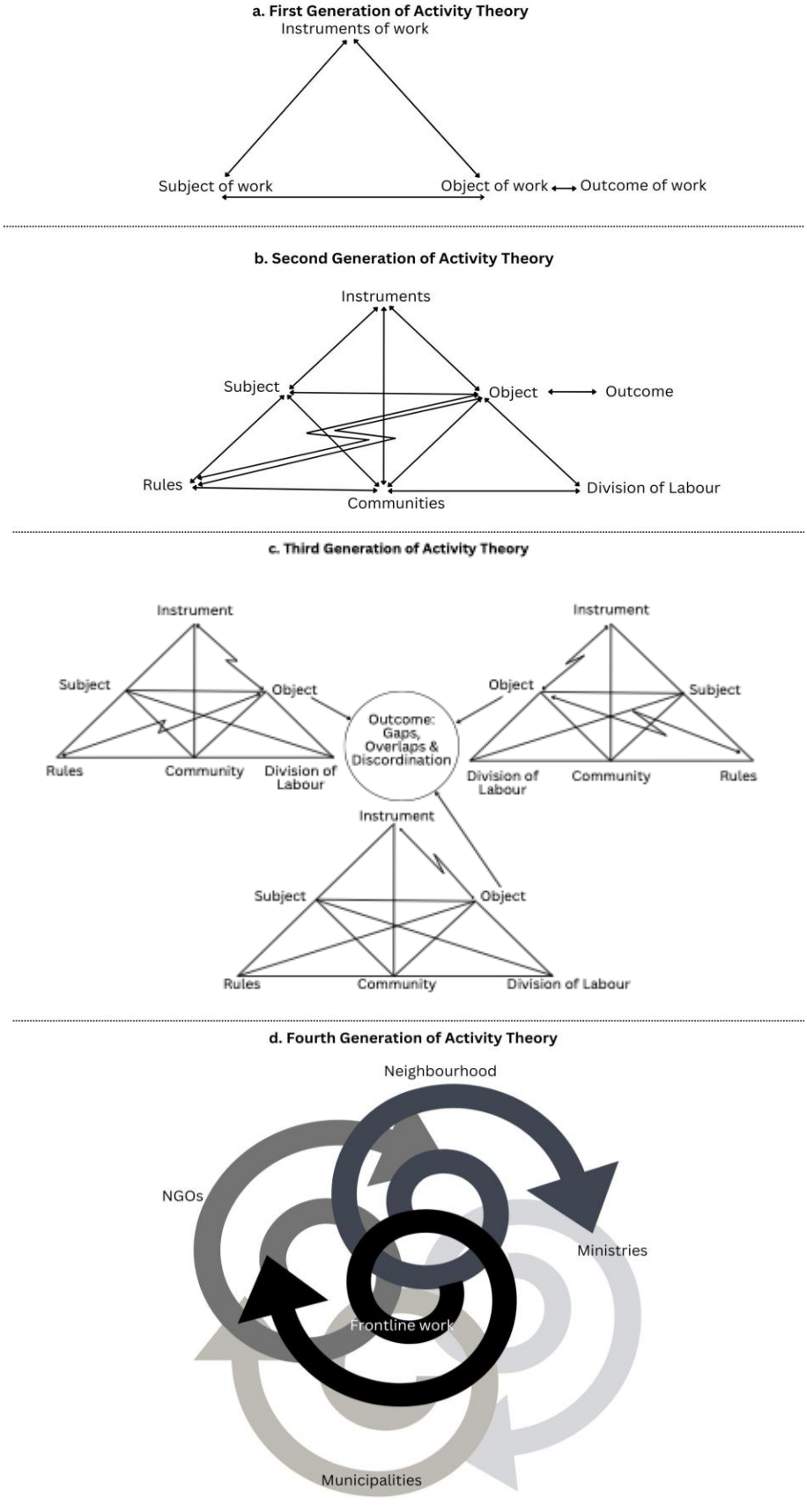
In Activity Theory, the unit of analysis is activity, which is divided into actions and operations. It led to a three-level model, where the first layer is activity driven by an object-related motive. The second layer is an individual or group action driven by a conscious goal. An activity can be composed of one or several actions. The third layer is operations, a routine process driven by conditions. Operations can become an action when there is a change in the condition. Thus, these levels have a bi-directional relationship. Different generations of Activity Theory depict its evolution and expansion, with added elements influencing activity. The first generation revolved around mediating artefacts (tools) affecting subjects and objects, resulting in a particular outcome (Figure 3.5a).

The second generation also discusses the rules, communities, and division of labour that affect roles and relationships (Figure 3.5b). Table 3.2 describes key elements of the Activity theory. Tools within Activity Theory address both physical (such as an IT artefact) and intangible (such as language or meaning inscribed within or ascribed to a tool) aspects of communication.

Table 3.2: Key elements and their meaning in the Activity Theory

Nodes	Description
Subject	The subject here refers to the key stakeholders in consideration for this study.
Object	It refers to risk communication and related issues that come from the communication mechanisms, such as infodemic.
Tools	They refer to the tools used for risk communication such as media or IT
Rules	These include the plans, policies and protocols followed in the communication process.
Community	It refers to the community participating in the communication
Division of Labour	It refers to the roles and task allocated to individuals

Figure 3.5: Four Generations of the Activity Theory



Based on Engestrom and Sannino, 2021.

A fundamental concept in Activity Theory is that of contradictions. Contractions depicting tensions and conflict between components are embedded in the activity system (Engestrom, 1999). They can appear in between any aspect of the system where their dynamics not only influence the elements but also the outcome. Contradictions keep the activity system in constant instability, but they are also the driving force behind innovation (Engeström, 2000, p. 966). They also bring the root cause of the issue. The third-generation activity theory highlights the interaction between various activity systems. In contrast, the fourth-generation activity theory highlights social transformation from coalitions of heterogeneous activities at different levels.

To summarise, even though risk communication and infodemic models acknowledge each other, they do not address the two phenomena together for varied disaster contexts. The different generations of Activity Theory, in contrast, pay attention to various characteristics of social processes that can offer new insights into risk communication that otherwise remain hidden. The activity theory has thus been used as an overarching framework to understand risk communication and associated and emerging issues of infodemic, and is discussed in Chapter 6.

4.

Mapping Infodemic During and Post COVID-19 in Bangladesh, India, and the United Kingdom

The infodemic emerged as a global challenge during the pandemic, with people sharing about risks and related information, including various misinformation, to make sense of the situation, share their concerns, and seek or offer help. Social media became the primary channel for spreading the infodemic, particularly among communities with limited health literacy (Pian et al., 2021). It resulted in excessive fears and deviations in responses to the unknown disease and measures such as nationwide lockdowns, quarantines, and closures of schools, workplaces, and businesses (Khan et al., 2022). The nature and causes of the Infodemic, however, varied within and across countries.

To map these differences, infodemic-related data were extracted and assessed from the three selected national newspapers: Daily Star (Bangladesh), Metro (the United Kingdom), and Times of India (India), from January 1, 2020, to June 30, 2024. For this, 24 keywords were used, which either referred to, depicted, or were found associated with infodemic in the literature. These keywords were used to extract and assess the nature of the infodemic across the three countries. While the standard search allowed for comparability, it is also likely that some context-specific keywords may not have appeared in the search results. Despite these shortcomings, the data provided noteworthy insights into the infodemic. This section provides an overview of the infodemic trends, characteristics, and patterns across the three selected countries, both during and after the COVID-19 pandemic.

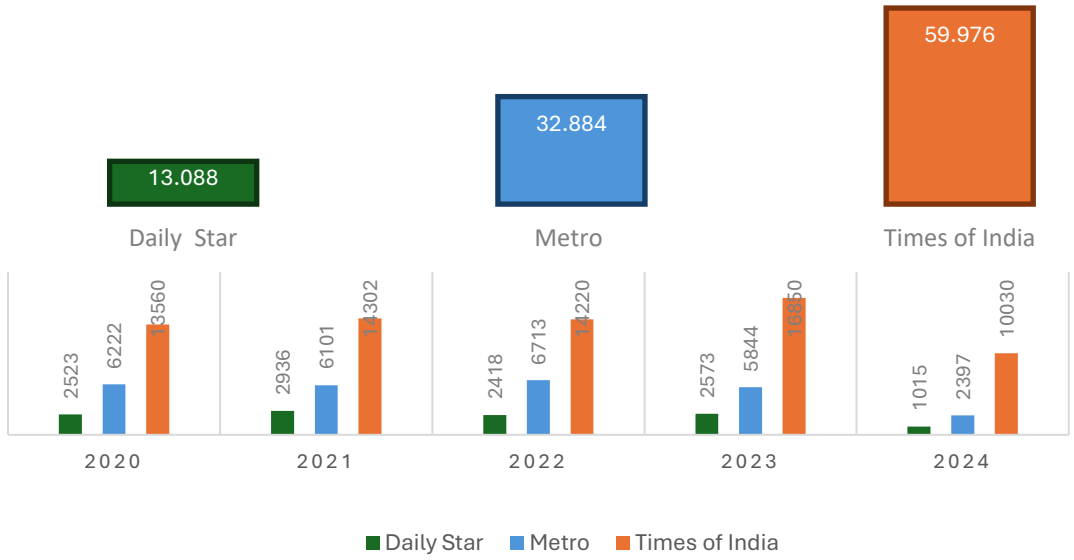
Infodemic Trends in Bangladesh, India, and the United Kingdom

The quantity of news content that embodied infodemic-related content varied significantly across Bangladesh, India, and the United Kingdom. These differences are based on the number of news articles published in the selected newspapers, which is also influenced by the size of the company and the country they cater to. Accordingly, the highest number of infodemic-related news appeared in Times of India, India (59,976), followed by the Metro, United Kingdom (32,884) and Daily Star, Bangladesh (13,088) over three and a half years (Figure 4.1).

The year-wise data of the infodemic news shows a fluctuating trend with limited control over infodemic-related news. While the overall trend for the three countries from 2020-2023 seems closer to the mean, the six-month data for 2024 indicates a rising trend in India and an ongoing trend in Bangladesh and the United Kingdom. The impacts of this were evident in the social unrest caused by misinformation and disinformation across the three countries.

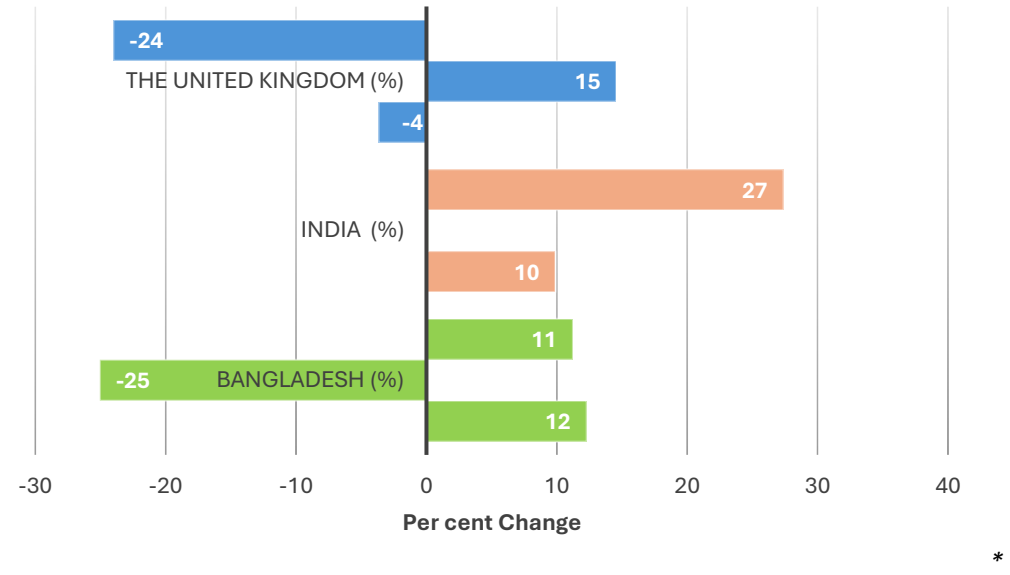
A closer examination of extracted content over the years reveals a play of the rise and control of the infodemic across the three countries (Figure 4.2). Among the three countries, it was controlled more regularly in the United Kingdom, with a four per cent decrease in 2021 and a 24 per cent reduction in 2023.

Figure 4.1: Infodemic News Contents Between 1 January 2020 – 30 June 2024



This is followed by Bangladesh, where media control resulted in a 25 per cent decline in infodemic reporting. In India, the volume of infodemic news content remained either the same or increased during the study period. Infodemic news content in India experienced a 27 per cent growth, the highest among the three countries in 2023.

Figure 4.2. Changes* in Infodemic News Contents (in percentage)

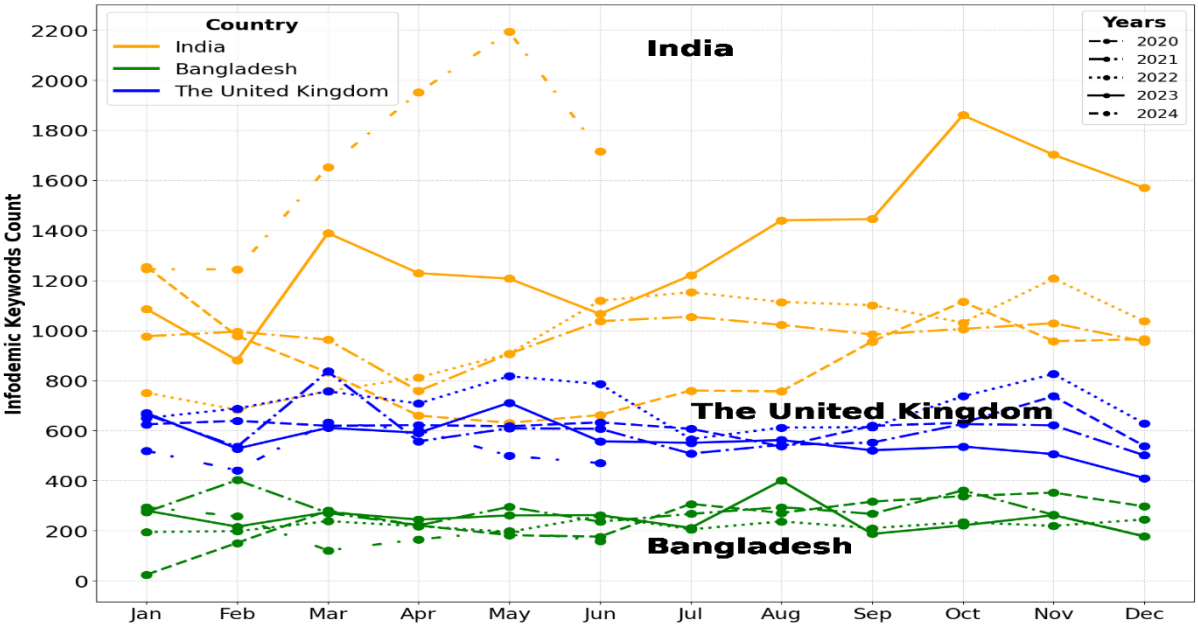


*

**The comparison does not include 2024 data.*

The monthly variations in the infodemic across the three countries from 2020 to 2024 are showcased in Figure 4.3. It gives further insights into the peaks and ebb of the infodemic along with their periods of growth across the three countries.

Figure 4.3: Infodemic News Trend in Bangladesh, India and the United Kingdom (Jan 2020 – Jun 2024).



In Bangladesh, a peak in content with infodemic keywords is observed in 2021, with 2,171 news items, followed by the United Kingdom in 2022, with 5,868 news items, and India in 2023, with 10,641 news items. The data also shows that while Bangladesh and the UK could control the infodemic closer to the average, in India, the number of infodemic news stories almost doubled during the study period.

Figure 4.4: Infodemic Keywords distribution in the Selected Newspapers (Jan 2020 – Jun 2024).

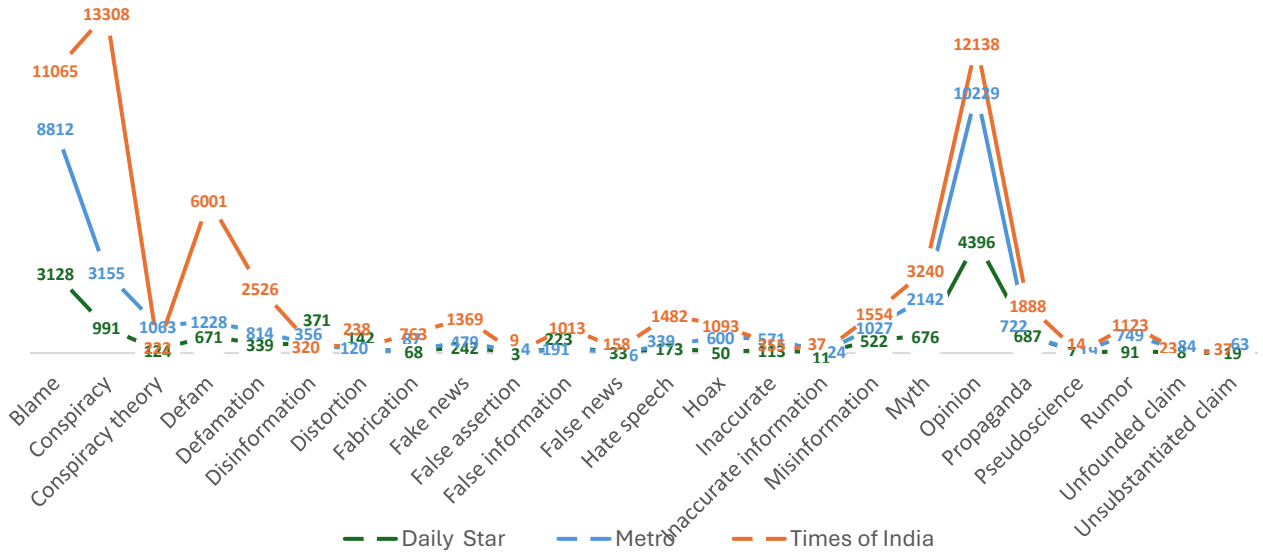
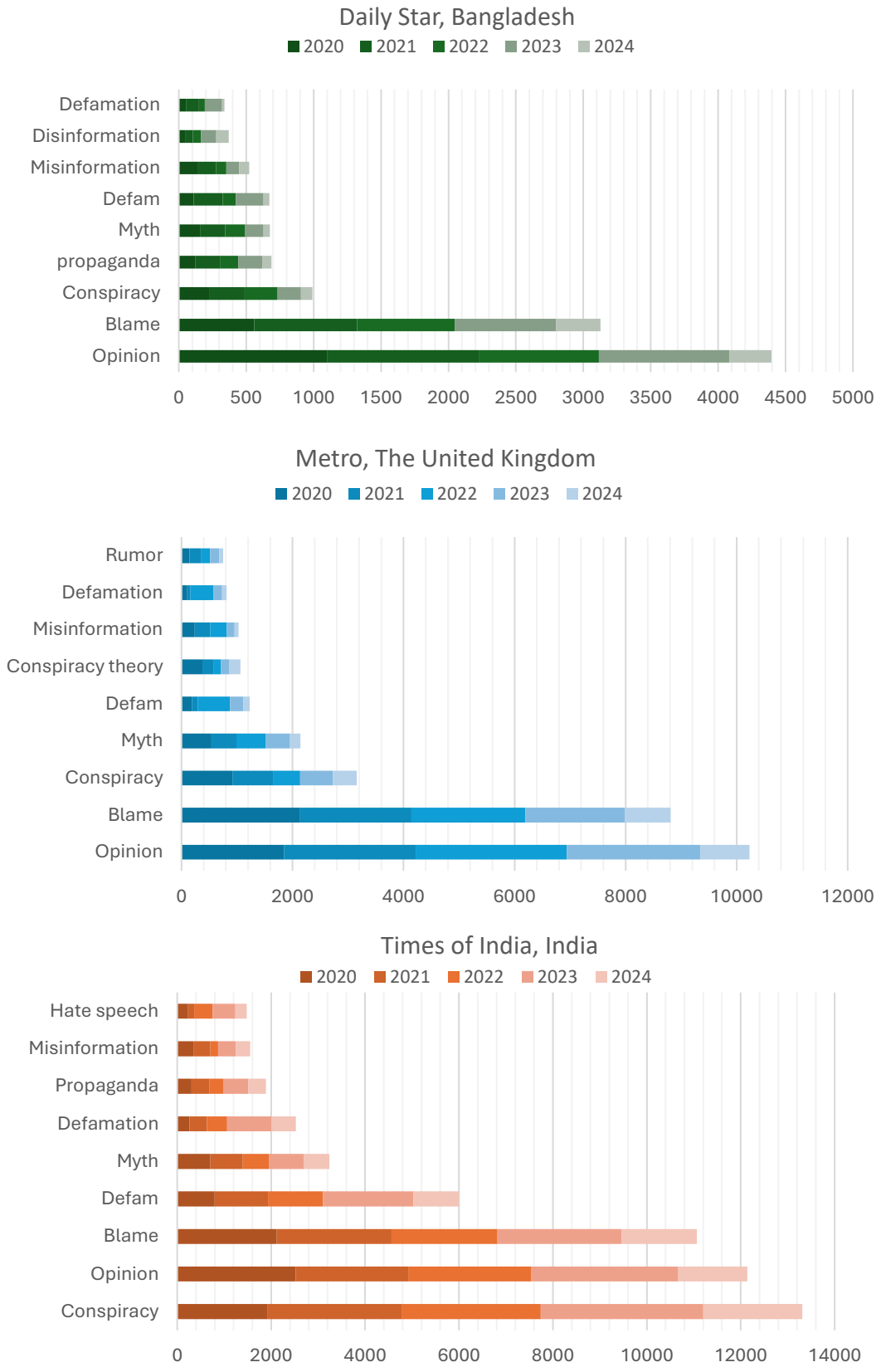


Figure 4.5: Dominant Keywords in Published in the Selected Newspapers in Bangladesh, India and the United Kingdom (Jan 2020 – Jun 2024).



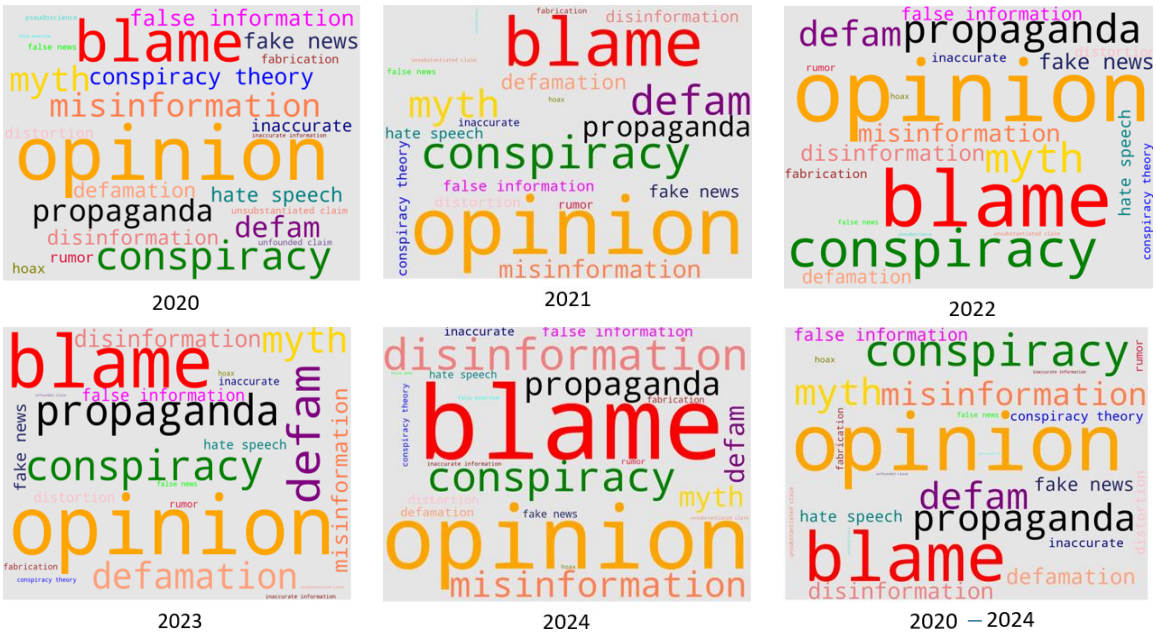
When the data is assessed for the nature of infodemic-related contents, the overall trend is dominated by selective keywords, such as ‘blame’, ‘conspiracy theory’, and opinions, rather than terms that directly represent infodemic, such as ‘misinformation’, ‘disinformation’, ‘myths’, or ‘rumours’ (Figure 4.4). However, when the infodemic-related content of individual countries was evaluated, both similarities and differences emerged.

The common ingredients of infodemic in all three countries were opinion, blame, conspiracy, defamation, myth and propaganda. It was found that while opinion dominated the infodemic-related content of Daily Star (Bangladesh) and Metro (UK), conspiracy appeared in most news extracted from the Times of India (India), followed by opinion (Figure 4.5). The combination of infodemic-related content also varied, with rumours and conspiracy theories being the dominant keywords in the Metro (UK), disinformation in the Daily Star (Bangladesh), and hate speech in the Times of India (India). The patterns diverge further when assessed at the country level.

Infodemic in Bangladesh

The assessment of Bangladesh data provides additional insights into the reasons behind various incidents that took place during 2020-2024. The word clouds from the newspaper data illustrate that opinions and blame were the dominant contents in the Daily Star, followed by conspiracy, propaganda and defame (Figure 4.6). Myth, misinformation, disinformation, fake news, and false information, though, were relatively less common, even though the extracted data represented infodemic-related content. The term “misinformation” was often used to describe potentially incorrect information.

Figure 4.6: Infodemic Word Cloud from 1 January 2020 to 30 June 2024 in Bangladesh

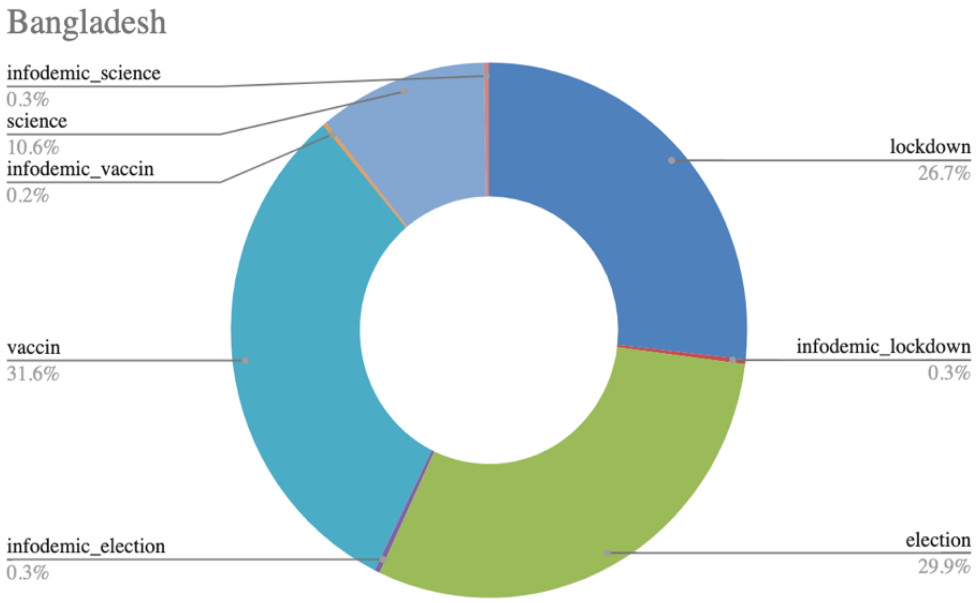


A closer look at the year-wise prevalence of different infodemic word clouds gives similar insights. However, a few anomalies are also observed, which draw attention. Misinformation, although mostly found at low levels across these years, had its lowest point in 2023, during a period of heightened media control in the country. Subsequently, the term disinformation

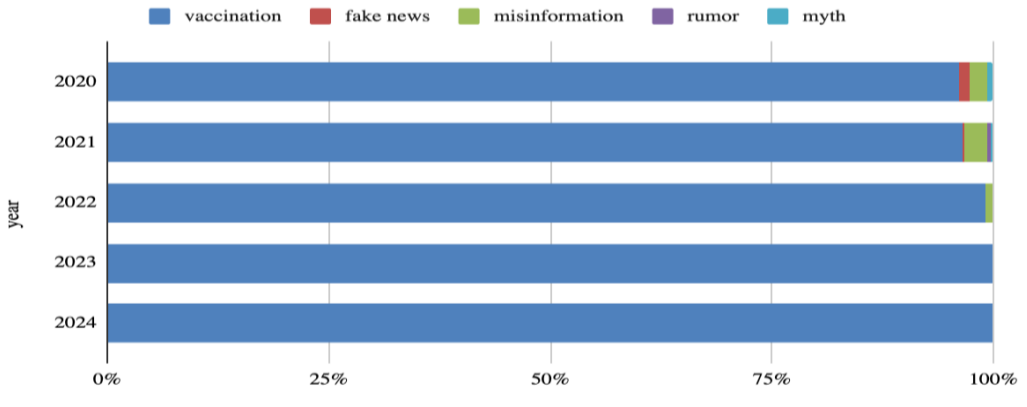
increased significantly in 2024, indicating an intentional perpetuation of erroneous information that occurred during mass movements and protests that shook the nation.

Figure 4.7: Distribution of Selected Keywords in Infodemic-Related Content in Daily Star, Bangladesh (Jan 2020-Jun 2024)

A. Proportion of Infodemic-Related Content Accompanied by the Keywords - Lockdown, Election, Vaccine and Science



B. Year-wise Distribution of Infodemic-Related Content Accompanied by the Keyword Vaccine



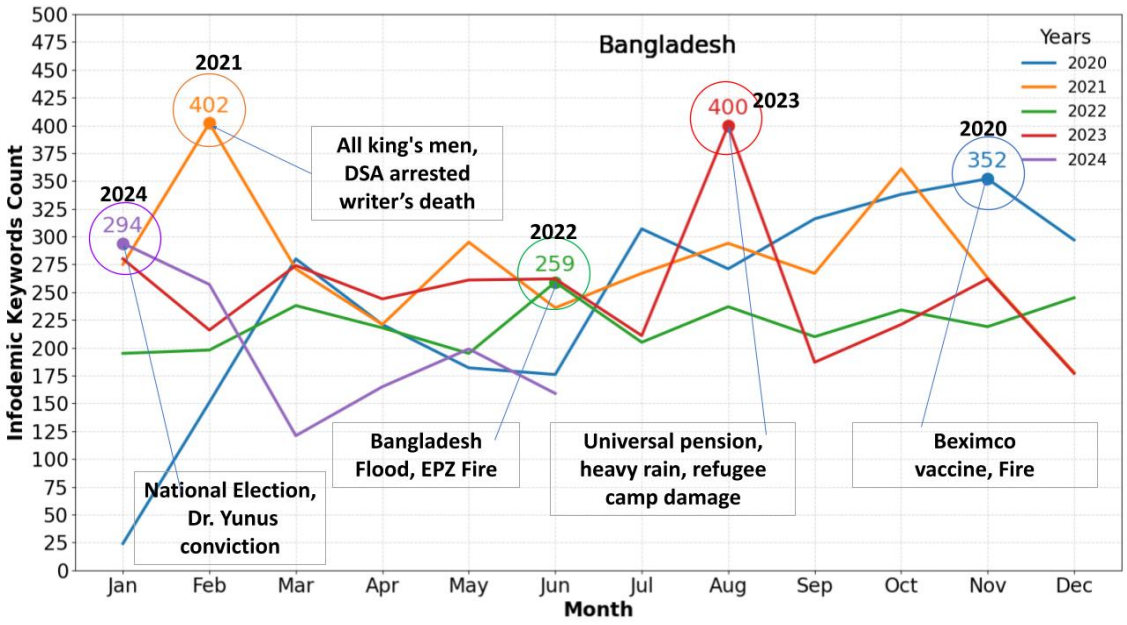
To understand the causes, keywords such as 'Lockdown', 'Election', 'Vaccine' and 'Science' were also assessed to comprehend how these phenomena affected news and narratives of different incidents that affected the infodemic in the country (Figure 4.7A). The data suggests that vaccination-related news (31.6 per cent) was the most common among various contributors to the infodemic, followed by elections (29.9 per cent) and lockdowns (26.7 per cent). It suggests that while attention to the infodemic initially focused on extreme measures,

such as lockdowns, it didn't stop with their removal but instead gained momentum with the introduction of vaccinations and election campaigns. The government enforced lockdowns initially for a week and periodically extended them after the end of the week. Such extension of lockdowns also meant that it was frequently mentioned in the news whether further lockdowns would be imposed or removed. Among these words, a similar repetitive nature of information sharing can also be witnessed in vaccination and elections. Science, the other keyword, also appeared in over 10 per cent of the news. It was likely used for the explanations or in opinions published in newspapers, inviting scientific and non-scientific stakeholders.

Figure 4.7B shows the presence of infodemic keywords that accompanied the term vaccine or vaccination. The data shows that fake news related to vaccination diminished over the years. Misinformation levels were slightly higher in 2021 than in 2020 but decreased significantly in 2022, before further diminishing in 2023. The myth was present to a minimal extent in 2020 and 2021 but vanished afterwards. Rumours involving vaccination, in contrast, were only observed during 2021. These numbers illustrate a low incidence of fake news, rumours, and misinformation at the beginning of the COVID-19 vaccination drive. Fake news and myths decreased, but misinformation increased in 2021. It was the year when vaccination campaigns were conducted nationwide, and most people were eligible for vaccination. The following year, misinformation was reduced as many people had taken the vaccine by 2021, and others were aware of its benefits. By 2022, the term "vaccine" was no longer accompanied by fake news, misinformation, rumours, or myths, as most people had received multiple doses, and the urgency of vaccine shots had also subsided.

Infodemic Peaks: The data is also analysed for peaks in infodemic-related content published annually. A parallel is drawn for the infodemic peak, with dominant events that occurred in the country during the month to understand the possible causes of the infodemic (Figure 4.9). The data shows that peaks were associated with local, national, and global responses to the pandemic and other events.

Figure 4.8: Infodemic Peaks in Daily Star, Bangladesh (Jan 2020-Jun 2024)



In 2020, the infodemic grew with COVID-19 and peaked in November with the confirmation of the first procurement of the COVID-19 vaccine. The online newspapers were flooded with news covering Beximco Pharmaceuticals' initiatives to secure COVID-19 vaccines. A tripartite agreement on November 5, 2020, between the Government of Bangladesh, Beximco Pharmaceuticals, and the Serum Institute of India meant that Bangladesh could procure 30 million doses of the Oxford-AstraZeneca vaccine. The news created some hope of getting people vaccinated, but it was accompanied by several types of misinformation, rumours, and misconceptions regarding whether the vaccines were safe and effective.

The infodemic intensified in the month when a fire broke out in a slum of Dhaka, destroying 300 houses and shops and leaving hundreds of people homeless. The event intensified the growing concern regarding recurring fire hazards in the Dhaka division, as it was only a few days after the investigation report of another fire incident in 2019 was revealed. The day of 24 November was the eighth anniversary of the Tazreen Fashions factory fire, which had claimed 112 lives at that time. The controversial nature of these events fuelled distrust and generated a wealth of content for newspapers, which captured attention and contributed to the infodemic.

The infodemic peak in February 2021 was dominated by news of authoritative discrepancies in governance that created massive debates and discussions throughout the country. Initially, in early February, Al Jazeera's investigative documentary titled "All the Prime Minister's Men" alleged corruption of high-ranking political and military figures. The Ministry of Foreign Affairs and Bangladesh Army Headquarters rejected the allegations, labelling them as baseless and defamatory. Subsequently, a sedition complaint was filed against four individuals associated with the documentary. The High Court of Bangladesh ordered the Bangladesh Telecommunication Regulatory Commission (BTRC) to remove the documentary from the internet. Such a turn of events sparked numerous discussions all over the country, with everyone taking sides and offering their judgements to add to the criticality of the scenario.

The whole situation worsened with the news of a writer's death under custody, who was arrested for breaching the Digital Security Act (DSA). He was held in pretrial detention for nine months and was denied bail six times before he died in custody at Kashimpur High Security Prison on February 25, 2021. His death intensified the ongoing unrest, resulting in protests across the country, with human rights activists demanding a transparent and independent investigation of the death. The government faced significant domestic and international criticism, with calls for the amendment of the DSA to prevent misuse of the law. It also led most governing bodies to address the challenging task of managing information combined with public concerns, misinformation and distrust.

The lowest level of infodemic-related content was observed in 2022, with a relatively lower peak in June when severe flooding occurred in the north-eastern areas of the country, followed by a fire outbreak in Narayanganj, a central district of Bangladesh. The floods were so severe that they affected 7.2 million people and were described as the worst in 122 years. The event triggered discussions about Bangladesh's vulnerability to natural disasters, which will likely worsen in the coming days due to climate change-related adversities. There was significant news regarding record rainfall, infrastructural damage due to mismanagement of rivers and barrages, and other aspects of disaster management. Such discussions also invited a plethora of blame, conspiracy theories, and disinformation to emerge. The crisis soon coupled with the news of another fire outbreak, which again dominated the internet by initiating conversations similar to those in previous years. Media outlets highlighted the gaps in enforcing proper safety

protocols during construction, particularly in industrial zones. A further assessment of newspaper content reveals that the repetition of fire incidents raised concerns among the general public, resulting in diverse opinions from various stakeholders that made their way into the news.

After a controlled phase of media content, another peak emerged in August 2023, attributed to the floods resulting from heavy rainfall in the Chattogram division. The flash floods and landslides caused severe damage in several districts of the southern parts of the country, affecting over 1.5 million people. The government executed relief operations in collaboration with different humanitarian organisations. The flash floods also caused significant and lasting damage in the Rohingya refugee camps in Cox's Bazar due to the fragile infrastructure of the camps. Such destruction of the division, especially the refugee communities, raised concerns among both national and international communities, which subsequently resulted in numerous propaganda and defamation along with ever-present blame and opinions contributing to the spike in infodemic keywords as observed in the data analysis. Amid all the negativities, the inauguration of the Universal Pension Scheme grabbed attention in the latter half of August, which was referred to as a pivotal step in the country's social security framework. The scheme would enable private sector employees, self-employed individuals, low-income individuals and Bangladeshi expatriates to get matching contributions from the government upon their fixed monthly contributions to the scheme. Such initiatives meant that all citizens aged 18 and above in the country were eligible to participate and receive the scheme's benefits. Although the initiative received praise, it also contributed to the spread of disinformation and varying opinions, which intensified the infodemic.

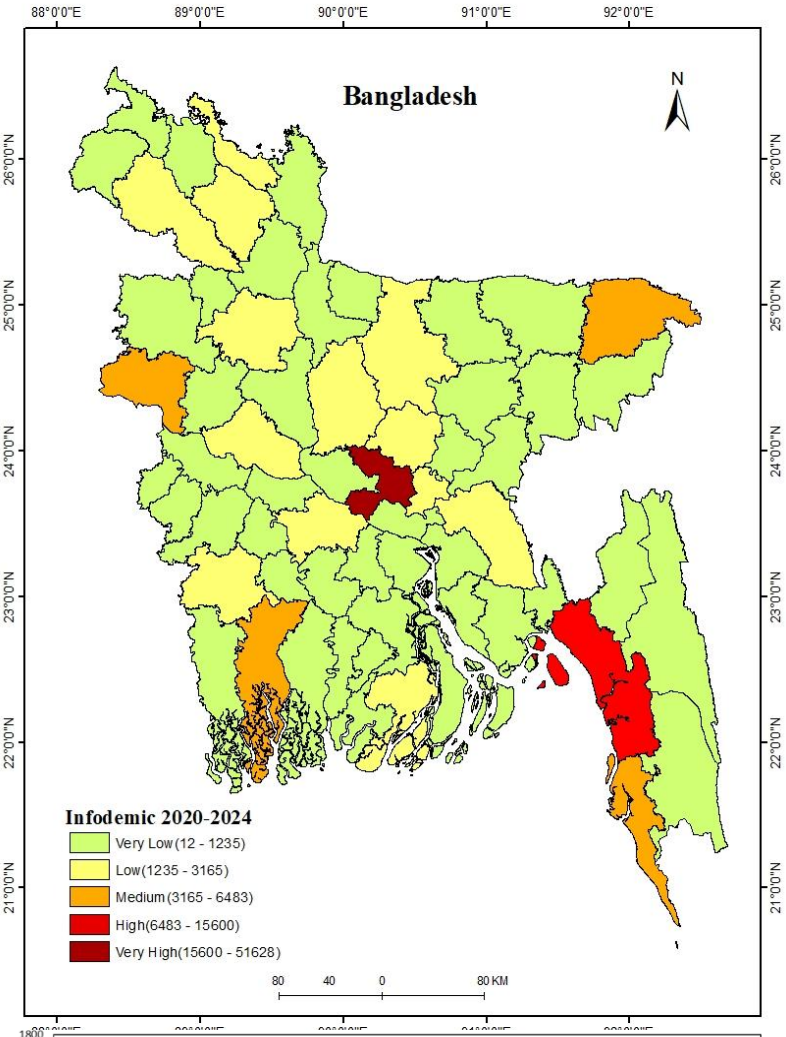
The news in 2024 (till 30 June) exhibited an infodemic peak at the beginning of the year (January), coinciding with the national election in 2024. For obvious reasons, the election was the focal point in the media, with all sorts of opinions, disinformation and misinformation making frequent headlines. The unrest and abundance of wrong information also resulted from the conviction of Nobel laureate Dr. Yunus, founder of Grameen Bank and the pioneer of microfinance. He was sentenced to six months in prison for alleged violations of labour laws. The conviction received significant attention from national and international media outlets, contributing to further blame and different opinions regarding judicial independence and the treatment of prominent figures in the business and social sectors. Thus, the year's infodemic was poised to surpass all previous years' numbers with the abrupt change in government. The country may have experienced more peaks in the year. However, they were not captured due to the closure of data collection on 30th June 2024.

Spatial Distribution: The spatial distribution of the infodemic-related content shows its geographical concentration in large urban areas of the country (Map 4.1). Although most districts were found to be mentioned in the infodemic-related content, Dhaka, as the capital and administrative hub with the highest population in the country, emerged as the centre of the infodemic. Almost half of the news, consisting of infodemic keywords, involved Dhaka.

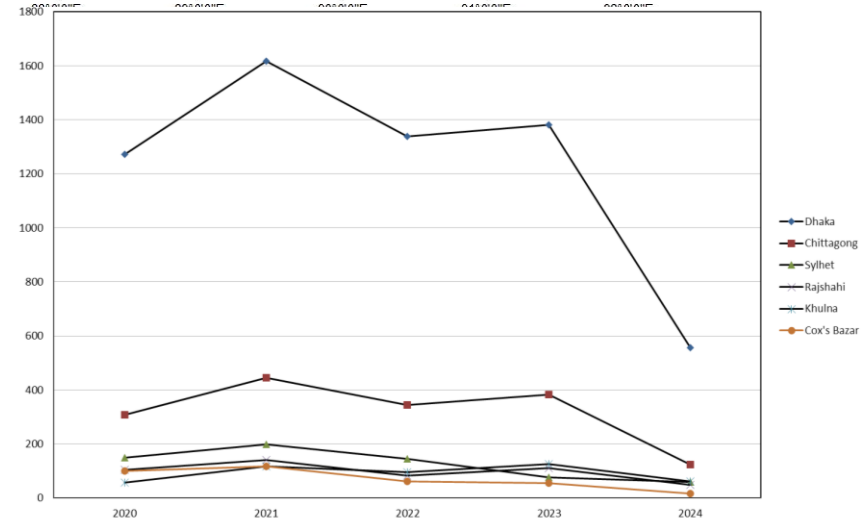
Chattogram, as the business centre, is found to be the second most frequently mentioned place in infodemic-related content. It was mentioned in less than one-fourth of the total news that mentioned Dhaka, yet it had 2.5 times more content than the news that mentioned the third most mentioned place, Sylhet. Chattogram's dominance in numbers after Dhaka can be attributed to its vast area and diversity, which often drew the attention of the newspapers. Over the years, recurring natural disasters, environmental issues, and industrial accidents like fire outbreaks have contributed to the infodemic in Chattogram. Besides, the 2021 city

corporation election and COVID-19-related uncertainties were significant events that fuelled the infodemic.

Figure 4.9. Infodemic and Spatial References in Daily Star (Jan 2020 - Jun 2024)



A. Mapping Spatial References of Infodemic-Related Content in Bangladesh



B. References of Cities in Infodemic-Related Content

When it comes to floods, the flash floods of June 2022 were a major contributor to the representation of Sylhet in infodemic news. The flash floods severely

affected the district on two occasions during this four-and-a-half-year period. These floods were the worst in over 100 years in this district. Sylhet's rich cultural heritage and its popularity among tourists also make it an area of interest for many throughout the year for various reasons, due to various cultural and religious festivals. The city corporation election also impacted the numbers similar to Chattogram.

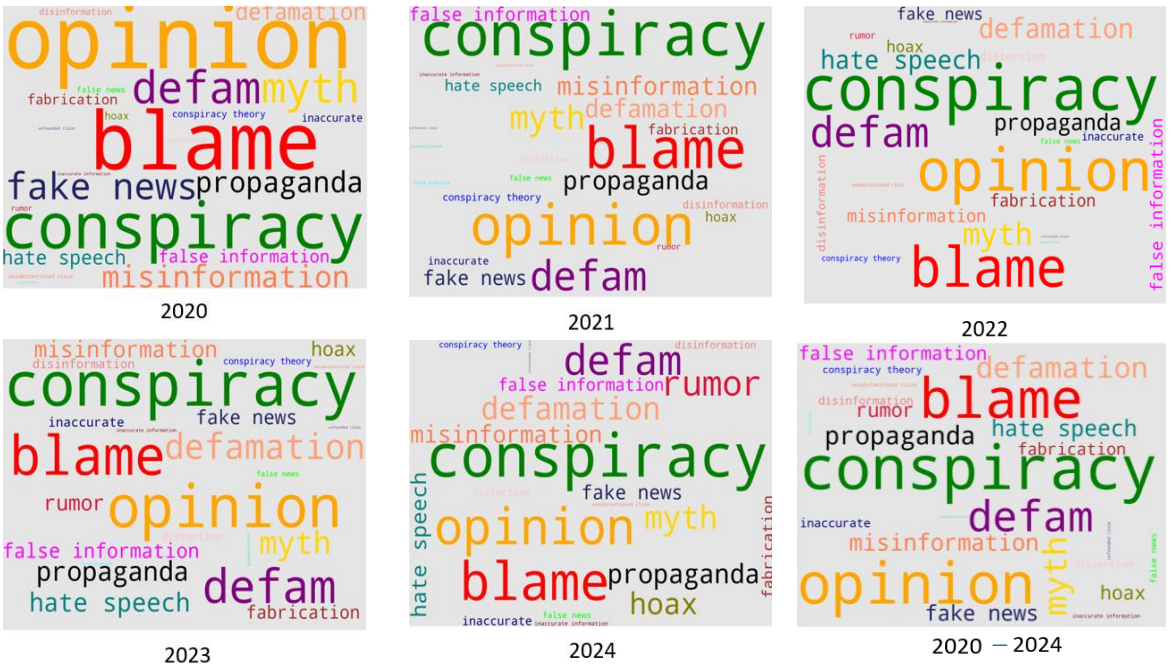
Likewise, the other two bigger divisional cities, Rajshahi and Khulna, stood out in numbers among other places. However, Cox's Bazar was the 6th highest infodemic-affected district in the country. It is the only district that does not have divisional cities, which means that there were no city corporation elections to push the numbers higher, like the other districts mentioned previously. In the case of Cox's Bazar, it was the Rohingya refugee camps that kept the district in the news over the years, and it received significant attention both locally and globally. For example, during the floods in 2023, Cox's Bazar was affected along with other districts of the Chittagong division. Yet, Cox's Bazar received special attention among the international community, organisations and news outlets due to the refugee camps and their infrastructural vulnerability.

Overall, the infodemic in Bangladesh exhibited an increasing trend, with high levels of disinformation attributed to political changes. This was followed by the infodemic related to vaccination and hazards, such as fires and floods, which predominantly affected the densely populated urban areas of the country.

Infodemic in India

Although the infodemic trend in India appears similar from a bird's eye view, it varies in its content and characteristics. The word cloud of infodemic keywords shows the dominance of conspiracy, blame, and opinion, followed by defam/defamation, myth, propaganda and misinformation (Figure 4.11). Besides, while fake news, false information and hate speech have been there in most years, hoaxes gained volume more in the recent years.

Figure 4.10: Infodemic Word Cloud from 1 January 2020 to 30 June 2024 in India

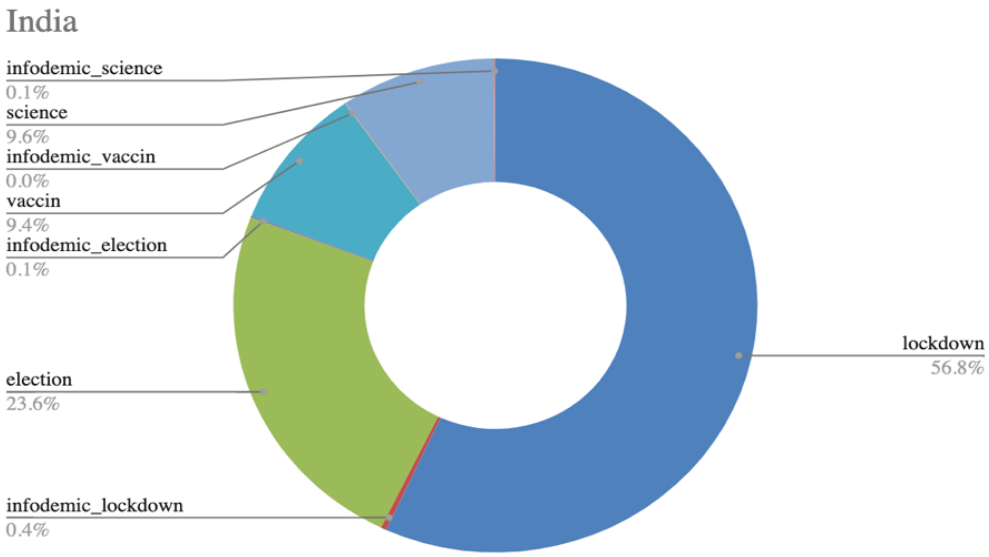


The distribution also indicates the reporting of various conspiracies that garnered public attention and opinions. The fake news and opinions that dominated the infodemic scenario in

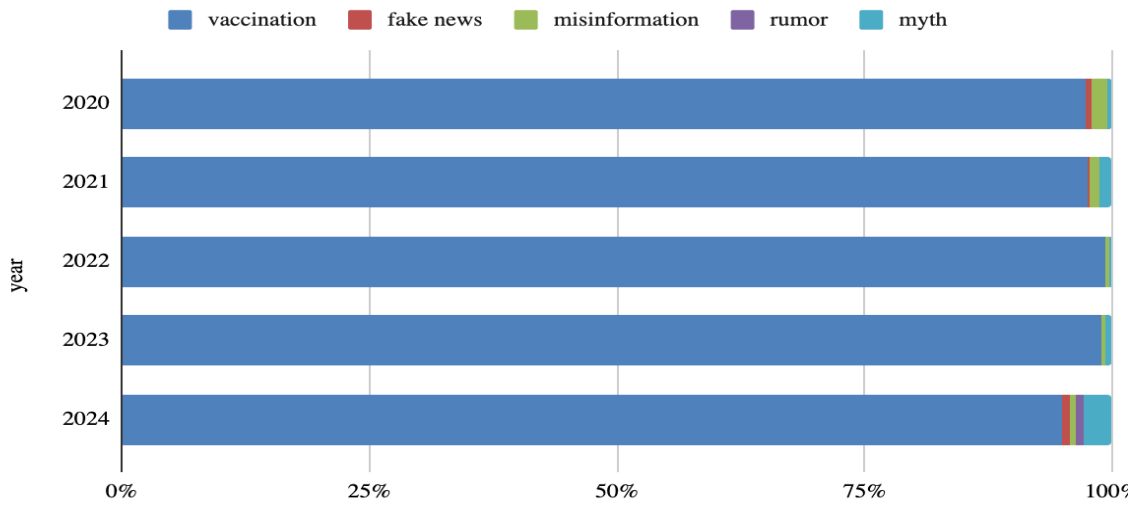
2020 were reduced in the following years, and other forms of erroneous information, such as rumours and hoaxes, gained prominence. The presence of defam/defamation coupled with propaganda and hate speech can be attributed to frequent elections and the political orientation of the news in the country.

Figure 4.11: Distribution of Selected Keywords in Infodemic-Related Content in Times of India (Jan 2020-Jun 2024)

A. Proportion of Infodemic-Related Content Accompanied by the Keywords - Lockdown, Election, Vaccine and Science



B. Year-wise Distribution of Infodemic-Related Content Accompanied by the Keyword Vaccine



When these keywords were assessed for their relevance to significant events like lockdown, vaccination, election and science, a very different picture emerged from that of Bangladesh (Figure 4.11A). The data show that the maximum infodemic-related contents were related to lockdown (56.8 per cent), followed by election (23.6 per cent), science (9.6 per cent), and vaccine (9.4 per cent). In India, a nationwide lockdown was imposed from March 23rd to April

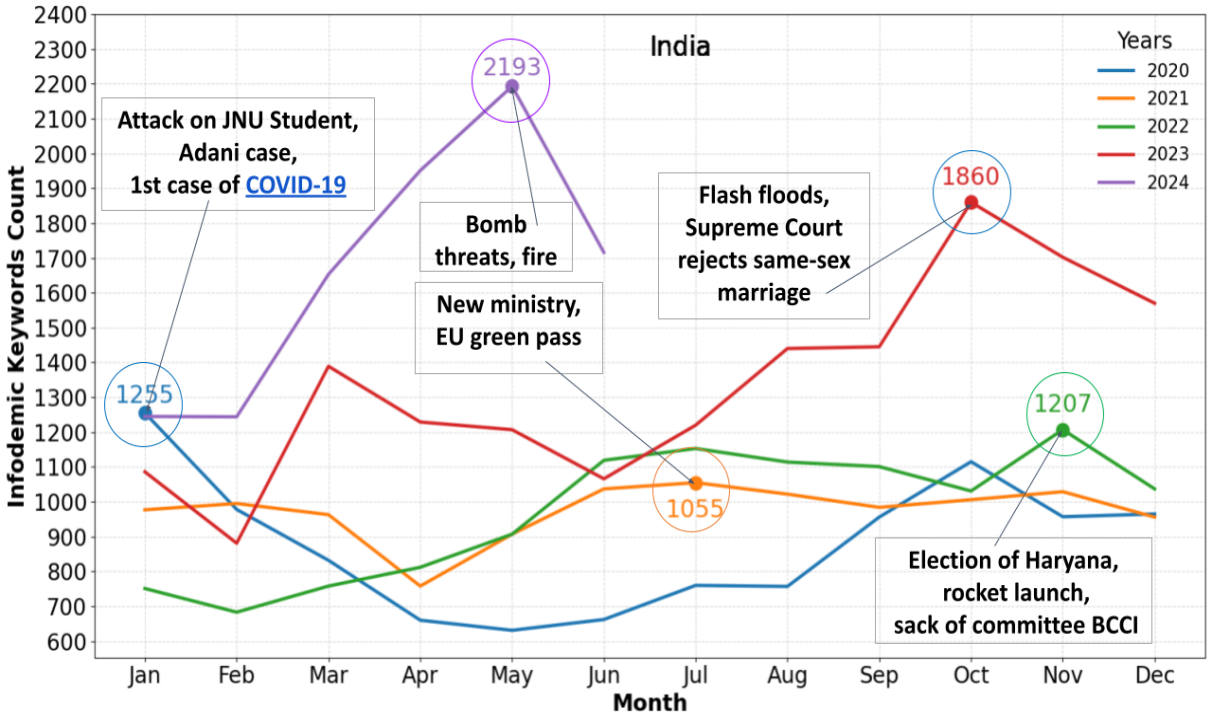
14th, 2020. It was extended four times and regarded as one of the strictest lockdowns in the world.

It created multiple concerns, uncertainties, and questions among people, which were widely shared on social media and attracted global attention. Such a confusing scenario led to several news articles with infodemic keywords. India's constitutional structure of state elections, followed by months-long national polls, also resulted in more infodemic-related content related to elections. Due to the dominance of lockdown and election-related news, the vaccine and science-related infodemic had a subdued presence in the Indian infodemic data compared to the other two countries.

Further evaluation of vaccine-related content reveals that, although vaccination frequently appeared as a focus of news, it was also associated with fake news, misinformation, and myths in 2020 and 2021 due to concerns related to its recent development and widespread application (Figure 4.11B). The data also show a significant decline in fake news and rumours in 2022 and 2023, with minimal misinformation and myths during the nationwide vaccination drive. However, a sudden rise in fake news, myths, rumours and misinformation was observed during 2024, attributed to its perceived side-effects.

Infodemic Peaks: Peaks in infodemic-related content published from January 2020 to June 2024 show various causes other than COVID-19 that fuelled misinformation and disinformation in India. In contrast to Bangladesh, the first infodemic peak in India happened at the beginning of the year 2020 rather than at the end (Figure 4.12). Preceding political protests for CAA got a boost in the sharing of concerns and emotions with an attack on a student at Jawaharlal Nehru University, based in the capital of the country. The initial speculations of COVID-19 were supported by the first confirmed patient at Thrissur, Kerala, who had returned from Wuhan in January.

Figure 4.12: Infodemic Peaks in Times of India, India (2020-2024)



The rising number of cases and extreme protocols in China garnered public attention, but they did not substantially contribute to the infodemic content at this stage. Therefore, the infodemic-related content in India peaked before the declaration of COVID-19 as a global pandemic. The nationwide lockdown came as an extreme shock to people. The rising concern for survival in the environment of heightened uncertainty shifted their attention from political tensions to personal livelihood, resulting in a decline in the infodemic that again started to rise after the end of the lockdown, with an uncertain future and untested vaccinations. Conspiracy theories also garnered significant attention during this phase.

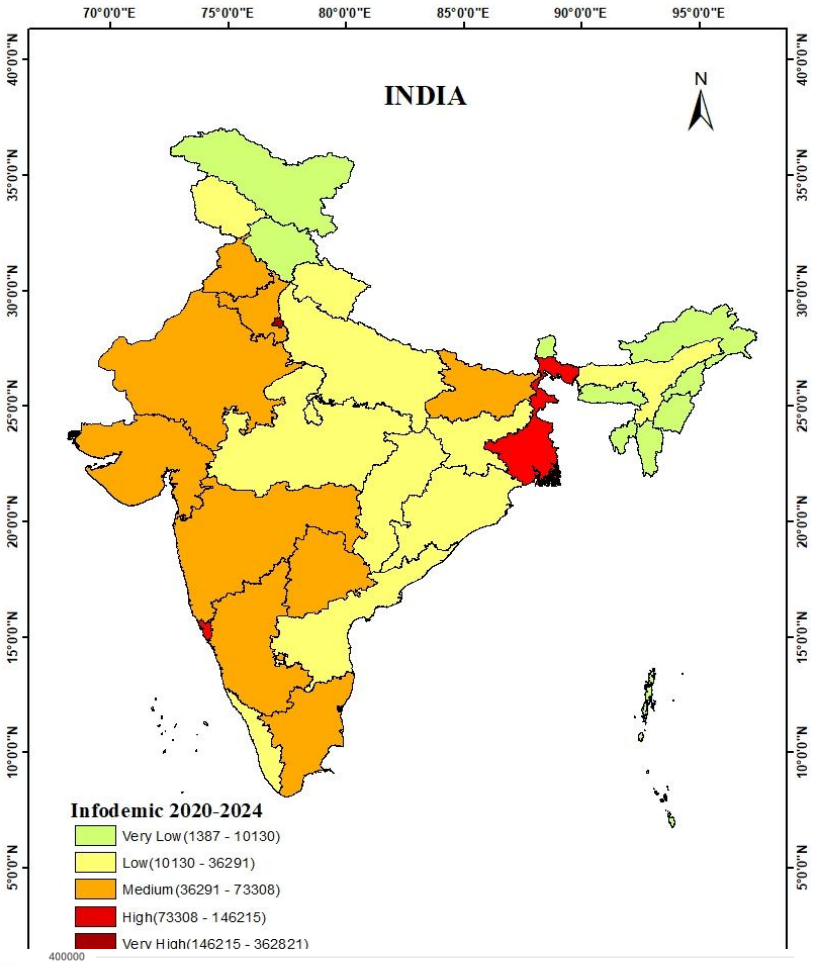
The infodemic remained controlled in 2021 and experienced a dip in March and April, during the peak of the second wave of COVID-19 in India. This year's highest point in the infodemic also coincided with political changes rather than the pandemic. The infodemic gained momentum towards the end of 2022, coinciding with the Haryana election and the sacking of the BCCI committee. The election and its results are essential features of the country's local and national political dynamics. The sacking of the Board of Control for Cricket in India's (BCCI) committee also attracted public attention. The peak was also influenced by the farmers' protests against the three farm laws by the central government, which were later repealed.

Fluctuations in the infodemic were more evident in 2023 than in previous years. This year's peak coincided with the Supreme Court order that gave the verdict on same-sex marriage on 17 October. The court declined to grant recognition for the same-sex marriage, stating that the authority to amend the law rests with the Parliament. The verdict received mixed reactions, leading to acute polarisation of views among different groups of people. LGBTQIA+ rights advocates expressed their disappointment, while many people from another school of thought regarded this decision as very favourable to stabilising the traditions and culture of the country. Besides, sudden flash floods in Sikkim claimed the lives of 14 people and rendered more than a hundred people missing, also resulting in the sharing of opinions and concerns.

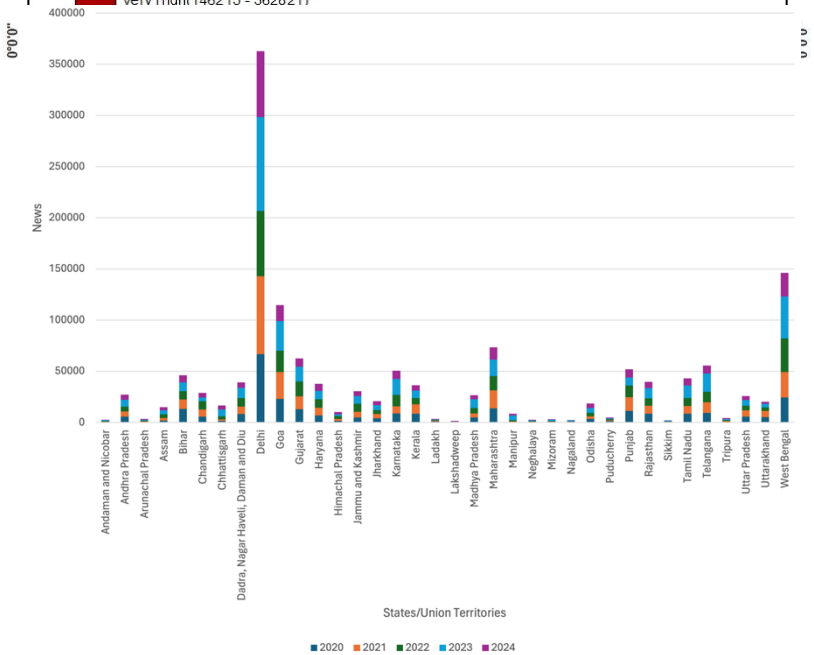
The 2024 data exhibited a turbulent first half, which not only began with relatively high infodemic-related content from the previous year but also reached its highest peak in May, with over 2,193 infodemic-related news items. The peak during 2024 coincided with the national election in the country and extensive reports of a series of bomb threats and fire incidents across India, raising concern, fear, and panic among the masses. On the first of May, over 60 schools in the Delhi-NCR received bomb threats via email that required mass evacuations to ensure students' safety, but created havoc on the roads with traffic jams. The incident was followed by bomb threats reported at eight hospitals in Delhi, Indira Gandhi International Airport and Ahmedabad Airport on May 12. Security measures were heightened, and thorough search operations were conducted, which ended without much success. Additionally, two separate fire incidents on May 13 led to further scrutiny. The data shows that news containing conspiracy theories, blame, false, and fake information creates an acute infodemic scenario.

Spatial Distribution: A different picture emerged when the infodemic-related content was assessed from the spatial lens. Figure 4.13A shows that a more significant proportion of the country was affected by medium to high levels of infodemic during the study period, in contrast to Bangladesh and the United Kingdom, where heavy infodemic was primarily limited to major cities. The data also included the names of cities and states that appeared in infodemic-related content, with an evaluation that puts Delhi, the national capital, and information at the top of the infodemic chart, followed by West Bengal, Goa, Maharashtra, Gujarat, and Telangana (Figure 4.13B).

Figure 4.13. Infodemic and Spatial References in Times of India (Jan 2020 - Jun 2024)



A. Mapping Spatial References of Infodemic-Related Content in India



B. References of States and Union Territories in Infodemic-Related Content

While in Delhi, infodemic-related content primarily focused on political protests, policies, and hoaxes, the higher infodemic-related content in West Bengal was attributed to politics, migrants and natural calamities, mainly cyclone Amphan, which affected the state during this time. In Goa, the Oxygen supply crisis, Cyclone Tauktae, and flooding also appeared in the infodemic-related content. Maharashtra, on the other hand, received a lot of media attention

due to the severe impact of COVID-19 on the residents and immigrants. It also impacted its role as a financial hub, with the presence of the Sensex and Bollywood, which drew public attention and news. Gujarat also gained attention for its COVID-19 management and industrial accidents in chemical plants, while the flooding in Hyderabad caused heightened concerns in Telangana. The data also shows that small states, including Sikkim, Arunachal Pradesh, Tripura, Mizoram, Meghalaya, and the Andaman and Nicobar Islands, appeared less frequently in infodemic-related content than the larger states.

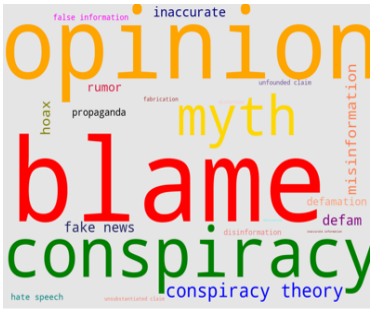
Overall, the infodemic in India showed deeper roots than in the other two countries. It was observed not only in both rural and urban areas, but the nature of the infodemic-related content also varied within the country. Apart from the standard infodemic-related contents of conspiracy, blame and opinions, the presence of hoaxes, rumours, and hate speech in recent years reflects recurrent elections and associated uncertainty.

Infodemic in the United Kingdom

The word clouds of infodemic-related keywords in the United Kingdom indicate that opinion, blame, conspiracy theories, and myths dominated the trend from 2020 to 2024 (Figure 4.16). Interestingly, although blame was predominant in 2020, it reduced over time, giving way to conspiracy theories and defaming, while opinion had a significant share throughout this period. The nature of the content in 2020 differs significantly from that of 2023 and 2024. The complexity of the infodemic-related content in the recent past could also be seen as the building up of energy behind recent riots in the United Kingdom due to misinformation in the second half of 2024.

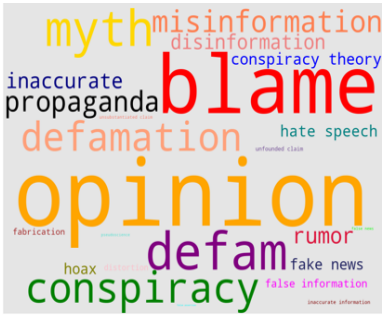
Figure 4.14: Infodemic Word Cloud from 1 January 2020 to 30 June 2024 in the United Kingdom

Figure 4.15A assesses the presence of keywords such as "lockdown," "vaccination," "election," and "science" in infodemic-related content. It shows that a significant proportion of infodemic-related content revolved around lockdown (68.4 per cent). In contrast, vaccination appeared in only 16.8 per cent of the content.

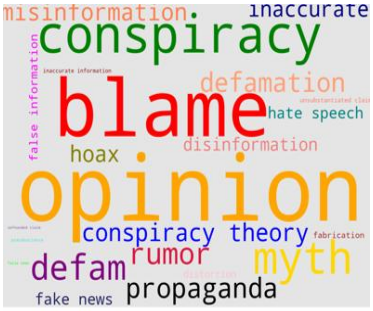


2020

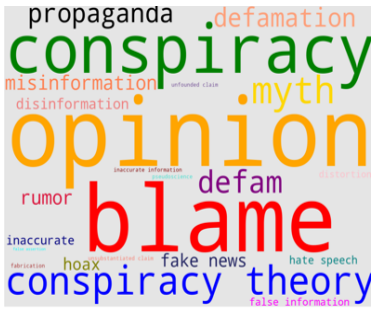
2021



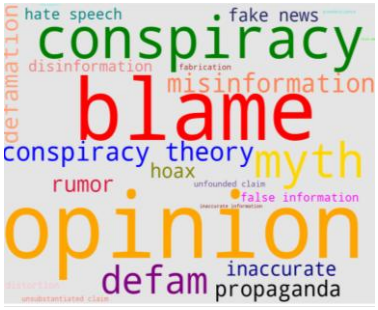
2022



2023



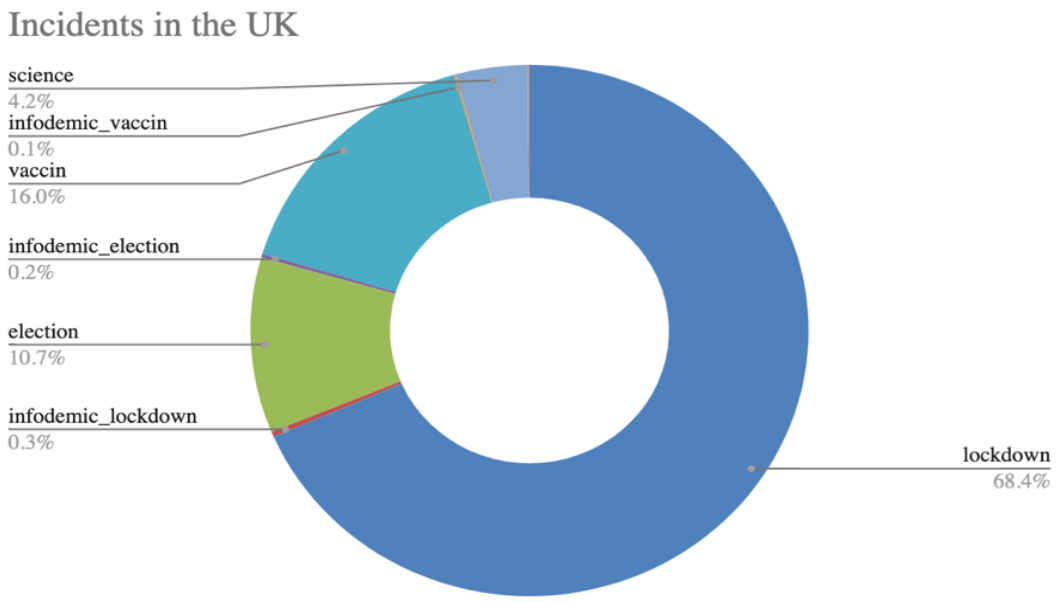
2024



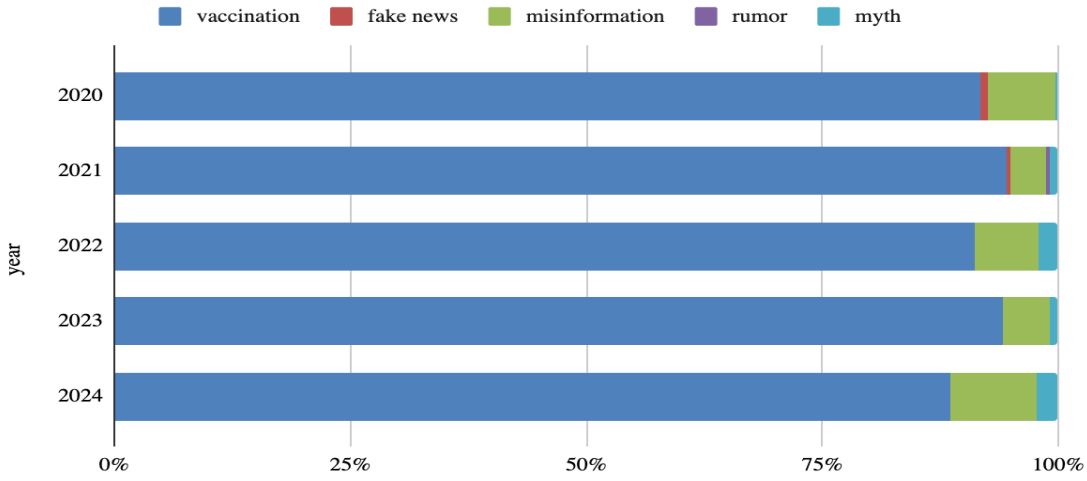
2020 – 2024

Figure 4.15: Distribution of Selected Keywords in Infodemic-Related Content in Metro (Jan 2020 - Jun 2024)

A. Proportion of Infodemic-Related Content Accompanied by the Keywords - Lockdown, Election, Vaccine and Science



B. Year-wise Distribution of Infodemic-Related Content Accompanied by the Keyword Vaccine

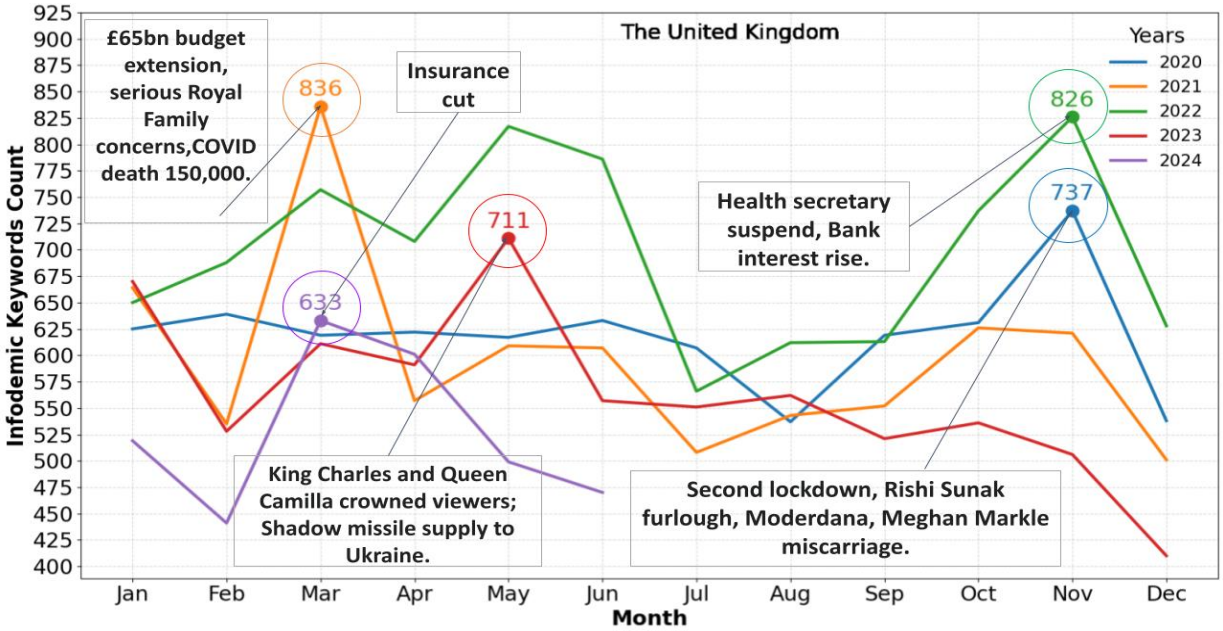


Ten per cent of the content also mentioned election (10.7 per cent), while science was mentioned in less than five per cent of the infodemic-related content. It indicates that the lockdown disproportionately influenced public emotions and thus contributed to a variety of news with infodemic-related content. Several anti-vaccination perceptions and opinions emerged in the country during the vaccine rollout, as evident in Figure 14.15A, where the keyword 'vaccine' appeared as the second most frequently mentioned term. The lower representation of science indicates fewer efforts to justify infodemic-related content through scientific narratives, which was much more prevalent in Bangladesh and India. Interestingly,

the data also showed that misinformation in the United Kingdom had a greater impact on vaccination rates than in Bangladesh and India (Figure 4.15B). Despite a reduced number of infodemic-related news in comparison to Bangladesh and India, misinformation and myths continued to be associated with vaccination in the UK. It also indicates one of the possible reasons behind vaccine hesitancy in the country.

Infodemic Peaks: In 2020, the year of the COVID-19 pandemic, infodemic-related contents were found to be high throughout the year in the UK (Figure 4.16). It peaked in November, the month that started with the second national lockdown, which lasted almost a month to prevent the spread of COVID-19. It closed non-essential businesses and restricted social gatherings, resulting in confusion and social anxiety attributed to recurrent lockdowns. Fear and panic were, however, later eased with the rising hope with the development of the Moderna vaccine, which showed approximately 95 per cent efficacy in preliminary trials. It also brought significant attention and varied opinions. The month ended with the saddened revelation of the miscarriage suffered by the Duchess of Sussex. She revealed the incident in a personal essay published in The New York Times, which drew a lot of media and public attention.

Figure 4.16: Infodemic Peaks in Metro, the United Kingdom (2020-2024)



After a temporary decline, infodemic-related content reached a new high in March 2021, with the increasing COVID-19 death toll reaching up to 150,000. To address the country's economic scenario, a budget extension of £65 billion was also presented, including the extension of the furlough scheme to provide grants for self-employed individuals and the implementation of business support loans. Much like the infodemic peak of 2020, the scenario of March 2021 was also intensified by the concerns over the Royal Family when Prince Harry and Meghan Markle's interview revealed allegations of racism and lack of support within the family. Subsequently, the interview sparked widespread discussions within and outside the Royal family.

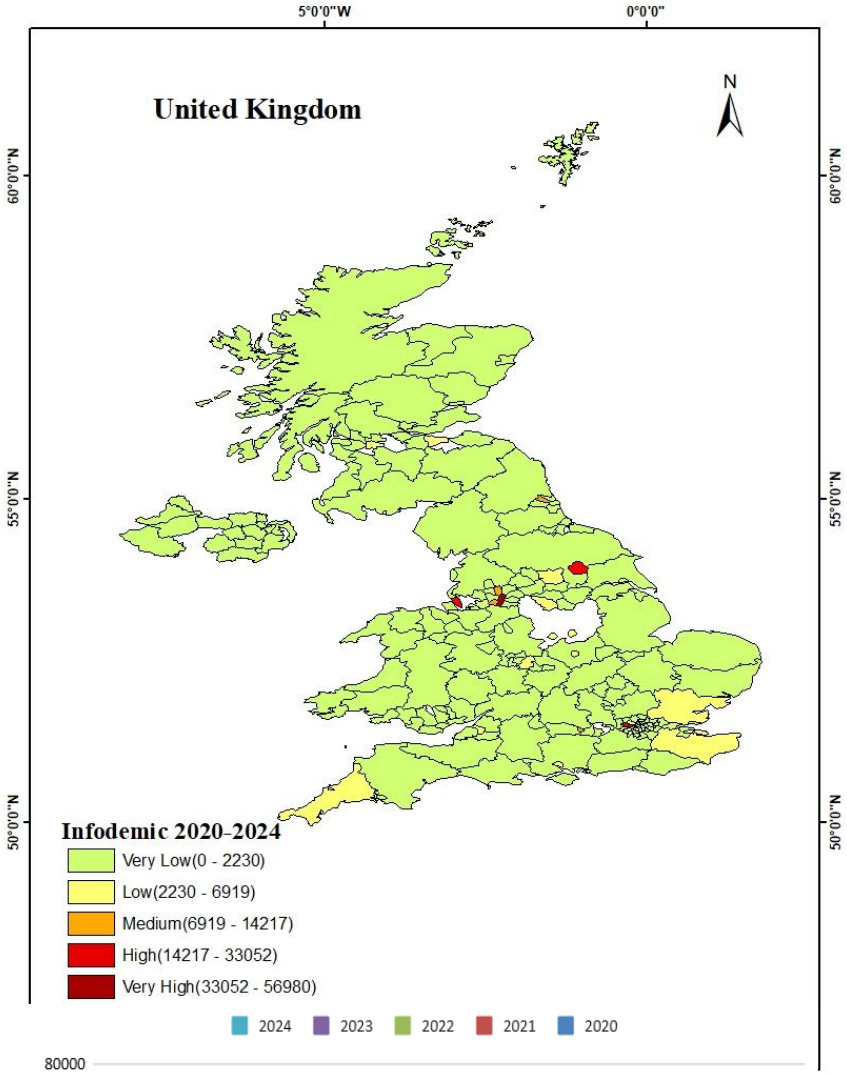
The infodemic-related content, although it fluctuated significantly during this year, achieved its highest peak from 2020 to 2024 in November. A few key incidents of the month included the suspension of the country's health secretary from the Conservative Party after he joined a reality TV show during a parliamentary session. The news was extensively covered throughout the British media, leading to a spike in keywords such as defamation, which is also evident in the 2022 infodemic word clouds. The event was accompanied by the news of a rise in interest rates by the Bank of England, the most significant single increase in the last four decades. The decision directly affected mortgages, loans, and savings of households and businesses across the UK.

The infodemic-related content, however, was reduced in the following years. The peak in 2023 occurred in May, coinciding with the historic crowning ceremony of King Charles III and Queen Camilla, which garnered the highest viewership in the UK's online broadcast history for any event. The country’s declaration of supplying missiles to Ukraine in early May also attracted a lot of media attention and elicited diverse opinions. The data collected for the first six months of 2024 shows a peak in March 2024, which coincided with the announcement of significant reductions in National Insurance contributions aimed at alleviating the financial burden on workers. The announcement received mixed reactions, with many appreciating the facilitation for the workers, whereas some experts raised concerns regarding its long-term economic impact. Overall, the fluctuation in infodemic-related content in the Metro News was significantly greater than that of The Daily Star and The Times of India.

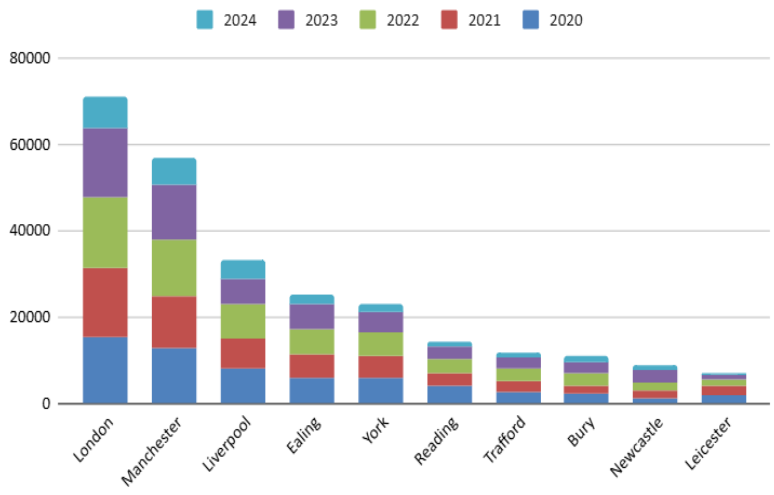
Spatial Distribution: When the data were assessed for their spatial attributes, nearly 203 locations were identified with varied infodemic-related content. However, when mapped, a skewed distribution of the infodemic related content is witnessed that was prominent in the major urban areas (Figure 4. 17A). A further evaluation of the data (Figure 4.17B) shows that the highest infodemic related content appeared in London followed by Manchester, Liverpool, Ealing, and York. Patterns remained similar over the years, with the number of mentions for each city being proportional to the total infodemic news in the year, without much distinction over the years. London, being the country's capital, comfortably outnumbered all other regions. It was also among the hotspots during the COVID-19 pandemic and was the subject of more discussions regarding lockdowns and other pandemic scenarios. The exposure of different cities to multicultural environments, education, tourism, and business sectors contributed to their prominence in the news.

Manchester also drew significant media attention with its industrial and political history and involvement. It is also a hub for the county’s broadcasting and media industry. These factors propelled its numbers very close to those of London. Liverpool’s association with infodemic news can be attributed to its economic issues, including efforts to reduce poverty, unemployment, and promote regeneration projects. As part of Greater London, Ealing often drew media focus for the local governance and transport infrastructure issues.

Figure 4.17. Infodemic and Spatial References in Metro (Jan 2020 - Jun 2024)



A. Mapping Spatial References of Infodemic-Related Content in the UK



B. References of UK Cities in Infodemic-Related Content

The attention to York can be explained by the recurring flood issues that the area experienced during the timeframe. The amount of infodemic-related content regarding these areas accumulates to more than half of the total infodemic in the country, suggesting the dominance of these areas in the media.

Overall, the infodemic trend in the United Kingdom showed controlled content in numbers and was confined to urban areas. Characterised by conspiracy/conspiracy theories, blame, opinions, myths and defamation, the country witnessed a variety of infodemic-related content. The country's diverse population also contributed to fear and faster news propagation on social issues in those areas, resulting in more activism and initiatives.

To conclude, a comparative analysis of the infodemic-related content published in the three leading newspapers of Bangladesh, India, and the United Kingdom shows that despite varying degrees of control applied across the three countries, the overall infodemic-related content and impacts are increasing. The differences in the nature of infodemic-related content and its consequences were aligned with the country's local socio-economic and political characteristics. Although the peaks of infodemic for different years occurred for various reasons, they can be broadly classified into the response measures applied for the pandemic, hazard occurrence and political events and interventions. Besides, the data also shows that densely populated urban areas of high political significance were more affected than rural areas with lesser political interest and importance.

5.

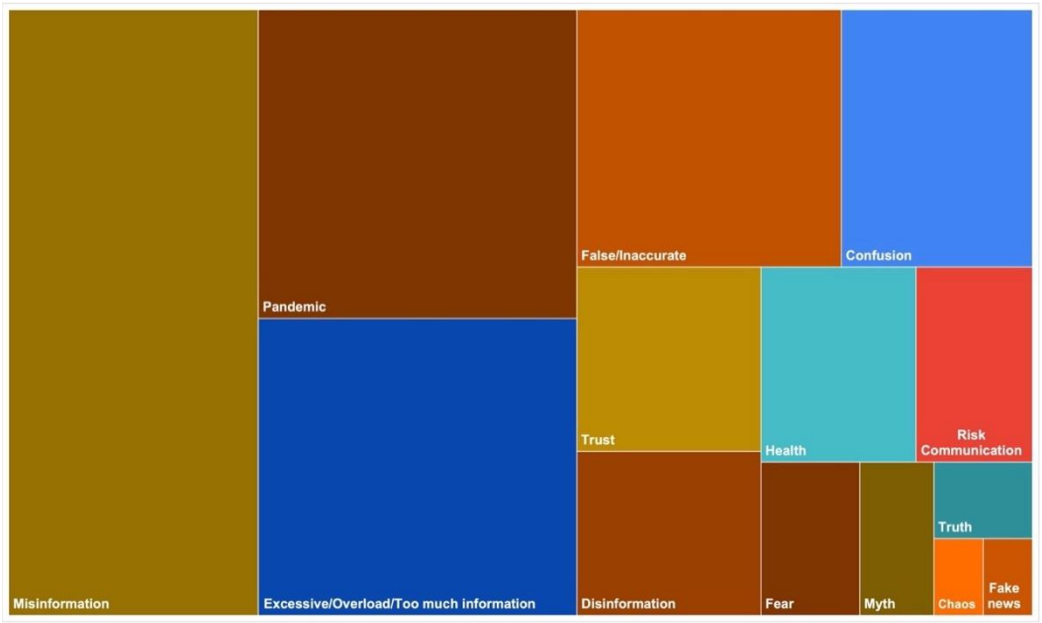
Infodemic and Risk Communication Governance in Bangladesh, India, and the United Kingdom

As the nature and impacts of the infodemic and risk communication varied across the three countries due to their diverse socio-economic and political contexts, key stakeholders were interviewed to understand their perspectives and responses. Thirty key stakeholders from the government, INGOs, NGOs, media, education, and private sectors were interviewed from Bangladesh, India and the United Kingdom, along with fifteen international experts. Secondary data and literature reviews were also used to triangulate the findings and to bridge the gaps. This section elaborates on the perceptions and experiences of key stakeholders and evaluates the infodemic and risk communication governance to understand key challenges, best practices, and policy gaps.

Perception of Infodemic and Risk Communication

The perception of infodemic varied among the key stakeholders. While ninety per cent of the stakeholders interviewed were well aware of the infodemic, nearly six per cent mentioned hearing the term infodemic for the first time, and four per cent had not personally experienced any infodemic incident. For most stakeholders (38 per cent), the infodemic meant "misinformation", and a quarter of them (25 per cent) saw it as a "peculiar feature of the pandemic" (Figure 5.1). A lesser proportion of stakeholders (24 per cent) saw it as "excessive", "too much" or "an overload of information", while 17 per cent mentioned it as "false" or "inaccurate information". Several other essential features of the infodemic were also mentioned by the stakeholders, but they didn't gain the attention of the majority. These include "confusion", mentioned by 12 per cent, and "disinformation", pointed out by eight per cent.

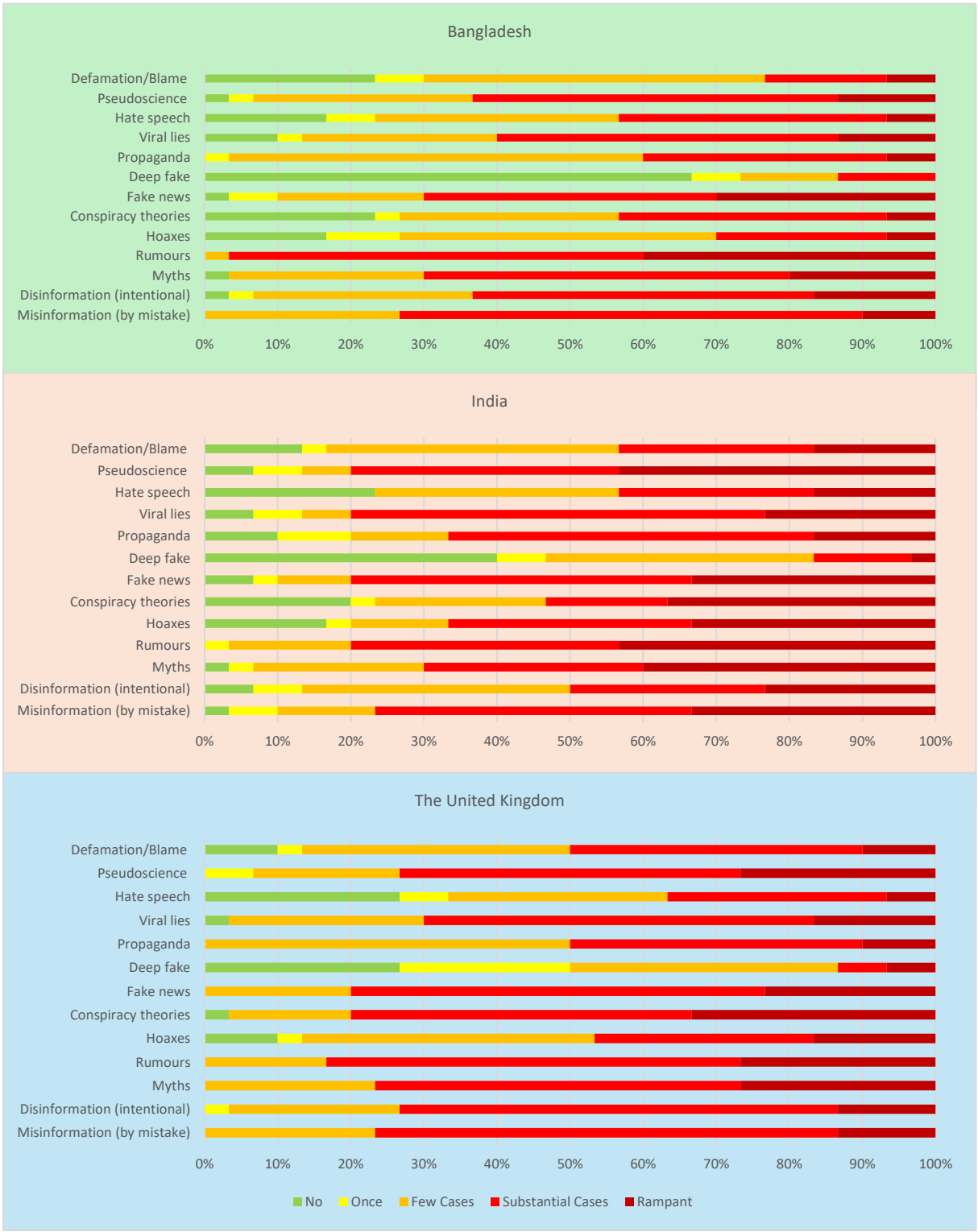
Figure 5.1: Perception of Infodemic Among Key Stakeholders



Interestingly, five per cent of respondents also mentioned "risk communication", and another six per cent related it to "trust" issues, which reflects the essential concern of government

bodies during the infodemic. Less than five per cent of respondents also used terms such as "fear," "myth," "truth," "fake news," or "chaos."

Figure 5.2: Nature of Infodemic related contents Observed by the Key Stakeholders

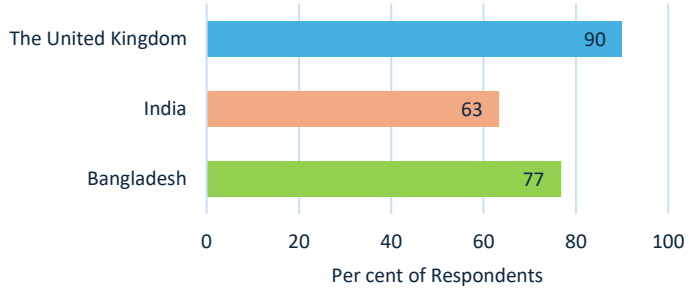


The stakeholders were also asked if they observed various types of infodemic related content in their respective countries. From the given list, the combination of infodemic related content, as discerned by the key stakeholders, varied for the selected countries. In Bangladesh, sixty per cent or more stakeholders observed a substantial to rampant existence of rumours, fake news, myths, pseudoscience, viral lies, disinformation and misinformation (Figure 5.2). In

India, in contrast, a more significant proportion of stakeholders (sixty per cent or more) reported the existence of substantial cases due to the rampant existence of rumours, fake news, viral news, pseudoscience, misinformation, and myth, along with hoaxes and propaganda. Similarly, sixty per cent or more stakeholders in the United Kingdom also observed conspiracy theories besides rumours, fake news, myths, misinformation, disinformation, pseudoscience and viral lies. Rumours were thus found to be the leading infodemic related content across all three countries, which represent a mix of both online and offline communication.

The stakeholders were also asked about the impacts of the infodemic on their respective organisations. Over ninety per cent of stakeholders in the United Kingdom claimed that their organisations were affected by the infodemic. A lower proportion than the 63 per cent of stakeholders who reported their organisation to be affected in India, although India had the highest reported infodemic related content in newspapers (Figure 5.3).

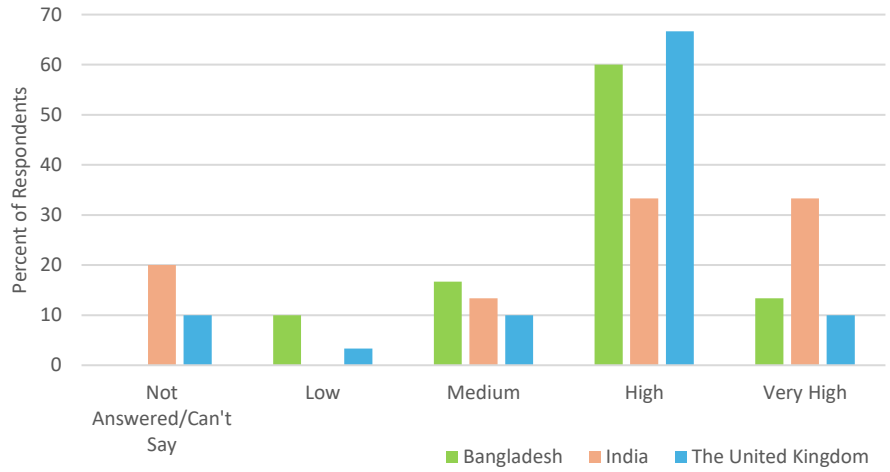
Figure 5.3: Organisations Affected by Infodemic



The stakeholders also discussed how the infodemic affected their work and organisation. While most educational institutions transitioned to online platforms, allowing for remote work, it also created fear and confusion that affected students' performance and mental well-being. In Bangladesh, students also got engaged in creating propaganda that affected the faculty members and institutions. Journalists had to do extra work in the print media to verify information for accuracy. During lockdown, many people also relied on social media, which was inundated with misinformation. Hospitals and medical institutions faced burnout due to misinformation because people had different understandings and were hesitant and fearful about the treatment. The workers in NGOs faced a high risk of COVID-19 during their field visits and meetings with community members. Mental health emerged as a challenge for organisations, particularly in the post-COVID-19 phase. Many institutions lost their revenue due to the online transition of their work, while some also reported adverse effects on their reputation due to misinformation.

Most stakeholders also observed the infodemic to be severe across all three countries (Figure 5.4). While a more significant proportion of stakeholders in India found infodemic to be very high or high in the country, more stakeholders reported it to be high, followed by medium and very high in the UK and Bangladesh. The nature of the incidents and their experiences also varied across these countries. Many stakeholders in Bangladesh experienced an infodemic related to the fear of transmission, information discrepancies, and vaccination, as people were unsure how to respond to the pandemic. Additionally, as these interviews were conducted after the change in government, many stakeholders also mentioned experiencing disinformation that was politically motivated and intentionally disseminated on social media.

Figure 5.4: Severity of Infodemic as Perceived by the Key Stakeholders



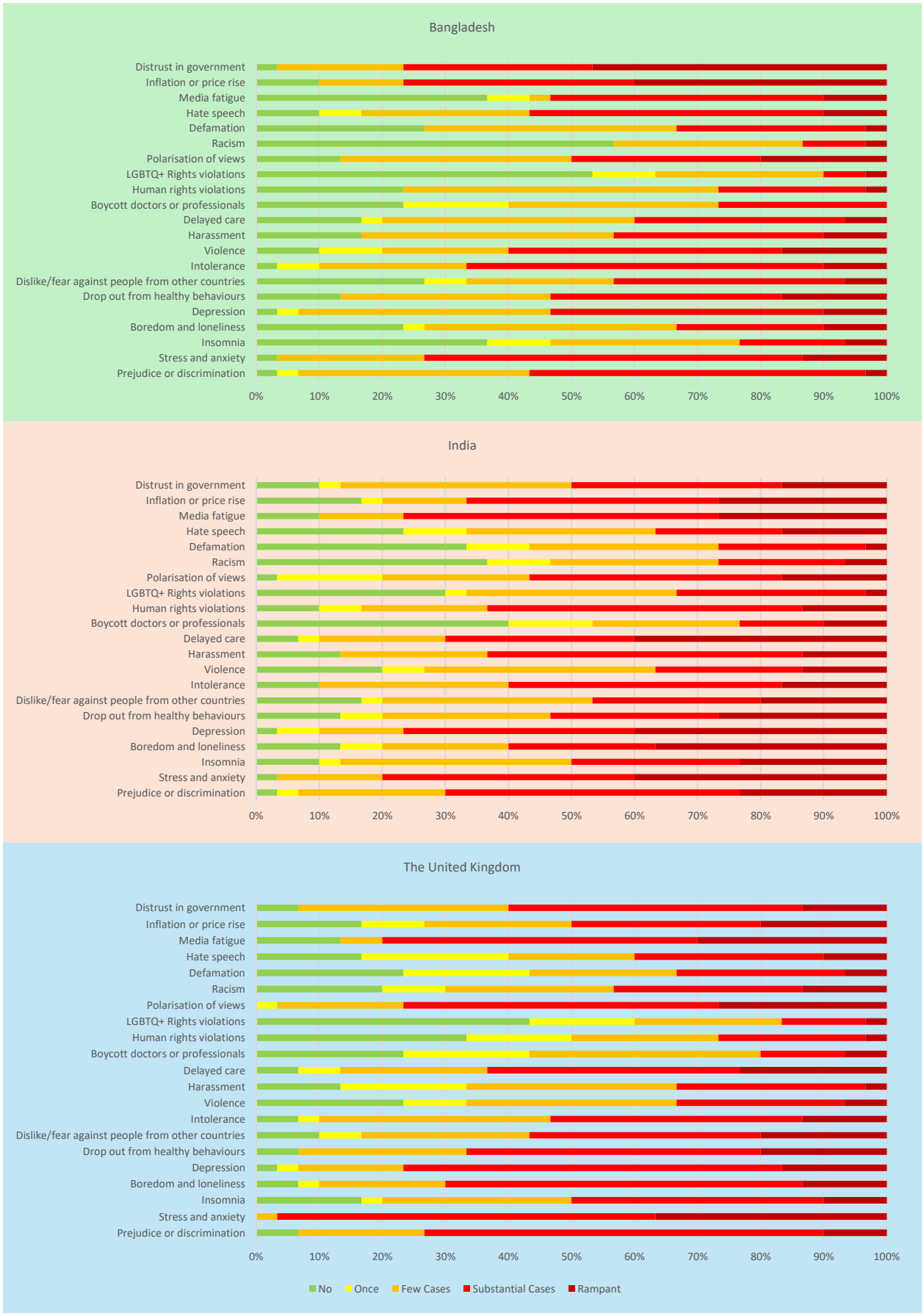
In India, stakeholders found that the infodemic became severe due to social media, mainly through WhatsApp groups. According to them, WhatsApp, also infamously called WhatsApp University, became a channel for perpetuating fear and uncensored health advice about concoctions, washing vegetables, and shortages of injections or oxygen cylinders. Besides, the severity of issues migrant labourers faced, along with fear of transmission and unreliable information regarding vaccination, accelerated the infodemic. In the United Kingdom, stakeholders discussed a range of issues related to the infodemic. A few of them had also studied the problems of the infodemic. They noticed that various topics such as hardships of ethnic communities, fear, weird explanations, riots, and overflow of information leading to ignorance and overwhelm through social media gained people's attention and traction.

Table 5.1: The Most Harmful Impacts of Infodemic Noted by the Key Stakeholders

Bangladesh	India	The United Kingdom
Fear; Fights and tensions; Vaccination hesitancy; High mortality among people tested negative; Targeted disinformation; Loss of Trust; Work affected due to unreliable information; Propaganda and movement; harassment; Stigma; Confusion; Discriminatory violence on minorities; Acceptance of wrong information; Reluctance to follow protocols; Enmity based on wrong information.	Migrant crisis; Panic; Confusion; Hazardous Behaviours; Families suffered due to rumours; Untouchability; Social isolation; Chaos; Targeted discrimination on minorities; Deaths; Perceived shortage of resources such as Oxygen cylinders or injections; Enhanced vulnerability; People encashing the situation with disinformation; Acceptance of wrong information	Violence and risky health behaviours; Acceptance of wrong information; Chaos; Confusion; Vaccination hesitancy; Scepticism; Loss of trust; Enhanced vulnerability; Polarisation of view; Political uncertainty; Physical and virtual attacks

When key stakeholders were asked about the most harmful impacts in their country, a few common implications of the infodemic emerged. These included confusion, fear, loss of trust, vaccination hesitancy, enhanced vulnerability, targeted disinformation and acceptance of wrong information (Table 5.1).

Figure 5.5: Prevalence of the Infodemic Issues in Bangladesh, India and the UK



Certain specific implications peculiar to these countries also emerged. The stakeholders in Bangladesh mentioned propaganda and movements against the government, along with social and political harassment and reluctance to follow protocols among people due to widespread disinformation. In India, on the other hand, the migrant crisis, the suffering of labourers and their families on state borders, and the perceived shortage of injections and oxygen cylinders proved to be very harmful at the local level. In contrast, in the United Kingdom, violence and risky health behaviours, scepticism, political uncertainty, as well as physical and virtual attacks were seen as the most harmful impacts by the stakeholders interviewed.

The stakeholders were also given a list of possible impacts to compare the prevalence of infodemic issues in the three countries (Figure 5.5). For example, more than 70 per cent of the respondents found rampant cases of stress and anxiety, distrust in government, and inflation, while nearly 60 per cent noticed rampant instances of intolerance and violence in Bangladesh. At the same time, issues such as racism or violation of the rights of the LGBTQ+ population were found to be minimal in the country by most stakeholders. Different forms of mental health issues were also found rampant, which was, though, not seen as the most harmful impact of the infodemic.

In India, more than 70 per cent of the stakeholders witnessed rampant cases of stress and anxiety, media fatigue, depression, prejudice and discrimination, as well as delayed care. In comparison, nearly 60 per cent mentioned harassment, intolerance, boredom and loneliness, human rights violations and price rises and roughly 50 per cent also observed insomnia, depression, polarisation of views and distrust in government. Issues of the boycott of doctors and professionals, racism, defamation and violation of LGBTQ+ rights were observed by very few stakeholders.

Table 5.2: Causes of Infodemic As Perceived by the Key Stakeholders

Bangladesh	India	The United Kingdom
Social media (9); lack of education (4); lack of fact checking (2); ignorance (2); lack of digital literacy (2); lack of access to proper information; irresponsible use of internet; no filter of any misinformation; hype driven nature and the lack of transparency; lack the habit of verifying information; no preventive mechanism for checking the information; lack of awareness; people giving expert advice without being expert; no control from government; law or proper practice; TV, Newspaper and friends; political unrest	Social media (9); lack of proper or right information (3); Political reason (3); lack of official channel of communication; Political leaders; lack of knowledge and education; change in narratives; multiple sources of information not in sync; information overload; carelessness; top-down approach; easy access to online platforms; poor management; panic; too much or limited information; confusing information; negative orientation of people	Social media (8); opinion (2); crisis situation (2); fear (2); access to smart phones; people wanting to become famous; abundance of information; COVID economy; algorithms; media; hurry in decision-making; seeking information; information rage; misinformation; disinformation internet; uncertainty; media; proliferation of communication channels; anti-vaccination movements

In the United Kingdom, over 90 per cent of the stakeholders mention the rampant presence of stress and anxiety. In contrast, over 70 per cent of stakeholders also noted the widespread presence of media fatigue, depression, prejudice, discrimination and polarisation of views. Fifty per cent or more stakeholders also mentioned boredom, dropout from healthy behaviours, distrust in government, insomnia, inflation, intolerance, and dislike for people from different backgrounds. Few stakeholders found violations of human rights or LGBTQ+,

boycott of professionals or defamation. Most stakeholders across the three countries thus agreed on a widespread prevalence of mental health, media fatigue and distrust in government. These didn't appear strongly in their perception of the harmful impacts of the infodemic, which revolved around fear, confusion, crisis and violence affecting individuals and families.

The stakeholders were also asked about the possible causes of the infodemic, which brought forward a few similarities and differences across the three countries (Table 5.2). Most stakeholders labelled social media as the primary culprit. A few stakeholders across the three countries also mentioned friends, neighbours, communities, TV, news or mainstream media, radio, the Internet, online forums, and even the government in some cases.

In terms of difference, while many stakeholders in Bangladesh also mentioned a lack of education or digital literacy among people, in India, stakeholders found a lack of proper information, defined channels, or political reasons to be the cause of the infodemic. On the other hand, opinions, fear, and crisis also contributed to the spread of the infodemic in the UK.

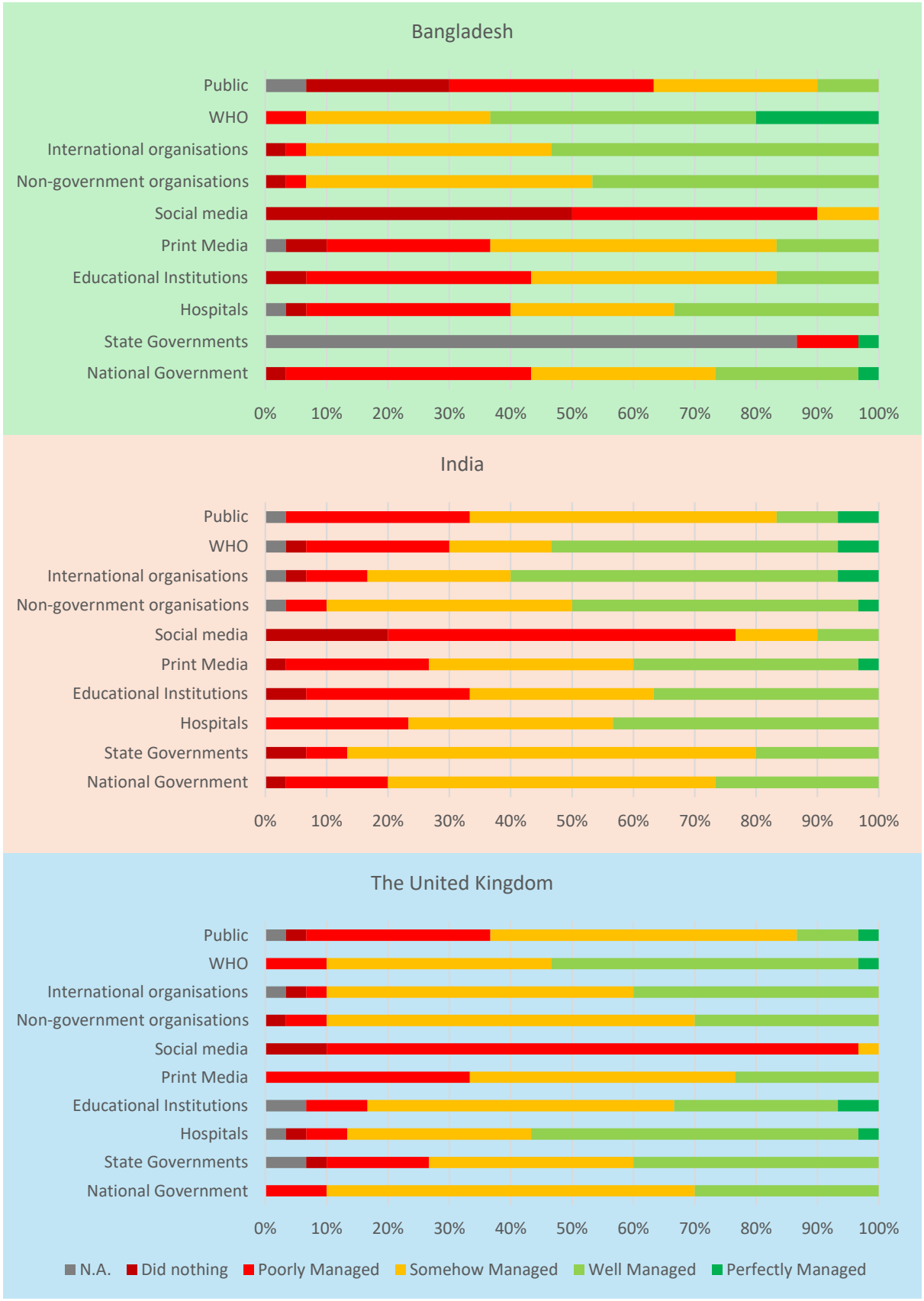
Infodemic and Risk Communication Governance

Infodemic and risk communication governance for the pandemic required the engagement of international, national, state and local agencies. The initial communications from the WHO and governments focused on risk communication regarding COVID-19. However, the applications of extreme measures were met with resistance and counterproductive responses, resulting in the declaration of an infodemic by the WHO (Khan et al. 2022). It also generated the need to manage the infodemic on a priority basis.

When key stakeholders were asked about infodemic management by various institutions, their perceptions varied significantly among themselves and for different institutions (Figure 5.6). Despite the political and controversial nature of the issue, most stakeholders across the three countries rated the role of the World Health Organisation positively in managing the infodemic, along with other international organisations. The ongoing efforts of the WHO to develop policies and address issues were helpful for the respondents. On the other hand, most stakeholders rated the infodemic management by their national and state governments as less than well-managed.

More than eighty per cent of the stakeholders across all three countries believed that the social media platforms either did nothing or poorly managed the infodemic. Most stakeholders observed that the public also found it challenging to manage the infodemic. Besides, they were both on the side of creating and being affected by the infodemic related content. The works of NGOS were found to be more positive, given their limited funding and scope, in all three countries. For hospitals, more than fifty per cent of respondents in the UK mentioned that they are well-managed, while nearly forty per cent in India and only thirty per cent in Bangladesh found them to be well-managed. Educational institutes, on the other hand, scored less, with only 15-20 per cent of respondents finding them well-managed in Bangladesh and 30-40 per cent in the UK and India.

Figure 5.6: Infodemic Management in Bangladesh, India and the United Kingdom



The stakeholders witnessed a few gaps in the governance system that contributed to poor infodemic and risk communication management. These included a lack of any structure to check information or preventive measures or filter for misinformation shared, lack of transparency, lack of coordination, no control from the government, law, or proper practice in Bangladesh; change in narratives; multiple sources of information not in sync; top-down approach and poor management in India, and inadequate structures to keep people informed, updated and reassured; proliferation of communication channels in the United Kingdom. As discussed in the following section, many of these also emerged as critical challenges in addressing the infodemic.

Key Challenges in Addressing Infodemic and Risk Communication Governance

Infodemic management was overwhelming, with numerous and diverse challenges faced by the three countries. A few prominent challenges that emerged from the discussion are as follows:

1. Lack of Preparedness to Address Infodemic with Risk Communication

Various planned measures to address the pandemic and emergencies failed to tame the infodemic, which was a new hazard for most. The stakeholders noted inadequate preparedness to deal with various information issues in the absence of support, which is available for physical challenges such as labs, human assistance and vaccination, but not much for the soft skill issue. Many of the responses were ad hoc and inconsistent, such as fact-checking, while the infodemic, as a global challenge, required a planned approach. A few stakeholders also discussed the gaps in the information provided to the citizens. Subsequently, when people started to share relevant information to fill the void, multiple messages with different and incomplete information contributed to the chaos. People required information for everything during the lockdown, and their absence increased the fear of disease and death.

In the words of a stakeholder: "…., perhaps the lack of information. Of course, I mean. I'm not trying to play the blame game… the seriousness of the information came a bit late. … it had spread a lot, and it was inevitable. I am just saying that's how it started…even information in terms of isolation came a bit late… also the understanding of isolation. … Now, for instance, when one person is sick in the family, how do you handle other people? And then, when some person gets hospitalised, how do you manage the family? And making sure that the hospitalised person is taken care of. And when that person dies, what about then? There was chaos in terms of the disposal of bodies. In the beginning, the hospitals were disposing of the bodies in a city like Delhi, and that was a lack of information and disinformation. There was so much chaos because of the infrastructure collapse. Why is it that so many bodies were being left on the road? Because there's no information on it, you know. How do you handle a body like that? And okay, if you know, the crematoriums are full. Is there information on it? How else can we dispose of the body? … There is some dignity that is required, right? And this genuinely did happen….the dead bodies just left on the road belong to someone. There were people who loved them. There was no information on how you can handle them….it took a while before people understood that. What if there is a family where everyone's affected by Covid? ….Okay, create this kind of a system for your areas … that it could not happen".

In the words of another stakeholder:

“We are still not prepared to deal with the infodemic whenever it happens in our country. We are very prone to it.”

2. Lack of an Effective Risk Communication Channel

Several stakeholders also highlighted that people were relying on social media in the absence of a clear and proper risk communication channel and feedback mechanism. This not only enhanced their vulnerability to the infodemic, but their concerns also contributed to concerns circulating on the Internet and social media. Almost everyone, from citizens to local, national and global institutions, used social media, which had numbers but limited and at times conflicting information.

In the words of a stakeholder: “One of my major concerns is the fact that the primary avenue for information to reach people now has become social media. It's not even the Internet, it's specifically social media. And what that does is social media algorithms have a life of their own. They change, they morph, and they're different for everyone, which means that as much as media organisations and other responsible stakeholders try to adapt and make sure that they are there to tackle the infodemic, …social media organisations are fooled by profit and will pursue profit. And if a by-product of them pursuing bigger revenue is that the infodemic will get worse. …and I don't believe they care about that.”

The stakeholders also noted that spreading information through social media is easy but very difficult to control. They observed that the rampant use of social media makes it easy to spread misinformation because not everyone checks for accuracy, but most people forward it. People share information because they find it amusing or valuable, or see a connection with their own lives, such as colours, décor, religious sentiments, or emotions. Intermixing these messages with risk communication can thus lead to misinformation or disinformation.

Stakeholders noticed the necessity of having a proper channel for risk communication and disseminating information at frequent intervals, which enables people to interact sensibly. It should provide accurate information, clearly distinguish between fact and misinformation, and allow for fact-checking or verification.

3. Lack of Disaster Risk Communication Policy and Unclear Rules and Regulations for Infodemic and Different Media Platforms

A few stakeholders highlighted the policy gap, as well as the unclear rules and regulations governing social media, through which the infodemic spread. While in the United Kingdom, policies for risk communication and disinformation existed, the infodemic had many other notions and content forms, which remain unaddressed for disaster risk communications. In India and Bangladesh, in contrast, no risk communication policy was mentioned. They applied international policies, yet gaps in policies, rules and regulations, as well as their implementation, were observed by a few stakeholders. Most stakeholders also observed that their organisations followed some existing protocols or created procedures to address the infodemic, but not a policy.

According to a stakeholder: *“There is no policy at all. You need a policy for every crisis, like rescue, relief and treatment. We must have a policy, a concrete policy.”*

It also hampered infodemic management because, in several cases, the government was seen as solely responsible for it. It also raised concerns about information censorship on social media. In the absence of clear guidelines and accountability, on the one hand, misinformation continues to prevail, while on the other hand, some genuine voices get controlled, especially

those who had different views or stands, which is against the rights provided under a democratic system. According to a stakeholder:

“I have seen time and time again that under the guise of safety and regulation, what it (internet regulation) becomes is a way of censorship of genuine voices. On the one hand, we all understand that there should be quality regulation of this thing that is going out. On the other hand, how can you prevent it from becoming a censorship tool? And in a democracy, having free, fair voices is very important, right? It's the only thing left to us.”

It happens due to personal profits and the agenda involved in the process. Besides, there are limited regulations for spreading misinformation, and those that exist are often not well-known.

4. **Inadequate Capacity-Building and Skills for Managing Infodemic**

The stakeholders also observed a lack of skills and capacity-building to address the infodemic to the last mile in the governance system, particularly in developing countries. In contrast, social media has the technical expertise and AI to enhance information outreach, including different kinds of infodemic related content. Addressing infodemic further becomes complex with posts written in the local language and increasing diversity of concern, nature of information, flawed translations, and types of infodemic related content. The problems become compounded and challenging to address, given limited resources and personnel with limited skills to address the issue.

According to a stakeholder: …. “that in the western countries, social media are filtering a lot of misinformation. And they're using AI tools, and they're using machine learning to feature a lot of unreliable conditions. But the problem is in countries like Bangladesh, where there are a lot of the posts, which are social media posts that are communicated in Bangla. These AI tools are not advanced enough to pick up the translation and understand what they're saying. So it might take longer for these social media companies to address these things like how to stop infodemic via social media. Because of the translation issues they have. So, they do have translators who are skimming through posts. But there are very few people only compared to the population or number of people using Facebook and Instagram in Bangladesh”.

The problem is further challenging for disinformation, where the message is carefully planned and spread through social media. AI has immense potential to replicate images and sounds with desired changes, which could become very difficult for both people and managers to differentiate. According to a stakeholder:

….. AI generated contents, especially images. It was happening before using Photoshop. But nowadays, due to access to advanced tools, and the barriers to create those things have lessened. So that is now growing and spreading in a very alarming rate. I have seen many cautious people sharing those things and getting deceived by those contents. In order to combat the infodemic in social media, there is that scalability issue …. Secondly, we can do fact-checking through different technologies, but the fabricated truths are very difficult to determine. Even after human intervention, it’s hard to determine up to which level we should filter that. Thirdly, there is a moral dilemma. Like, there are many grey areas which are hard to judge and depend more on perspectives, where people from different beliefs interpret things or react to things differently. The fourth issue is that it is not really possible to have one automated version for such a variation of truths across different regions, countries, and communities. It is the biggest challenge that I don't think is easy to solve in the near future. In fact, social media platforms now use content reporting to prioritise the content to check for

inappropriate information. There are some automation tools that remove content if a number of people report any content. But this feature is also misused to remove many correct or true contents.

Another stakeholder from the United Kingdom mentioned: “It is quite hard to tell the difference between user-generated. It's quite hard to distinguish between real content and something that has been AI-generated. I have done quite a lot of work on AI, just in terms of being able to use it. I've seen the frightening results, how realistic it can be”.

Limitations were observed in all areas, including skills, resources and collaborative efforts to address the issue.

According to a stakeholder, “verifying information is very difficult, and we have a significant limitation of resources and collaboration. Like, when there is news that pops up, we need to publish it very quickly; otherwise, it won't be viral. We need to have a good resource to verify that information but as we cannot afford to lose the chance of missing out on the information. This is my concern that we cannot verify information in those scenarios. Also, the skill and integrity of the news providers that we have, people who actually collect news for us…is also a challenge.”

There is a need for ongoing efforts, particularly in the post-COVID-19 phase, to address the infodemic to avoid harm from future disasters.

“We need to build more capacity on infodemic. And most importantly, I think we need to work closer between disciplines. …this is ..really important thing to flag that this is not something that can be done only by communication teams or only by public health specialists. It has to be a very close collaboration between behaviour change and public health. There is still not much changed in terms of the policy, the ethical, the legal backgrounds, but also the capacities, and you know, it seems that they had lots of appetite and interest and funding to support the infodemic and building capacity and behaviour change at the time of COVID. But that seems to be faded, and it seems that it was not properly integrated into multiple preparedness plans for many places for future pandemics. So that's still something missing.”

5. Lack of Awareness

Lack of awareness emerged as a significant challenge with multiple connotations. It is observed for the disease, the infodemic, social media, and even government response. As diseases and disasters continue to evolve, there is a need for ongoing updates and awareness about changing scenarios and responses.

In the words of a stakeholder: “In our country, people have taken up to the fourth dose of the vaccine, yet it's reported that many people are still getting infected with COVID-19, showing similar symptoms as before. …. when people are getting tested for dengue or other conditions, many are showing lower blood counts. ..as … I oversee these, I can say there's a lot of confusion and misinformation among people regarding this. Whether through social media, print media, or other channels, I believe the government needs to take the initiative, and the concerned departments should work to raise awareness. People need to understand why this is happening, what actions they can take, and how to overcome this. It’s crucial that this information reaches the public”.

Stakeholders also observed that people use social media and digital devices without much awareness of their potential consequences and how to address those harmful impacts.

A stakeholder mentioned that "..it is very easy to spread misinformation as everyone has a device now. Many did not have that during or before COVID. Everyone has a machine to extract any type of information in the world. But they don't have the proper knowledge or awareness to verify that information."

Besides, various efforts to generate awareness have failed to draw the attention and response of the masses:

"…we are not being able to effectively generate awareness among people. Many campaigns are being organised but yet the awareness is not even near where it should be."
"We need to be clear that there can be post-COVID illness, but what measures and preventive treatments that we have, everyone should have that knowledge. Many issues are occurring, like the inability to remember things properly, vulnerability towards fevers of different types, and so on. In fact, it has affected the overall immune system of elderly people especially. But are they related to COVID-19? We need to identify that and treat it accordingly."

Besides, several unidentified illnesses that have emerged in the post-COVID-19 phase are not addressed appropriately, and how they are addressed is not known to the public. Lack of awareness about the government's efforts also contributed to distrust in government.

6. Complex Vulnerability Scenario with Existing Inequalities and Digital Divide

The infodemic became difficult, not simply because of errors in the information, but also due to the complex vulnerability pattern. On the one hand, stakeholders mentioned a traditional set of vulnerabilities such as women, the elderly, children, minorities, the disabled, the illiterate and the poor. On the other hand, many argued that everyone was vulnerable, including people of both genders, people of all ages, urban and rural populations, professionals, public health providers, media, and governments. Stakeholders also mentioned that the targeted disinformation makes everyone vulnerable.

The changing nature of vulnerability made the issue particularly challenging to address. On the one hand, the less educated population found it difficult to trace the information or check the facts; on the other hand, the literate population, including the young generation and elderly with phones, got addicted to social media and unintentionally became the carriers of infodemic. Similarly, migrants suffered due to misinformation and became the carriers of the disease and misinformation to distant and rural places. During the infodemic, both rural and urban areas were affected, but their vulnerability varied in nature. While metropolitan areas became hubs of misinformation, in rural areas, people suffered due to a lack of access to healthcare, digital infrastructure, and vaccination hesitancy.

The digital divide is particularly pronounced in Bangladesh and India, largely due to the rapid growth in technology users, which has expanded to rural areas with insufficient digital literacy and infrastructure, further complicating the management of the infodemic. Rural communities are particularly found to be marginalised in these countries due to a lack of reliable information or literacy issues compounded with language barriers and cultural diversity.

According to a stakeholder in India, it poses a significant challenge in contextualising risk communication messages: *"Once people are more literate, then they are more aware of what is right or wrong. then… there is a language barrier, … people, particularly in rural areas, are not very aware of the language. India has a line of diversity."*

It thus requires risk communication to be sensitised to diverse vulnerable groups in urban and rural areas.

7. Increasing Distrust in the Government, Governing Bodies and Society

Lack of trust not only intensified the infodemic but also various types of disinformation that complicated the socio-political scenario of the countries, resulting in further distrust in government and governing bodies responsible for disaster response. The issue of increasing distrust was observed across all three countries.

A stakeholder observed that there is… "persistence of misinformation and the public's growing distrust in official sources. Nobody nowadays seems to believe government sources. Even though the immediate crisis of COVID has gone, the infodemic is making it harder for people to differentiate between reliable and unreliable information."

A stakeholder in the United Kingdom exemplified an incident in which authoritative people were involved in scandals that significantly altered people's trust. "...issue about the people in authority not necessarily following the rules themselves. And then we had the party gate scandal, and there was a lot of distrust about whether we can even believe what these people are telling us?"

Besides, stakeholders also observed that not only citizens but, in some cases, political leaders also spread misinformation. It is observed when they suggest measures not backed by scientific evidence. It also erodes public trust in the government. Such incidents were also observed across countries.

A stakeholder mentioned, "I think we saw in COVID, some of the things that were going around about things that could help with COVID-19. If you are deficient, it is definitely a good thing to do, particularly vitamin D, which most of us who are living in the UK are deficient in….but then if you're saying sort of this, you know this thing will trick is an effective treatment. And, in fact, it's not. Then I think that's a big, big potential harm.

Lack of trust was also observed by the doctors. According to a stakeholder:…." when the patients do not believe the doctors, it becomes very hard for doctors to do their work properly… they would rather play safe and try to avoid criticalities."

The heat of growing distrust was also witnessed by small stakeholders, who had to engage the public and work during tough times of emergencies and disasters.

A stakeholder said: "I think the smaller organisations suffer a lot in this regard, which may not be as concerning for the bigger ones. Infodemic makes things complicated to communicate, and smaller organisations face rather intensified trust issues due to that"

This becomes a further challenging issue to address when people trust the things posted on social media but do not trust agencies working towards their safety. A stakeholder observed that: "There's also the challenge of digital literacy, especially in rural areas, where people may still rely on word of mouth or unverified social media posts. Not that it's not among the literate ones or the urban ones, they also fall for this information many times."

8. Hype, Propaganda and Attention Economy

The heavily invested social media industry is driven by profits governed by public attention, which can also distract them from serious issues, such as risk communication that is not adequately funded. Several stakeholders reported an increase in mental health issues and reduced immunity due to COVID-19, which are not sufficiently addressed due to fear, lack of interest and distraction created by the artificial hype that drives focus to the news, products or other misinformation or disinformation.

A stakeholder observed that: “People in our country go with the flow too much, and they are hype-driven. This is why it is very easy to manipulate a large number of people through false information. It takes only four to five people to spread something in a public forum, and the majority of the people won't even do a basic check to see whether they are saying things correctly or if it is propaganda.”

A stakeholder mentioned that…” in the post-COVID infodemic.. the use of misinformation to spread news for personal agendas..has become a significant issue. It spreads so quickly that controlling the content is difficult. We have a recent example of this, where 3-4 students conspired against the chairman of a department. Before anyone could discern whether the news was true or false, it spread so rapidly that the chairman was forced to submit their resignation letter.”

According to another stakeholder, “when misinformation or rumours spread, there's almost always an underlying purpose behind it. When we start believing in these rumours, it means that the intent behind spreading the misinformation is succeeding. The more people believe in it, the greater the success of that objective, whatever it may be. This, in turn, amplifies the risk, as misinformation can mislead individuals or groups into making wrong decisions or holding misguided beliefs. This creates a chain reaction, where the original purpose of the rumour, whether political, social, or something else, begins to have real-world consequences.”

The problem becomes even more challenging with the invested interest of political parties in propagating misinformation.

A stakeholder observed that… “the reluctance of the government to prevent spreading misinformation and disinformation, rather than an overenthusiasm to utilise the opportunity to spread false propaganda and create a generation of misinformed people. In short, the governments, instead of being proactive in the prevention of the infodemic, see it as a tool to work in their own interest.”

The growing misinformation and disinformation not only threaten to hamper the disaster risk communication and response but also carry the potential to disintegrate societies for personal benefits.

9. Amplified risk of social disaster due to misinformation

The stakeholders also observed severe consequences of misinformation and disinformation, which not only could create confusion and chaos but may result in social disasters such as violence or riots. A few key aspects of the infodemic that further amplify the risk include the polarisation of views, data colonisation that limits its use for research and social welfare, and the dissemination of planted disinformation for political benefits.

A stakeholder noted that: “At a certain point, people became reluctant to follow safety procedures, which made it difficult for the rest to follow and keep their near and dear ones safe. Corruption in the health sector, the price of proper healthcare went up and made it difficult for the poor and needy to get proper medication.”

Data colonisation further creates a divide between the rich and the poor, benefiting those with money.

A stakeholder mentioned that…. “you could call it data colonialism or however you want is like this decreased, constantly decreasing access to data that researchers or journalists and fact-checkers or institutions like ours have access to like especially now with also with you know

new AI revolution the platforms have put even more blocks in having access to any data for the public good. So if you, let's say, if you want to do social listening, you need right now to pay a ton of money to an intermediary who goes and pays more money to the platforms to get access to this data."

The control on access to data and what people observe results in further politicisation and polarisation of views that could widen the existing differences and divide within society.

A stakeholder from Bangladesh noted that "the potential risk that an infodemic has like the potential of creating a very severe, catastrophic event of violence and uncertainty. For example, the Durga Puja is coming up next month. If someone can establish any misinformation that any statues are broken, it will put other areas at severe risk of escalating unrest in many more regions. These sensitive issues or big socio-political events are vulnerable to such an infodemic."

The stakeholders also noted its potential impact on creating instability at the country level, which can harm all sections of society.

10. Information overload and media fatigue

With the constant increase in information on social media, people are also experiencing media fatigue, which means they are less interested in verifying the accuracy of the information. It is also likely to slow down the process of mitigating misinformation or infodemic.

According to a stakeholder, "the amount of information has quadrupled. Platforms like X, where on one side you can see something that exists, but you don't know the context behind it. The information overload has only got much, much worse."

… "and I think it's got to a point where traditional media looks at platforms like X doesn't know whether it's real or fake or what the context is. And so things have gone unreported, and I think a lot of information, particularly around COVID, is still being spoken about, especially around vaccines. I think more interest has been built up since COVID, and because of that, disinformation and misinformation are going around. But the fact is that there's no one combating it."

Another stakeholder observed that "people are struggling to cope with all of this information and then with some of the stuff that we've seen, particularly around police and the national reviews that have been ongoing, the reports about, you know, inherent racism and sexism. I think it's fuelled some of that kind of mistrust of what would have previously been viewed as a very trusted organisation and trusted source of information, and social media, I would say, has just ramped up to fill that void even worse than it was when we were dealing with the pandemic. And I also think the rise of influencers, ….who carve out a real niche that fills a gap that isn't covered by mainstream media or mainstream organisations and then managed to grow these really massive followings …and I also think it's a generational thing as well. Because, if you look at sort of millennials down to Gen Z and then, you know, the even younger groups that are coming through, they all get their news from TikTok and social media. Nobody is looking at news or consuming news in the way that previous generations would have consumed it.

A heavy dependence on social media for news and other things, along with a declining attention span in the presence of information fatigue, challenges existing methods and mediums of risk communication in both triggering and managing the infodemic.

Best Practices in Addressing Infodemic and Risk Communication Governance

A few best practices also emerged during the discussion that helped the stakeholders to address the infodemic in their respective countries. They include the following:

1. A rise in fact-checking

A rise in the infodemic also necessitated fact-checking in the state, national and global organisations, mainly through websites, social media or apps that helped people verify misinformation circulating through different means. It also created a stream of professionals engaged in fact-checking who support companies and people seeking help with fact-checking. However, the pace of information generation outpaces manual fact-checking, and with the increasing use of AI, it is becoming challenging to identify and remove false information. Yet, fact-checking remains a best practice to address critical risk communications.

2. **Digital tools for rapid risk communication and surveillance**

The advancement of technology also brought forth a range of digital tools that allow quick dissemination of risk communication and surveillance.

Stakeholders mentioned that:

…. “we should continue using digital tools for reaching out to people as they are very active in social media nowadays.”

…. “technological solutions …to mitigate infodemic and get the correct information across.”

Stakeholders observed that, before the COVID-19 pandemic, risk communication methods were largely traditional and required close physical contact with people. However, during COVID-19, the online transition happened, which was very positive for them as they could now support more people. It also helped them in spreading awareness,

3. Community Engagement

Community engagement emerged as an essential need and a best practice for communicating risk and addressing the infodemic. In the United Kingdom, door-to-door information was provided to encourage people to get vaccinated.

A stakeholder reported that “we went to every house with the person needed to take the vaccine. Based on all the data that we have, we went there. We tried to provide them with adequate information, and we also answered any questions, queries, and concerns, and everything they had.”

Another stakeholder mentioned that… “so for me, infodemic management is by listening to people, by understanding what is happening by understanding their pain points or understanding their issues that are not that they don't know or that they did not hear; people should be the focus.”

Some educational institutions in the UK and India had also started community radio and hotline services that helped people address their queries during COVID-19. NGOs also distributed communication material, including posters and videos, to promote community awareness in India and Bangladesh.

4. Enhanced participation of experts and experienced professionals

Many stakeholders also noted an increased involvement of experts and experienced professionals in risk communication. Due to excessive misinformation and disinformation,

people were seeking expert guidance. This is particularly helpful in diverse risk communication scenarios that are subject to various types of misinformation.

A stakeholder mentioned that… "During any health emergencies like the COVID-19 pandemic, using community health workers was seen as a good approach."

In Bangladesh and the United Kingdom, participants also mentioned the efficacy of health workers' knowledge dissemination. Many local, national, and global organisations can invite and hold expert consultations using online meeting facilities.

5. Coordination and cooperation

Coordination and cooperation emerged as the best practices and are essential for the success of risk communication. It has been seen as very fruitful and effective by international organisations.

A stakeholder mentioned that… "we did a lot of coordination calls. …we do coordination calls on a monthly basis, at a normal time, but during COVID, we did it on a weekly basis, and each country basically provided an update of what they're doing …, and.. response. So that was very good…… at the regional level".

Another stakeholder said "During COVID, what I found as the best practice was the way all the relevant departments synchronously worked together to face the challenges posed by the pandemic. The coordination was a critical factor and that was well managed during that time. Health officers, UNO, police, and everybody else too, everyone worked together."

Coordination is an essential best practice for risk communication, which is now seen as even more relevant and significant in the Infodemic scenario. The damaging impacts and influences of the infodemic require more organisations to cooperate and work in alignment for effective risk communication.

6. Collaborations

The stakeholders also emphasised the importance of collaboration throughout various phases of the response. They also found that cross-sector partnerships were fruitful. Collaboration with nationwide teams and members, as well as links to verified sources of communication, including government agencies and cybersecurity experts, proved highly effective. Collaborative campaigns with local councils and civil society organisations helped address the infodemic at the local level. It enhanced public awareness and improved the risk communication strategies employed in the field.

7. Contextualising the risk communication

Contextualisation of the risk messaging was also identified as a good facilitator of proper communication. Stakeholders also mentioned that while everyone looked for the government, which had limited information and used a military approach, developing an understanding of the entire context of the infodemic proved more helpful.

According to a stakeholder, "We cannot just gather any information and pass it to the public. We need to assess our audience; we work with the most marginal ones, having less education and less awareness. So we first need to design the message based on the information before delivering it to the public so that they understand the information and do not become confused."

8. Having Reliable information sources and guidelines

Stakeholders mentioned that it is essential to have reliable sources of information and guidelines to control infodemic and for effective risk communication. The stakeholders commented that it is imperative in situations like the COVID-19 pandemic when actual and reliable information is very hard to find. Such practices were emphasised in situations where chaos and panic were observed, such as the recent movements and riots in Bangladesh and the UK. They also highlighted the need for guidelines. The stakeholders noted that maintaining a single point of contact while disseminating information was a good practice that many organisations followed.

9. Clear, transparent and timely risk communication

The stakeholders also mentioned having clear, transparent and timely risk communication as the best practice.

According to the stakeholders:

-"Timely, transparent, and real-time communication is essential. Transparency builds trust, so it always helps to address misinformation quickly."

-"Clear communication on what the current situation is; being very honest about what's happening."

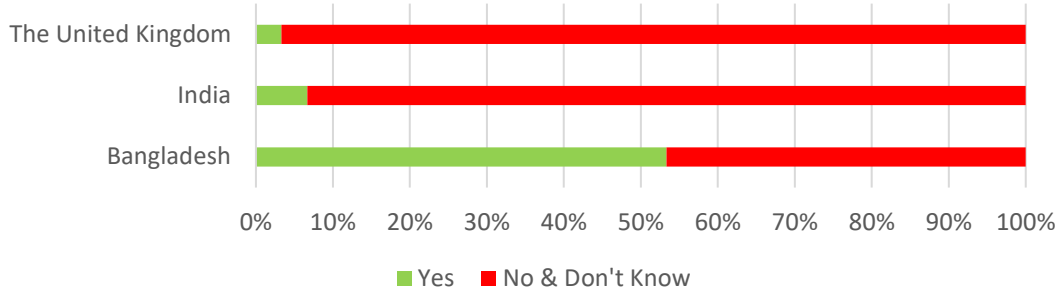
The best practices suggested by the stakeholders thus revolved around having clear, timely and transparent risk communication from a reliable source that facilitates fact-checking and allows cooperative and collaborative efforts.

Policy Gaps in Infodemic and Risk Communication

While a series of efforts and policy documents were created at the international level by the World Health Organisation to address risk communication and infodemic (WHO 2018, 2022), limited policies were found at the national level, particularly in developing countries, including Bangladesh and India. Both countries used the Risk Communication and Community Engagement (RCCE) strategies recommended by the WHO for community awareness and response to COVID-19. They also used several tools, which are discussed in the following chapter. However, a national policy for effective risk communication and infodemic was missing. In the United Kingdom, in contrast, communicating risk guidance exists to communicate risk more effectively (Cabinet Office, 2011). Besides, a toolkit for managing disinformation was also published to help people address disinformation in the information environment (Government of Communication Service, 2021). Yet, a clear gap is also observed in awareness of policies to address the infodemic and risk communication. Most stakeholders were unaware of the policies governing risk communication at the national level (Figure 5.7).

Even those who were aware mentioned the policies they were familiar with, and an even smaller number of stakeholders mentioned policies about risk communication and infodemic (Table 5.3). A few stakeholders mentioned the national disaster management guidelines and vaccination plan, which had less to do with managing the infodemic and related issues of risk communication.

Figure 5.7: Awareness of the key stakeholders about the risk communication policy applied during COVID-19



At the institutional level, stakeholders also mentioned data policies, cybercrime policies, and other relevant issues. Most stakeholders noted that they followed the general or standard operating procedures for verifying the information, fact-checking and following the proper channels to disseminate information. Only a few organisations reported having a spokesperson or director communicating the risk information. In the case of organisations engaged in scientific research, stakeholders mentioned the peer review system, in newspapers, they followed journalistic principle, and in disaster management section, they had access to disaster management guidelines and health–COVID–19 guidelines.

Table 5.3: Awareness of policies and guidelines among stakeholders working in different organisations

Agencies	Policies and Guidelines
Govt Organisations	Disaster Management Policies; Community Risk Assessment (CRA) guidelines; Rapid Response Communication Protocol, fact check
INGOs/NGOs	Impact framework, Disaster Management Guidelines; Information and Communication Policy
Private Organisation	Protocols, risk management policies, fact check
Scientific organisations	peer review system, expert opinion,
Universities	Shift to online education, code of conduct
WHO	Pandemic guidelines, Risk Communication and Community Engagement policy
Health Organisations	WHO guidelines, Pandemic or COVID-19 policy, Vaccination,
Media	Journalism Principle
Social Media	Organizational policy

Additionally, many were also uncertain about the effectiveness of the policy implementation.

According to a stakeholder in Bangladesh, “There was a risk communication policy, but the government could not implement it properly. It was seen that news media were providing information from one angle, and there was already an excessive amount of information circulating among people. So, they lost credibility and acceptance. It creates doubt in the perception of people. For example, people had a firm belief that the death toll that was shown in the news was much lower than the actual number.”

In contrast, when stakeholders were asked about policy awareness in their organisations, many responded affirmatively, but they also mentioned that there was no proper policy in place for the infodemic. There was a channel for communication, protocols, and rules, but adequate

policies and guidelines were missing in most organisations, except for WHO and INGOs. A clear need for policy were identified by the stakeholders.

In the words of a stakeholder,… “there should be some policy level decision…What could be the channel of information … there should be some screening of information. Some kind of penalty for those who are giving misinformation or those who are, I mean, giving information which is not acceptable to the society. So, there are some basic ethics. When we talked about print and electronic media which they actually study while they are studying the journalism course. But for normal people, we do not have that kind of rule, I mean. I mean we have not studied how to..share the information. So we do not know what is ethics of printed electronic media. Like we have some principles in social work. Similarly, some governments would come up with some strong policies not for each case. … I mean generic for the term infodemic, which you are saying. And not only making policy, but making it mandatory to be implemented by state and district office. And there's some. Some provision of penalty as well then only otherwise in India is difficult given the population and lack of awareness.

Overall, a need is observed for a comprehensive policy with a proper implementation structure and accountability to contain the infodemic after disaster risk communication. A greater consensus is observed for addressing the issue, while stakeholders mentioned numerous challenges and best practices. A proactive response could help to avoid further damage from infodemic in normal or crisis situations.

6.

Risk Communication and Infodemic Through the Lens of Activity Theory

In the age of post-truth society, misinformation and disinformation are prevalent and increasing, attributed to diverse understanding, varied practices, management styles, social transformations and limited attention span. It has significant repercussions for disaster risk communication, which can trigger fear and chaos in the presence of the infodemic. In this study, the activity theory is used as an analytical tool to understand the risk communication and the infodemic experienced during COVID-19. However, instead of selecting a particular generation, risk communication governance is understood through the lens of different generations of activity theory. It helped to bring forward various elements of the risk communication process on the surface that require attention to address complex issues like the infodemic.

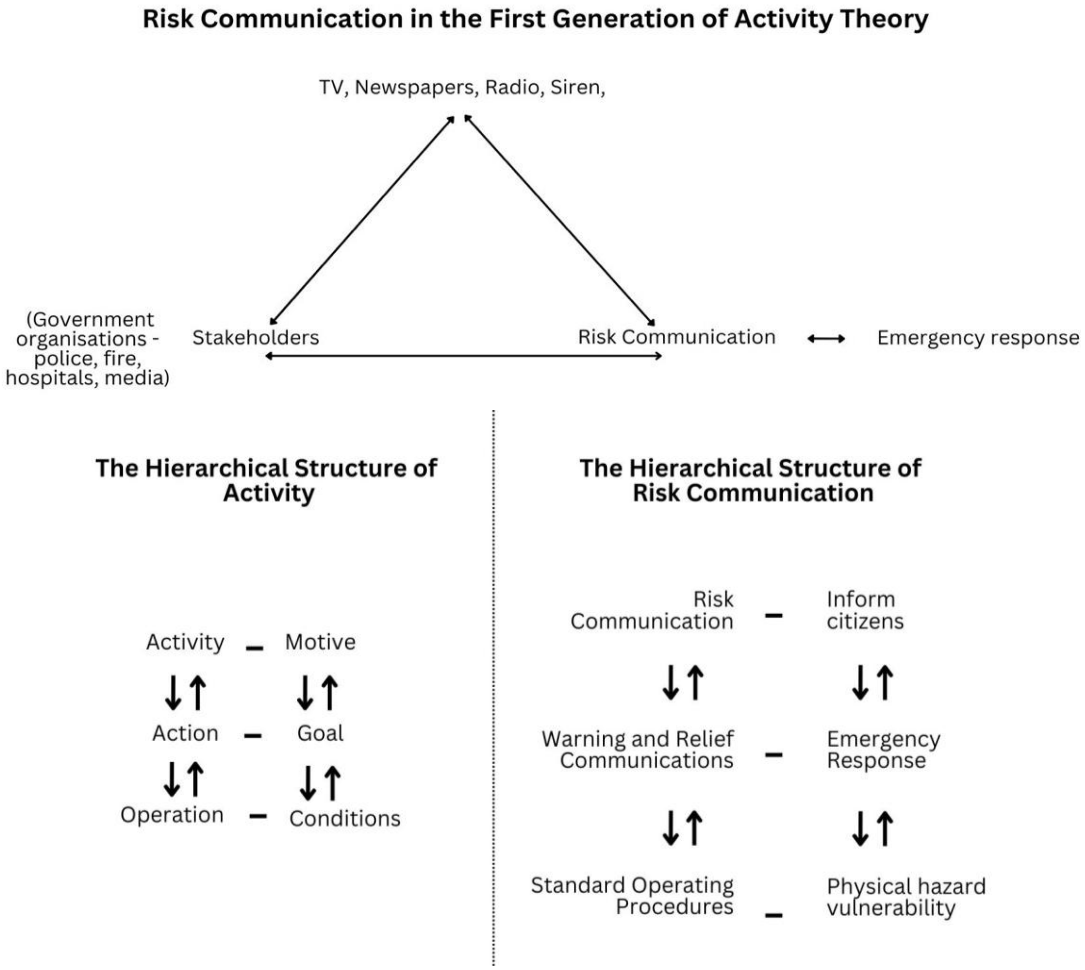
In activity theory, the unit of analysis is the activity itself. It makes it easier to assess risk communication by using the activity theory. The Theory has evolved into different generations that acknowledge the increasing complexity of real-world situations. Thus, a parallel can be drawn between the generations of activity theory and the evolution of risk communication over time.

The first generation of activity theory & Risk Communication

The first generation of activity theory focused mainly on the subject, tool, and object, which depicts the simplified form of risk communication, which was indeed common until the late 20th Century (Figure 6.1). The hierarchical structure of the activity theory effectively describes the top-down model of risk communication applied in most countries before the era of disaster management. In the hierarchical structure of the activity, the first layer is driven by an object-related motive. For most governments, the motive of disaster risk communication has been to inform people to protect or avoid disaster losses.

Prior to the 1970s, in the absence of early warning systems, most warnings were ad-hoc and often generated at the last minute or even after disaster occurrence. These warnings were also followed by relief communications to help people overcome the negative disaster impacts, which represent actions and goals at the second layer of the hierarchical structure of the activity. The third activity layer of operation is driven by conditions, which represent Standard Operating Procedures (SOPs) of the emergency managers that were modified according to disaster risks (hazard and vulnerability) and priorities. Various reports and research papers have repeatedly acknowledged the limitations of the top-down approach, where both communications and relief were distributed through institutional bodies. Some of these included gaps in responses, compensations, and addressing the needs of vulnerable communities and their viewpoints (Lebel et al. 2006, Khan 2012b).

Figure 6.1: Risk Communication in the First Generation of Activity Theory and the Hierarchical Structure of Activity



Based on Leontiev 1981 and Khan 2012a.

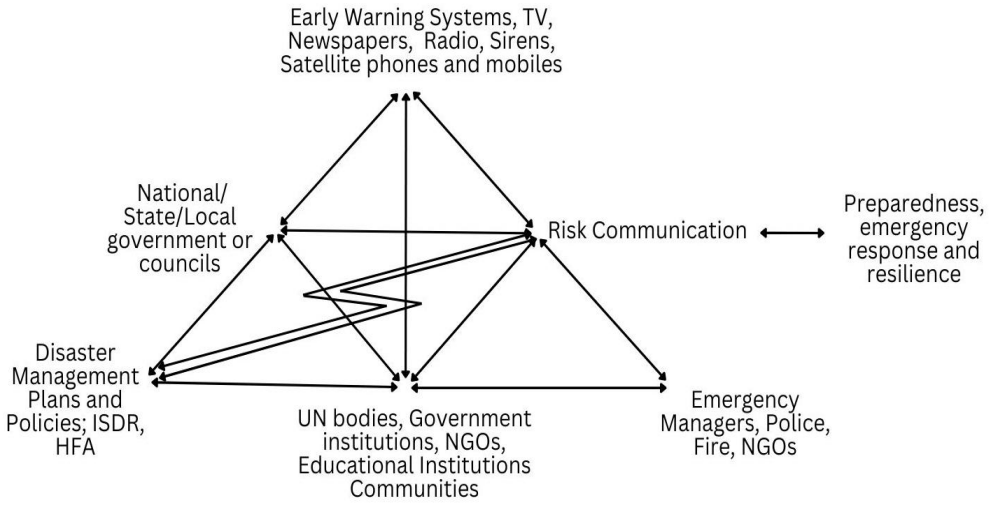
The second generation of activity theory & Risk Communication

The second generation of activity theory by Engstrom also included aspects of broader social contexts that influence an individual actions, such as rules, communities and division of labour (Engstrom,2000). This is comparable to the second generation of risk communication started in the late 20th century. Due to the increasing damages in disasters, a need is observed for global response. It led the expert group meeting of UNDRO in late 1970s followed by the declaration of International Decade for Natural Disaster Reduction (IDNDR) in 1990s, International Strategy for Disaster Reduction (ISDR) in 1999 and the Hyogo framework (2005-2015). In this phase, a significant progress is observed in the way disasters were managed across the world. Many countries created their disaster management plans and policies, which emphasised on the role of preparedness and community participation (Khan 2012).

In the second generation, the simplified procedure of emergency risk communication evolved with the additions of early warning systems in tools apart from mainstream media, traditional equipment of siren and emerging technology of satellite phones and mobiles. The rules

included acts, global and national policies, plans, and had extended community members that were engaged in the process of risk communication. The increasing structures also required the division of labour that not only included institutional bodies but also involved non-government organisations, volunteers and community leaders.

Figure 6.2: Risk Communication in the Second Generation of Activity Theory



The emergence of a disaster management plan aligned the efforts for greater awareness and preparedness for natural hazards and emergency response. Some contradictions, however, were continued to be observed due to the gaps in plans and policies, particularly in the context of risk communications (Khan et al, 2017). At the same time, many successful interventions and responses were observed in various countries, for example, cyclone preparedness in Orissa attributed to early warning systems and preparedness.

Applying the second generation of activity theory for disaster management also highlighted specific areas of consensus, collaborations, and contradictions as experienced by emergency managers and responders in the UK (Mishra et al. 2011). It is also observed that various tensions and contradictions in the systems, such as the use of various gadgets and gaps in skills and capacity building, though making them unstable, also triggered innovations (*ibid*).

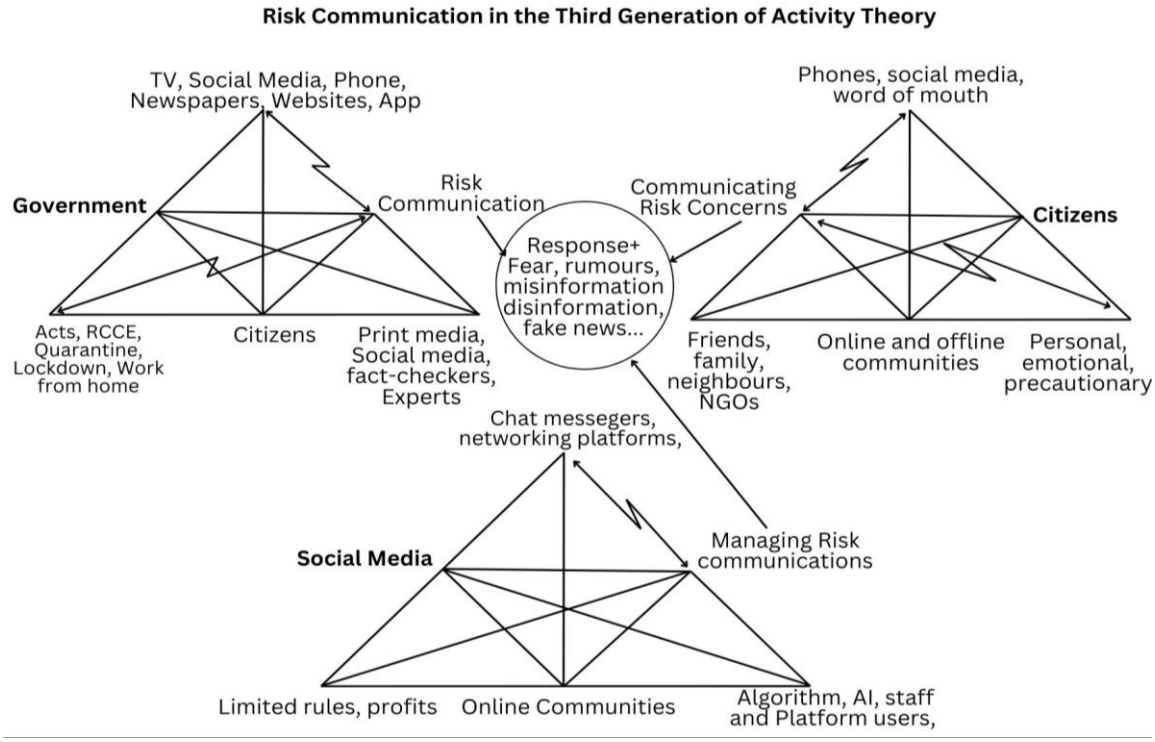
The third generation of activity theory, Risk Communication & Infodemic

In contrast to the second generation of activity theory, the third generation looked into multiple activity systems. With the emergence of social media, many HCI studies emphasised the need for the third generation of activity theory, which could also examine interactions of multiple systems to solve challenging, complex issues. Risk communication in the post-2015 period can be assessed more appropriately using this model.

The risk communication in this phase not only evolved with the Sendai Framework for Disaster Risk Reduction (2015-2030) but also with several other frameworks and policies that were developed to address Climate Change, health risks and those concerning information technology. The key challenges of the infodemic didn't come to the surface until COVID-19 risk

communication in 2020. The engagement and communication of risks during the pandemic broke the notion of a centralised risk communication channel. With the participation of multiple agencies and citizens on social media, three broad systems emerged that not only communicated risks but also became the prime responders to the infodemic (Figure 6.3).

Figure 6.3: Risk Communication in the Third Generation of Activity Theory



Activity System 1—Government: The government, as the key stakeholder, initiated COVID-19 risk communication in 2020. The objective of the risk communication was to prepare the communities for the pandemic and their effective response to the situation. For this, various tools, rules, and communities were engaged with defined boundaries and division of labour (Table 6.1).

Governments with access to most resources use digital and physical tools, including laws, acts, social media, print media, apps, and different means of communication such as phone or video conferencing. These tools were used to communicate risks and manage responses. An official from Bangladesh mentioned that during the pandemic:

"We conducted many of our activities in Google Meet and other video conferencing tools to mitigate the mobility issues during critical situations through these technologies."

The officials also looked into the language and contextualisation of the message, so that people could use it well. According to another official from India:

"*We try to make sure to disseminate the information in a way that people can understand the information so that they can act on it. We prepare the messages keeping these considerations in mind. This is how we create messages and communicate messages. Then, we give them to*

the media in letters and send messages to people's mobiles through the mobile operators we have, asking them to send them to the masses for the greater benefit of the people."

Table 6.1: Description of the Nodes within the Government Risk Communication System

Nodes	Description
Subject	Government as the key stakeholder
Object	Communication of risk and response
Tools	Online and offline tools (TV, social media, phone, newspapers, websites, apps, audio and video conferencing)
Rules	Acts, RCCE, Quarantine, Lockdown, Work from home
Community	WHO, UN, Govt bodies, emergency managers, police, mainstream media; public healthcare institutions, NGOs, INGOs, Influencers
Division of Labour	Ministry of Health, Print media, Social media, fact-checkers, Experts

Effective risk communication also requires division of labour within and outside government institutions, which also requires collaborations and guidelines. A stakeholder also mentioned the importance of the strategies needed to work with different teams:

"…emergency preparedness team, a surveillance team, so that whatever happens can be addressed by that team. Another thing is having a spokesperson or a single point of contact so that they can accommodate and disseminate any new information that comes our way without creating any discrepancies."

Collaborations were an essential element of risk communication within and across organisations. It was paramount that different departments and organisations work together. A stakeholder emphasised the collaboration by saying:

"We've always worked in partnership with all other organisations."

Another mentioned that:

"It's mainly done through the work of the community engagement officer. And so we have very close contact with civil society organisations with the faith leaders, you know, religious institutions and again,"

At the same time, some tensions and contradictions were also observed by a few respondents.

According to a stakeholder:

"The actions of the authorities are very restricted during any political or geopolitical crisis. They do not actually manage or handle the situation in a similar way. They are rather more cautious and puts much more restriction in the flow of information during these types of things."

Another stakeholder also noted that some officials did not follow the rules, which also created and even increased trust issues between the government and the public. Another stakeholder mentioned that:

"There is no policy at all. You need a policy for every crisis, like rescue, relief, and treatment. We must have a policy, a concrete policy."

Due to the environment of high uncertainty, gaps in communication, tension and contradictions, risk communication met with the scepticism and concerns of the citizen, which when shared widely through social media, also contributed to the infodemic.

The government was held responsible for every communication and managing infodemic, which is apparent in the sharing of a stakeholder, who mentioned that:

"… the government is the sole agent and the responsible figure to manage the infodemic"

This perception primarily emerges due to historical and cultural beliefs in the government as the protector of those governed. However, managing the infodemic was not as straightforward as risk communication. A stakeholder mentioned that:

"Even something coming from the government side was misinterpreted by so many channels, websites, and YouTubers. So, no doubt, it has created a lot of fuss."

Even though efforts were made to address various issues, gaps continued. According to another stakeholder:

"The way that our activities are split is between three value streams: risk communication, community engagement, and infodemic management. But there is, of course, a lot of overlap between the three, and we work to support mainly Member States with capacity building.

Activity System 2—Citizens: Citizens, as the first responders to any disaster, also actively participated in spreading awareness about risk and response. They shared not only the risks but also their concerns, questions, vulnerability, capacities, and response options.

Table 6.2: Description of the Nodes within the Citizen Risk Communication System

Nodes	Description
Subject	Citizens as key stakeholders
Object	Communicating Risk Concerns, questions, vulnerability, capacities and response options
Tools	Phones, social media, word of mouth
Rules	Personal, emotional, precautionary
Community	Online and offline communities
Division of Labour	Friends, family, neighbours, NGOs, Influencers

Citizens used physical and digital tools to share their concerns, questions, vulnerabilities, needs, capacities, and possible response options to help their family, friends, or neighbours. With the rise of social media, they shared their information with online and offline communities.

While there were not many clearly defined rules around risk communication, the outreach of citizens' communications was amplified by social media due to their genuine personal concerns, emotional and precautionary messages that they shared to seek help for themselves or others.

In the process, they became both creator and victim of the infodemic. According to a stakeholder, citizens are:

"Those who consume Facebook and all types of social media more often where the information is not authenticated, and rather fabricated and exaggerated."

Citizens and communities collaborated with the government, various agencies and social media. Various stakeholders mentioned their work with communities that were receptive to the communication. In the words of a stakeholder:

"We involve both communities and the public. The health workers we have are going directly to the communities. They have communities assigned to them. They go around every month visiting every house in that community..."

Contradictions were also observed by the stakeholders. A few stakeholders believed that literacy and gender played an essential role. Others believed that the infodemic created challenges for people from all sectors, but in different ways. According to a stakeholder:

"..infodemic distracts people from receiving the different programs in a positive way."

Activity System 3: Social Media: During the pandemic, social media emerged as the third important stakeholder. While it is blamed for the spread of the infodemic, it also helped enhance the outreach of risk communication and fact-checking. Most key stakeholders mentioned using social media for information dissemination before, during, and after COVID-19.

Table 6.3: Description of the Nodes within the Social Media Risk Communication System

Nodes	Description
Subject	Social Media as key stakeholder
Object	Managing Risk communications
Tools	Chat messengers, networking platforms, the Internet, phones
Rules	Limited rules, profits
Community	Online communities including governments, educational and medical institutions, NGOs, INGOs, citizens
Division of Labour	Algorithm, AI, staff and Platform users,

There was a lot of information in all three countries that was disseminated through social media and propagated using those media. According to a stakeholder:

"Social media, TV, newspaper, friends and neighbours all contributed to the spread. Because those were the communication channels during that time ..."

In contrast to citizens, who shared their communications freely, there were limited information-sharing rules on social media. It promoted the sharing of information, which was engaging rather than accurate. Stakeholders found that these rules contributed to the infodemic. According to a stakeholder:

"It's not only the social media regulations that are the weak link in the information ecosystem, but also there are a lot of tabloids and other entities of the digital world that cause the infodemic through disinformation and false news."

Social media also collaborated with governments. According to a stakeholder:

"Information was created, information was sent across on social media, whether it was Facebook, Twitter,…."

Another mentioned that as these collaborations are profit-based, at times, social media is used to generate fake funding. According to a stakeholder:

"Say, you had some sort of natural disaster. You would see this spike of media attention, and then within about 48 hours, you start to see it either dropping off, and then more negative media stories come. Now we have to also anticipate that within about 24- 48 hours, you're also

going to see information that's incorrect. And that could be impacting people both in the disaster zone, but relatives who are worried about friends and family, who to contact will anticipate? Fake fundraising."

Some contradictions were also observed. An official from India, in this regard, summed up the scenario succinctly while talking about the vaccine hesitancy in the country:

"If I'm consuming a lot of information which is giving me conflicting opinion about what vaccines or certain drugs can do to my body, naturally, it erodes my trust in the healthcare system. "

According to another stakeholder:

"But now with the social media and the internet, the information has exploded. So the pandemic is actually an infodemic. Your senses are overloaded with lots of information, content decree information, information which is traversing from sublime to ridiculous. So… I think it is an information pandemic,.. which the society is facing globally."

While all three systems were interacting with each other for risk communication, gaps and overlaps in the information created fear, confusion and a chaotic situation, which resulted in an infodemic. Governments, social media and citizens eventually became more aware of the issue of misinformation, and with the help of fact-checking and awareness, the COVID-19 infodemic could be contained to a certain extent. However, the issue of infodemic didn't end, and it was here to stay, as the data shows in section 4. It requires a different approach to address the growing complexity of risk communication and the infodemic.

The fourth generation of activity theory, Post-COVID-19 Risk Communication & Governance

The data shows that the emerging issue is far too complex to be controlled with the risk communication addressing only the hazard in focus.

According to a stakeholder:

"The user number is in the billions now, and then there is an unthinkable amount of information posted daily. How many to screen? It's not possible, right? Also, even if you screen some manually, who are you to decide whether the information should be filtered out? It varies from country to country, people to people, and religion to religion, and there are many more divides. What's wrong for me is the best version of truth according to other people's background and context."

Another stakeholder added that:

"Why is an infodemic happening? Because there is a vacuum of information. People want to know some stuff. Yeah, if you filled it with the correct and positive stuff, it would push out the negative, right? But if you don't bother, you sit there and complain that you know, people are filling it with wrong things."

The problem is further compounded by AI and diminishing attention span. According to a stakeholder:

"See, it is leading to two things. One, it is disintegrating your attention span. Distraction was always a problem. If you look back in history, 2000 years ago, the Stoic philosophers of Rome, Seneca and all that, they were also saying people are distracted. So it's not a new phenomenon. It has been happening since time immemorial. But this time, the disintegration

of attention is complete. People cannot concentrate for more than 10 seconds. They can't. And this is leading to all sorts of cognitive problems, learning issues. So that is part one. Part two, what is happening is the algorithm realises what your biases and prejudices are. It is feeding you with the same kind of content day in and day out."

The growing complexity of the infodemic in the post-COVID-19 phase can be addressed and understood better with the fourth generation of activity theory. It looks into multiple systems that interact and increasingly expand their learning to address the complex issue (Figure 6.4).

Figure 6.4: Risk Communication in the Fourth Generation of Activity Theory

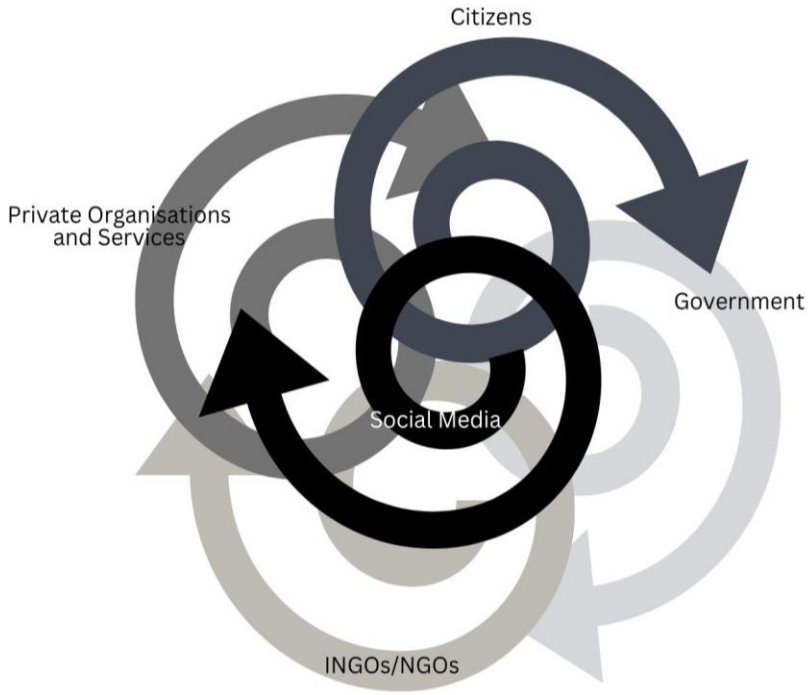


Table 6.4: Description of the Nodes within the fourth generation of activity system

Nodes	Description
Government	Risk communication and infodemic policy, resources and integration
NGOs and INGOs	Capacity Building, Contextualising and implementing Risk communications
Private organisations	Social listening, capacity building, collaboration and learning
Citizens	Actively communicating and participating in risk communication and infodemic, digital literacy, expansive learning
Social Media	Terms and conditions, profits, AI and risk communication

Collaboration has become a necessity. The post-COVID-19 risk communication and governance requires all organisations to work together to resolve the issue. According to a stakeholder:

"The agencies here cannot work independently. They are only independent in papers, but when the fieldwork necessities occur, nobody moves."

Various incidents of expansive learning were recorded in the stakeholders' interviews. According to a stakeholder:

"Due to the exposure to different types of infodemic, people now have adjusted their risk communication mechanisms a bit. Like, in the health sector, we emphasise more to communicate risk collaboratively."

It is also observed for organisations. According to another stakeholder:

We start social listening. What happens if we detect some things? We create a report. So we have these things set up, how do we support Member States if somebody reaches out to us with requests for help, what can we provide them? And we have a list of the capacity building offers, so we can go to the country and train their officers."

It was identified that different stakeholders (Government officials/Platform providers/NGOs/INGOs) need to work with the community for capacity building and with each other in partnership. Collaboration is very much needed at the ground and upper levels, which is also emphasised in SDG 17 on partnership for the goals. Although collaboration is pertinent for addressing the infodemic for risk communication, several contradictions emerged from our data, which will be delineated in the section below.

Contradictions/tensions among different elements of the activity system

The stakeholders also observed some tensions and contradictions that highlight the complexity of seeking simple solutions, such as rules and regulations for social media or political interests. With the increasing data collection and AI, the issues relating to its use and misuse are even more complex. According to a stakeholder:

"…..you could call it data colonialism or however you want is like this decreased, constantly decreasing access to data that researchers or journalists and fact checkers or institutions like ours have access to like especially now with also with the you know new AI revolution the platforms have put even more blocks in having access to any data for the public good. So if you, let's say, if you want to do social listening, you need right now to pay a ton of money to an intermediary who goes and pays more money to the platforms to get access to this data."

Tensions and contradictions also create resistance to possible solutions. An example of this was cited by a stakeholder:

"Indian government was ready to come up with a policy to manage social media. But there was a lot of pushback from the opposition, academia, and civil society. So they backed down."

The pushback, it seems, is because of the perceived risks as pointed below:

"I feel like the issue of internet regulation is a very risky place to take a stand. I don't like to take a stand on it because I'm not sure what it will be used for. Because what I have seen time and time again that under a guise of safety and regulation, what it becomes is a way of censorship of genuine voices. So on the one hand, we all understand that there should be quality regulation of this shit that is going out. On the other hand, how can you prevent it becoming a censorship tool? And in a democracy, to have free, fair voices is very important, right? It's the only thing left to us"

These issues are further exacerbated by the use of Artificial Intelligence (AI). Stakeholders also observed that people are not able to distinguish between real content and content generated by AI, which further boosts the infodemic:

To conclude, the increasing number of key stakeholders requires a more integrated approach to address the infodemic and the disaster risk communication in the post-COVID-19 phase. It is essential as the two shared a very intricate relationship, as seen in chapter 4. While misinformation and disinformation were always present, now they affect billions of people to many natural and social hazards. So it cannot be ignored or sidelined. Further research is required to build the systematic involvement of multi-stakeholders to avoid and address the infodemic without compromising the urgency or sensitivity of the disaster risk communication. Besides, while social media could be a good source of data collection, especially for social listening, there is a need for clear policies and guidelines for the digital platform providers.

7.

Conclusion and Recommendations

The infodemic emerged as a prominent hazard of the 21st century, augmenting the cumulative damages from various disasters. However, the nature and impact of the infodemic varied for different hazards and across countries. Several studies have looked into the issue of infodemic in the context of public health and health emergencies. Thus, a gap is observed for studies that evaluate it from the perspective of disaster risk communication, which triggers and is impacted by the infodemic. This study aimed to partially fill this gap by assessing the infodemic during and after COVID-19 in three selected countries: Bangladesh, India and the United Kingdom. Its objective included mapping the state of infodemic, identifying key challenges and best practices, and reviewing and evaluating the existing policies to characterise gaps and find pathways for future disaster risk communication.

The study adopted a mixed-method approach by using quantitative and qualitative data and methods. It used a three-stage research method to achieve its objective within the given period of one year. Apart from the comprehensive literature review, the study also assessed the infodemic from the leading national newspapers of each country and the perspective of key stakeholders. Accordingly, three national newspapers with the highest readership, including the Daily Star from Bangladesh, the Times of India from India and Metro from the United Kingdom, were chosen to extract the data. The study used NLP techniques to extract and assess the infodemic related content published from 1 January 2020 to 30th June 2021. Besides, 105 key stakeholders from the selected three countries, including fifteen international experts, were interviewed to understand the ground realities, management challenges, and best practices observed across the three countries. These stakeholders broadly came from the government, non-government, international organisations, media, education, and private organisations. The findings highlight varied understandings, impacts and practices of the infodemic in general and for risk communication in particular.

The literature review of the studies focusing on infodemic not only brought forward the trends of excessive focus on health emergencies but also highlighted some overlaps and differences in the research focus in Bangladesh, India and the United Kingdom. In Bangladesh, the impacts of the infodemic on mental health, vaccination hesitancy, and the effects of literacy and education attracted the research focus. The literature on India focused more on digital literacy, user sentiments and behaviour, the spread of fake news, gaps and strategies of public engagement. In the United Kingdom, on the other hand, studies assessed the presence of misinformation in public space, the interaction of online users with infodemic related content, and physical and psychological solutions to address the issue. To understand infodemic in risk communication governance, another set of studies was evaluated irrespective of their place of focus. These studies not only highlighted the presence of the digital divide and lack of trust but also the communication crisis that emerged from a limited understanding of the issue. Differences were also observed in the presence and focus of policies on various health and climate crises, leaving a broad gap to be filled to address the infodemic in risk communication governance.

As most studies evaluated infodemic in the context of public health, a need is also recognised for a broader definition applicable to risk communication. The study thus defined infodemic

as a hazardous situation arising from the rapid intermixing of risk communication with distorted, erroneous, fake, inaccurate, and unreliable information due to excessive and unregulated sharing of public concerns, impacts and fear-based responses through different means of online and offline communication in the environment of heightened uncertainty following a natural, social or health hazard at the local, national or global scale. It is deemed essential to have a broad definition to accommodate various hazards with growing uncertainty due to climate change, which would require effective risk communication.

Different models were also assessed for their applicability in addressing infodemic and disaster risk communication. Most models addressed the focused problem in detail, and even though they could be applied, there were limitations in addressing the two together thoroughly and consistently. Therefore, the activity theory was chosen, which has been previously used as an analytical tool to evaluate complex issues. Different generations of activity theory not only help to understand the problems of risk communication and infodemic but also their evolution in time.

Infodemic was mapped using NLP techniques to process the vast data from the three national newspapers for four and a half years. In total 1,274,979 news items were extracted using 22 infodemic keywords, which were then cleaned and processed to assess the state and characteristics of the Infodemic across the three countries. The mapping of infodemic related content in the three countries not only depicts an increase in the quantity and variety of infodemic related content but also highlights its dominant concentration in large urban centres. It also shows that hazard occurrence, along with suggested response measures affecting a broader population, incidents of political significance and elections accompanied most infodemic peaks in all three countries.

The data also showed a rise in the infodemic related content over time, contrary to the common perception that it was due to and during COVID-19. It is further testified in the recent disinformation events that cause significant disruptions, protests, and riots in the three countries. The proportion of the infodemic related content also matched the size of the country and news consumption, which is highest in India, followed by the United Kingdom and Bangladesh. Among various keywords selected to search the infodemic, a few dominated the content across all three countries than others, such as opinion, blame, and conspiracy. In contrast, a few keywords outnumbered others in specific countries, such as disinformation in Bangladesh, hate speech in India and rumours and conspiracy theories in the United Kingdom.

The spatial distribution of selected keywords in these countries showed a very high concentration in three national capitals, including Delhi, Dhaka, and London, which are political hubs and megacities offering a fertile ground for the infodemic. A further assessment showed that in the UK, other than capital, high infodemic related contents distributions were limited to urban areas, while in Bangladesh, along with major metropolitan areas, infodemic was also found high in areas of high vulnerability such as Cox Bazar, which is inhabited by refugee community and thus has greater exposure to flood and low infrastructural resilience. In India, more areas were affected by the infodemic due to the high population and use of technology. Apart from the capital, states including West Bengal and Goa had a very high infodemic due to political events and hazard occurrences. All the states with other megacities reported a medium infodemic. Most infodemic events were broadly distributed towards densely populated areas of political significance and high vulnerability. The rural areas with less population and less political significance had limited reporting of infodemic related

contents. Besides, low infodemic in conflict areas may also be attributed to limited media reporting.

The stakeholders' perceptions of the infodemic varied within and across countries. Most stakeholders were well aware of the issues, except a few who heard it for the first time or had not experienced it personally. For a more significant proportion of stakeholders, infodemic mainly meant misinformation, information overload or something related to the pandemic. Only six per cent of stakeholders also mentioned risk communication and trust in their definitions. Stakeholder interviews also highlighted various infodemic related contents that dominated the three countries. For example, while most stakeholders agreed with the prevalence of rumours in Bangladesh, nearly seventy per cent of stakeholders in India observed rumours, fake news, viral lies, pseudoscience and myth. At the same time, an equal proportion of witnessed rumours, conspiracy theories, fake news, misinformation, myths, pseudoscience, disinformation and viral lies in the UK. A more significant proportion of stakeholders found the infodemic high to very high in India and the UK, while more stakeholders found it medium-high in Bangladesh.

The nature of the impacts observed also varied across the three countries. Whereas more stakeholders observed distrust in government and inflation in Bangladesh, stress, anxiety, depression and media fatigue were more common in India, and stress and anxiety, depression and media fatigue were also associated with the polarisation of views in the UK. In contrast, a significant proportion of stakeholders found social media to be main cause of infodemic along with few other factors that varied across the three countries, which included lack of education, fact-checking, ignorance and digital literacy in Bangladesh, lack of right information, political reason, and lack of official channels in India, while opinion, crisis and fear in the UK.

Regarding infodemic management, most stakeholders agreed that WHO and international organisations managed the situation well. A broad consensus is also observed for social media, which played an active role in spreading the infodemic and poorly handled the situation. Stakeholders across all three countries found that their governments somehow managed the problem, and the public could have done better. At the organisational level, more stakeholders reported witnessing the infodemic in the UK, followed by Bangladesh and India, which were managed with organisational rules and fixed communication channels.

The stakeholders also mentioned various challenges that made it difficult to control the infodemic across the three countries. These included: 1) lack of preparedness to address the infodemic in risk communication; 2) lack of effective risk communication channel; 3) unclear social media, AI and IT regulations; 4) inadequate capacity-building and skills for managing the infodemic; 5) lack of awareness; 6) complex vulnerability scenario with exiting inequalities and digital divide; 7) Increasing distrust in the government, governing bodies and society; 8) hype, propaganda and attention Economy; 9) amplified risk of social disaster due to misinformation; and 10) information overload and media fatigue.

The stakeholders also identified various best practices that helped them address the infodemic. They are also broadly classified into 1) a rise of fact-checking; 2) digital tools for rapid risk communication and surveillance; 3) community engagement; 4) enhanced participation of experts and experienced professionals; 5) coordination and cooperation; 6) collaborations; 7) contextualising the risk communication; 8) having reliable information sources and guidelines; 9) clear, transparent and timely risk communication; and 10) having clear policies for disinformation

A clear gap is also observed in the risk communication policy, policy implementation, and awareness of policies applied at different levels across the three countries. This suggests a need for a clear policy with adequate structures for its awareness and implementation for effective risk communication and governance, which successfully manages the infodemic.

When risk communication is assessed using the lens of activity theory, it highlights the evolution in the nature of the risk communication governance system over time. The added complexities in the tools, channels, rules and communities of risk communication also created gaps in information needs and supply, giving way to infodemic in the third generation, which has strengthened with the collaborations across heterogeneous organisations for risk communication and disinformation. This complexity has further been enhanced with the emergence of AI, which makes it even challenging to detect misinformation circulating on the Internet.

The study thus brought forward some critical issues that need the attention of researchers, policymakers, media, and other stakeholders interested in and affected by the problem of the infodemic. The study's findings should be seen in light of the issue's fixed timeframe and growing complexity. As per the study design, the data collection was conducted from January 2020 to June 2024, while many severe disinformation events, particularly in Bangladesh and the United Kingdom, happened after that. However, the stakeholder interviews capture some of these incidents and related perspectives. The newspaper analysis also covered only the leading newspapers published in English, leaving out the scope to assess regional and local infodemic related content that may have appeared in the local languages. The political nature of the issue also affected the key stakeholders' participation, limiting the findings to those who volunteered to participate and had some background knowledge about the problem. The study also did not cover the perspective of the local population, which may have brought forward some issues that may not have appeared in the limited sample of stakeholder interviews.

Recommendations:

Based on the key findings of the study, the following recommendations are made for effective risk communication governance:

1. A holistic and comprehensive risk communication policy that not only addresses details of various hazards but also caters to public information needs and potential causes of infodemic.
2. A transparent, accountable and well-defined social media policy for responsible sharing and outreach of risk communication
3. A preparatory framework that allows misinformation detection, observation, and monitoring with digital and physical services.
4. Clearly defined accountabilities, rules and regulations for disinformation shared by individuals, parties, and platforms at the time of crisis or hazard.
5. Linking risk communication, infodemic, and social media policies with crisis, emergency and disaster management plans and teams at the local, national and global scale.
6. A dedicated online and offline space, channel and team for risk communication with interdisciplinary risk communication experts to address public and inter-sectoral risk communication.

7. Communicating risk in a way that ensures safety with adequate measures and response options instead of creating fear.
8. Emergency response facilities should also include provisions for mental health support services.
9. Capacity building and training for risk communication managers to address the infodemic and public information needs.
10. Creating feedback loops for correcting disinformation at different levels online and offline.
11. The multi-hazard early warning system should be linked with risk communication and mainstreamed so that people can communicate and fact-check for critical support services.
12. Further research in AI, risk communication and specialised cases of infodemic for emerging complexities and solutions can be integrated for effective risk communication.
13. Ensuring the representation of marginal voices from the general public when risk communication pathways are formulated.

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Glossary

5G Conspiracy Theories: False beliefs associating 5G technology with harmful effects, including links to the COVID-19 pandemic.

Digital Bangladesh: A government initiative in Bangladesh aimed at digital transformation and increasing technology use.

Disinformation: False information deliberately spread to deceive or manipulate.

Fake News: False stories are presented as news, often to mislead or entertain.

Governance: The frameworks, policies, and practices used to manage and guide public responses during crises.

Government Agencies: National-level bodies responsible for policy formulation and implementation during crises.

Infodemic: Excessive or hazardous information, including misinformation, spreading during a crisis, such as the COVID-19 pandemic, causing confusion and undermining public health efforts.

Pandemic: A global outbreak of a disease affecting a large proportion of the population.

Misinformation: False or misleading information spread regardless of intent to deceive.

Natural Language Processing (NLP): A field of artificial intelligence focused on the interaction between computers and human language.

Non-Governmental Organizations (NGOs): Independent organizations working to address social, environmental, and health challenges.

Paris Agreement: An international treaty aimed at combating climate change by limiting global warming.

Risk Communication: The process of sharing information about potential hazards and risks to enable informed decision-making by individuals and communities.

Sustainable Development Goals (SDGs): A global agenda set by the United Nations to address pressing issues like poverty, inequality, and climate change.

Variants: Mutations of a virus that can affect transmissibility, severity, and vaccine effectiveness.

Vaccine Hesitancy: Reluctance or refusal to vaccinate despite the availability of vaccines.

Visualization: The graphical representation of data for easy understanding and interpretation.

United Nations: An intergovernmental organization working globally on peace, development, and humanitarian efforts.

Web Scraping: The process of extracting data from websites.

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INDIA: 2nd Floor, West Wing ISID Complex, 4,
Vasant Kunj Institutional Area, New Delhi-110070, India

EUROPE: 63 Boulevard François Mitterrand - CS 50320,
63009 Clermont-Ferrand Cedex, France

US: Clifton Larson Allen LLP, 901 N. Glebe Road,
Suite 200, Arlington, VA 22203, USA