

Driving citizen engagement through Twitter: The case of COVID-19 vaccination drive in India

Abstract

Effective crisis communication is essential to efficiently handle the uncertainty and anxiousness of citizens during the COVID-19 crisis. Government Twitter handles are an excellent platform for faster information dissemination and engaging citizens. While most government ministries actively use Twitter, limited attention is given to its modus operandi. Using data scraped from the official Twitter handle of 'The Ministry of Health and Family Welfare' (MOHFW) of India, the current study examines the effect of the content characteristics, including content type and media type, on citizen engagement measured as tweet likes and retweets. The findings are based on 3742 tweets from MOHFW, recording more than 4.06 million likes and 1.23 million retweets over the initial six months of the largest COVID-19 vaccination drive. Results show that content-sharing guidance for stakeholders gained the maximum engagement, while the latest news about the COVID-19 crisis resulted in the least engagement. Photos gained maximum engagement, while statuses resulted in the least engagement. The results illuminate the textual features of the Government's Twitter communication and will enable policymakers to manage their social media content strategy diligently.

Keywords: citizen engagement, content strategy, crisis management, Government, media strategy, Twitter

1. Introduction

Over the last century, vaccination has been recognised as a potent weapon for preventing various diseases and pandemics affecting human beings (Rémy, Zöllner, & Heckmann, 2015). According to estimates, about 3 million deaths are prevented annually due to vaccination programs. Life-threatening diseases such as smallpox, polio, and Haemophilus influenza type B (Hib), among others, have been eliminated from large parts of the world where national governments and other agencies have successfully run vaccination programs.

The crucial role of a rapid rollout of a global vaccination program in the war against the newly emerged, currently ongoing COVID-19 pandemic, especially in developing countries such as India, cannot be overstated. In the long run, such deadly pandemics are brought under control by achieving herd immunity in the general population. Herd immunity can only be reached if a significant percentage of the target population receives vaccination or builds antibodies through infection by the disease. Suppose a large proportion of the population gets infected in a pandemic. In that case, the overall death count becomes unacceptably large even if the disease's fatality rate is low to moderate. Given this stark scenario, vaccinations must be rolled out rapidly to cover the vulnerable population and minimise human misery and death. This is especially true in developing countries with large populations, such as India, South Africa, and Brazil. However, lack of awareness, misinformation, fear of adverse effects, a general distrust of the Government, and the effect of anti-vaccination campaigns by various social, political and religious groups have been detrimental to achieving a faster immunisation rate (Scannell et al., 2021).

To overcome these challenges, governments need to strategise and implement effective policies for public health crisis management (Coombs, 2007). An integral dimension of such crisis management is effective communication with citizens. Effective engagement with citizens helps the Government successfully address and overcome the crisis and thereby maintain its reputation (Bundy et al., 2017). To get the citizens to behave appropriately in a public health crisis, governments need to work towards building a trusted relationship with their citizens through effective

citizen engagement that focuses beyond simple information exchange (Chen et al., 2020).

The increasing importance of social media as a medium of interactive government-citizen communication has been well-recognised by governments and governmental agencies (Bonson, Perea, & Bednárová, 2019). Social media is critical in disseminating public health information (Neely, Eldredge, & Sanders, 2021). Specifically, the public extensively uses social media platforms such as Twitter and Facebook to stay informed during crises (Lachlan et al., 2016). The information received on these platforms is not always official and often intermixed with false information (Chou et al., 2018). Such misinformation is referred to as an 'infodemic'. It can "lead to poor observance of public health measures, thus reducing their effectiveness and endangering a government's ability to stop the pandemic" (WHO, 2020). To combat the ill effects caused by the infodemic, governments actively communicate essential health information through their official sources.

Although the ill effects of misinformation have always been present to some extent, the global extent of the COVID-19 pandemic has underscored the importance of timely and appropriate information dissemination to the public through social media platforms (Kouzy et al., 2020). With government-driven social media campaigns to persuade public vaccination taking precedence during COVID-19, it becomes imperative to explore the factors affecting the effectiveness of such campaigns. Citizen engagement through government use of social media, especially in developing countries such as India, has been effective in scotching rumours, providing guidance and timely and appropriate information (Chatfield & Reddick, 2018), and building trust. The effectiveness of any social media campaign is reflected in the engagement it generates with the intended target audience, such as consumers, citizens, or the public.

Governments and governmental agencies are, therefore, focused on effectively utilising social media channels to disseminate information about the COVID-19 pandemic situation and the rollout of the anti-COVID-19 vaccination programs. The lack of trust in the Government, low perceived severity of the disease, and concern

about vaccine safety are the major factors affecting vaccine hesitancy (Salmon et al., 2005).

Given its large population, geographical spread, and relatively poor public infrastructure, the Indian Government has understood the importance of effectively utilising social media platforms to communicate with the general public, especially during a crisis. The Indian Government's social media campaigns in this regard have multiple objectives¹. First, it wishes to inform the population about the COVID-19 pandemic and its progress/status. Second, it intends to spread public awareness about what measures individuals can take to minimise their risk of infection. Third, it aims to encourage the public to get vaccinated. Finally, the Government intends to showcase its achievements in the fight against the COVID-19 pandemic. In this regard, crisis communication literature has primarily focused on image restoration by the Government through leadership efforts (Benoit & Henson, 2009; Kaur, Verma, & Otoo, 2021) or public organisations efforts (MA et al., 2021; Olsson, 2014). Despite its societal, policy and public-interest implications, research has not sufficiently explored the factors affecting the effectiveness of government-driven social media campaigns that focus on public health issues.

Extant research on crisis communication has highlighted many factors, such as content characteristics and the frequency of content shared, that affect the success of social media campaigns (Mori et al., 2021; Puri et al., 2020). The content has been studied based on actionable information and affective orientation (Lachlan et al., 2016). Research has explored the influence of content type based on messages emphasising the possible losses against the gains for not following a prescribed behaviour (Lee & Cho, 2021). Informative content detailing the ground reality during a crisis, the latest news and the efficacy of the Government in handling the crisis gained increased engagement among citizens (Chen et al., 2020; Xie et al., 2017).

¹ <https://www.mohfw.gov.in/pdf/Covid19CommunicationStrategy2020.pdf>

Despite the studies mentioned above, existing literature lacks research into how different content types affect citizen engagement during a public health crisis. Specifically, research warrants the need to study governments' operational use of social media to ensure successful vaccination drives (Puri et al., 2020).

The effectiveness of any social media communication is understood from the engagement it generates with the intended target audience, such as consumers, fans, or the public. In this direction, the current study attempts to understand the effectiveness of the Government's social media campaigns for communicating COVID-19 vaccine-related information to speed up the immunisation rate among citizens. This study aims to provide a nuanced understanding of online citizen engagement on vaccine-related information by examining the relationship between government social media communication and citizen online engagement behaviour. The study is grounded in the widely used uses and gratifications theory (UGT). It contributes to the public administration and citizen engagement literature by detailing the effect of content type and media type of the Government's social media messages on citizen engagement.

We aim to address the gap in the extant literature by studying citizen engagement on the official Twitter handle of the Ministry of Health and Family Welfare (MOHFW), Government of India. India is a case of interest as it recorded the highest number of COVID-19 infections in the world. It also responded positively through the world's largest vaccination drive to the COVID-19 pandemic (WHO, 2022). In 2021, in India, the number of household internet users increased nearly three times compared to the previous year (Indiatimes, 2021). Further, internet usage increased by over 50% during the COVID-19 lockdown (MicroSave, 2020). Also, social media usage has surged by 87% since the outbreak of the COVID-19 pandemic in India (Singh, Dixit, & Joshi, 2020). These factors provided us with highly appropriate conditions for our empirical analysis. We investigated 3742 tweets shared on the Indian Government's official handle that had recorded over 4.29 million impressions over six months in 2021. The empirical study sequentially conducts a content analysis of Twitter posts and quantitative testing of the hypothesised relationships among the variables of interest using Bayesian inference with Markov Chain Monte Carlo (MCMC) analysis.

The rest of the paper is organised as follows. First, we introduce the key concepts of our study and provide a focused review of relevant literature, followed by developing our hypotheses. Second, we detail our research methodology, showcase our results, and discuss our findings. Finally, we share our study's policy, practice, research implications and limitations.

2. Literature review

2.1. Government crisis communication

Crises such as global pandemics are dire circumstances that necessitate immediate governmental actions to manage social, institutional and public interests (Rosenthal, Hart, & Kouzmin, 1991). One crucial factor affecting the Government's attempt to manage a crisis (and minimise the damages inflicted therefrom) is appropriate, effective and timely crisis communication with the relevant stakeholders (Elbanna et al., 2019).

Timely, frequent and effective communication helps reduce stakeholder scepticism that may affect the Government's reputation (Sanjeev, Pandey, & Santosh, 2021). The task of crisis communication involves both crisis knowledge management and stakeholder reaction management (Coombs, 2009). Crisis knowledge management deals with creating public responses to a crisis. Stakeholder reaction management focuses on influencing perception about the crisis, the Government, and its response. Thus, governments continually collect, process, and disseminate relevant information during crises to their citizens.

The citizens' information needs are different during different stages of a crisis, namely during pre-crisis, crisis, and post-crisis stages (Coombs, 2007). During the pre-crisis stage, the focus is on collecting information related to the impending crisis, risk assessment, and equipping the crisis-response team. During the crisis stage, the Government focuses on the dissemination of relevant information to the relevant stakeholders to elicit appropriate behavioural responses. In the post-crisis stage, the focus shifts towards reviewing the Government's crisis handling. Government crisis communication aims to achieve three strategic objectives: 'instructing' information to

handle the crisis, 'adjusting' information to support psychologically, and 'repairing' information to minimise reputational loss (Sturges, 1994).

Extant literature offers numerous frameworks and models on the significance of crisis communication. Image restoration theory (IRT) proposes strategies to protect the image during a crisis (Benoit, 2014). Situational crisis communication theory (SCCT), based on attribution theory, is widely applied in crisis communication. It highlights that, in a crisis, timely information dissemination and instructions help the public (Coombs & Holladay, 2012). SCCT posits that citizens attribute the responsibility for managing a public health crisis to government institutions. Thus, it becomes incumbent on governments to effectively manage stakeholder perception during a crisis.

The social-mediated crisis communication (SMCC) framework details the direct and indirect dissemination of information across digital media in an emergency (Liu, Austin, & Jin, 2011). The SMCC framework divides citizens into influencers, followers, and inactive members to detail the dissemination of information (Liu et al., 2020). The integrated crisis mapping model (ICM) details the stakeholders' emotional changes, namely anger/anxiety and sadness/freight, in a crisis (Jin, Pang, & Cameron, 2012). These crisis communication models deliver directions to handle stakeholder emotions and behaviours effectively and protect governmental/ institutional reputations through effective crisis management.

2.2. Citizen engagement through government social media communication

The recent rise of social media communication has created an increased expectation (among citizens) of getting constantly updated content. The need for frequent information updates and instant gratification is even more heightened during crises (Ford, 2013). Government agencies cater to citizens' needs by using social media platforms for crisis communication (Chatfield & Reddick, 2018). Government agencies regularly share crisis-related content on official platforms to guide citizens, quash rumours, build social cohesion, and encourage good citizen behaviours. For instance, the Ministry of Information and Broadcasting, Government of India set up a dedicated Twitter account named “#IndiaFightsCorona” with the handle @COVIDnewsbyMIB to

share authentic COVID-19 crisis-related information and updates with Indian citizens (The Economic Times, 2020).

Similarly, the official Sina Weibo (Chinese microblogging website) account named “Healthy China” is managed by the National Health Commission of China to engage citizens (Chen et al., 2020). Thus, many governmental agencies leverage social media to share authentic information with their citizens expeditiously. Of all social media platforms, Twitter is used as the primary platform for critical disaster communication to citizens by government agencies (Son et al., 2019).

In the past, few researchers have studied the characteristics of content and media in the information shared on social media by government agencies (Bonson et al., 2019; Chen et al., 2020). Citizens’ online activities are broadly categorised into consumption, contribution, and creation (Muntinga, Moorman, & Smit, 2011). Citizens’ online activities are akin to social media usage in any other context, where consumption refers to the passive viewing of the content without any recorded reaction. In contrast, contribution refers to an active reaction such as liking, retweeting, and commenting on the Twitter platform. Creation refers to the conception of new content by the users. The contribution activities of users are most accurate and visible when measuring the volume of user activities on any social media platform (Annamalai et al., 2021).

Extant studies of citizen engagement on government-owned social media use volume-based engagement measures such as the number of likes, comments and shares or retweets (e.g., Brubaker & Wilson, 2018; Kim & Yang, 2017). The other popular citizen engagement index is the sum of popularity, commitment and virality measured through the social media volume measures such as the number of likes, followers, shares, reposts and total posts (e.g., Bonsón et al., 2019; Bonsón, Royo, & Ratkai, 2015; del Mar Gálvez-Rodríguez et al., 2019). Few other studies measure citizen engagement as the sum of likes, comments and shares (Jiang & Beaudoin, 2016). In summary, various behavioural manifestations on social media measure citizen engagement in crisis management literature.

3. Theoretical foundations and hypotheses development

According to the Elaboration Likelihood Model (ELM) of persuasion (Petty & Cacioppo, 1986), individuals process information via two distinct routes. First, the central route focuses on the quality of the message content shared, and second, the peripheral route focuses on functional traits such as the media type that do not concern the central content. The current study investigates the influence of these two content characteristics, namely content type and media type, on the citizen's online behavioural outcomes of citizen engagement measured as the number of likes and retweets.

3.1. Content type

The central route of persuasion focuses on the content quality of the message per the ELM (Ji et al., 2019). Citizens seek three types of informative content from the Government during a public crisis: concerns regarding their own interests, accurate facts detailing the severity and government handling (Xie et al., 2017). Prior studies exploring the effect of content types on citizen engagement in government social media communication during a public crisis have mixed findings due to contextual differences. For instance, Xie et al. (2017) observe information related to government handling to influence online sharing behaviour during public emergency events. In contrast, during a public crisis in China, content sharing the latest news recorded the maximum engagement, followed by the government handling related information on the official Sina Weibo account (Chen et al., 2020). Even though the results differ, the content type preferences for citizen engagement during the COVID-19 vaccination drive can be derived from motivation literature.

UGT has been widely used in crisis communication in the social media context (Austin & Jin, 2016). Citizens have various motives that drive them to engage with the content shared by government agencies on social media. In the motivation literature, seeking and giving advice and opinion is one of the key motives that drive individuals to use social media platforms (Wang & Fesenmaier, 2003). Further, individuals are driven to

engage by their positive altruism, i.e., to help their connections by spreading relevant information and keeping them updated (Sundaram, Mitra, & Webster, 1998). This motive also applies to social media platforms (Yesiloglu, Memery, & Chapleo, 2021). Along similar lines, the primary objective of government crisis communication is to share expert advice and opinion content that caters to the information need of citizens (Sturges, 1994). Further, the need to exhibit positive altruism can be expected to drive engagement during the vaccination drive in the COVID-19 pandemic context. The corresponding content type (i.e. similar to sharing expert advice and opinion) on government social media communication is content shared that guides citizens (Chen et al., 2020) and is likely to drive higher levels of citizen engagement in government-managed Twitter accounts.

During a pandemic such as COVID-19, citizens look to the Government for direction on various dimensions. They look for guidance on how they should behave. They also seek guidance on what behaviour should be avoided as it may result in harm (or punishment) to themselves and society. Since most persons wish to help others in their network (Wasko & Faraj, 2005), they are more likely to be engaged on social media and guide others. Also, given the highly cluttered social media environment, citizens naturally get engaged with the guidance provided by government sources as it is seen as authentic and trustworthy (Islam et al., 2021) and, therefore, shareable. Thus, we hypothesise:

H1: Content type influences citizen engagement in the crisis communication context, such that content that shares guidance for stakeholders results in maximum citizen engagement among all content types.

3.2. Media type

Media richness theory prescribes that the media type has differentiated abilities to enable a shared understanding of communication (Daft & Lengel, 1986). It triggers different degrees of social media engagement (Chen et al., 2020). The theory emphasises that the media richness must match the task to maximise shared understanding and is independent of the vividness level. Social media research

categorises the media type of content as video, photo, link, and only text (e.g., Annamalai et al., 2021; Lappas, Triantafillidou, & Kani, 2021; Soboleva et al., 2017). The media type of photo positively affects Twitter engagement measure of retweeting in a cross-industry study including FMCG, automobile, and luxury goods (Soboleva et al., 2017). Compared to other media types, photos recorded the maximum number of likes and comments on the Facebook platform across industries (e.g., Annamalai et al., 2021; Li & Xi, 2020). In the context of government social media communication, photos elicit the highest level of engagement (Bonsón et al., 2015). These social media literature findings converge with the earlier advertising research detailing the benefits of images in advertisements (e.g., Rossiter & Percy, 1980; Unnava & Burnkrant, 1991). Since individuals process the functional trait of media type only through the peripheral route of persuasion per the ELM (Ji et al., 2019), citizens can be speculated to exhibit maximum engagement for photos. Hence, we hypothesise:

H2: Media type influences citizen engagement in the crisis communication context, such that photo results in maximum citizen engagement among all media types.

4. Method

4.1. Data collection

The study collected Twitter data from the official account of MOHFW. The Twitter page was crawled and scrapped using the Academic Track Twitter application programming interface (API), which enables the collection of predated tweets. The API was accessed using the R -language package *academictwitterR*. The largest COVID-19 vaccination drive for all citizens Pan-India was opened on January 16, 2021. The data for this study consisted of all tweets posted from January 1 to June 30, 2021. For each tweet, the following information was captured: tweet text, media shared (photo, status, video), number of likes, and number of retweets. A total of 10957 tweets were extracted during the study time frame. Removing 6456 retweets and 759 non-English tweets resulted in 3,742 tweets, with 3,593 related to the COVID-19 vaccination drive. An automated text analysis word cloud visually represents the tweet data. A word

4.2. Variable operationalisation

The content and media types are operationalised as part of government-shared crisis communication. The primary engagement activities of citizens are operationalised under citizen engagement. The proposed research model with the operationalised variable is detailed in Figure 2.

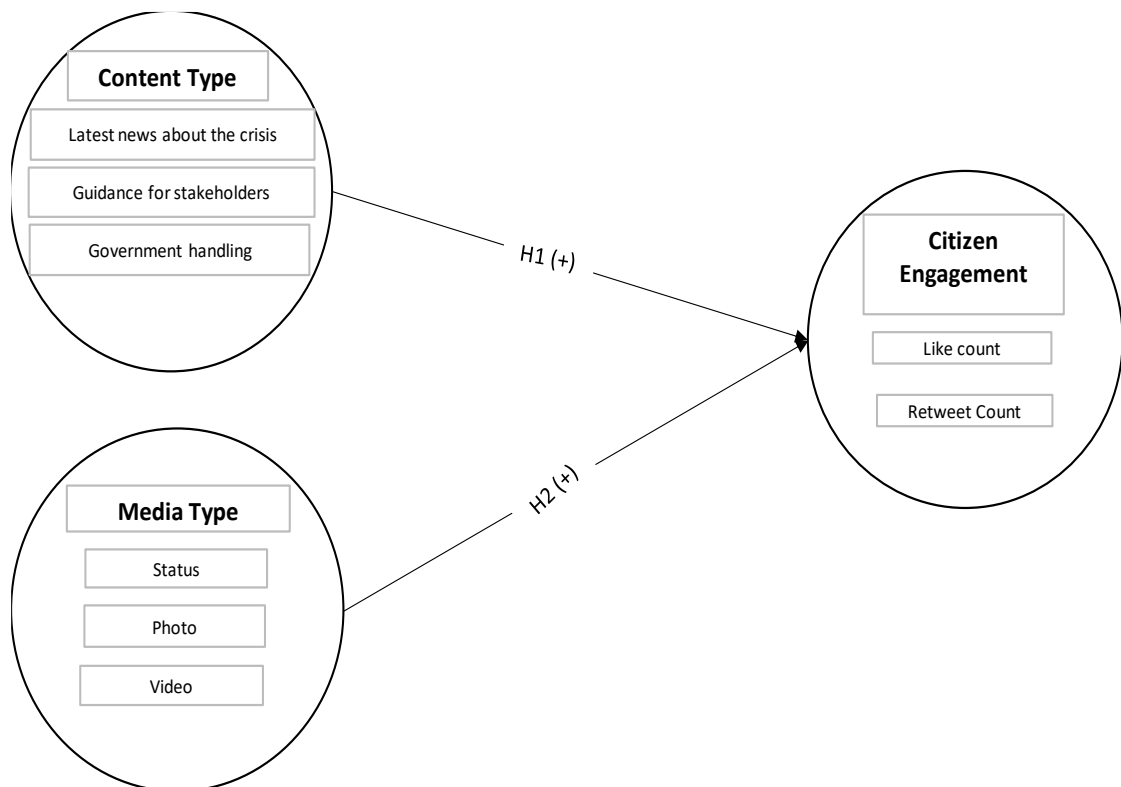


Figure 2. Research model with the operationalisation of variables.

4.2.1. Independent variables:

Content-type: Content analysis is a standard approach to find the common crisis communication themes that are used to classify the types of content (Bonsón et al., 2019), and our codebook and definitions were adapted based on theoretically supported categories (Chen et al., 2020; Sturges, 1994; Xie et al., 2017). The tweets were classified into three content types (Chen et al., 2020; Xie et al., 2017), namely (1) the latest news about the COVID-19 crisis, (2) guidance for stakeholders, and (3) information about the Government's handling of the crisis as shown in Table 1.

Table 1. Content category of Tweets with examples

Categories	Example posts
Latest news about the COVID-19 crisis	#Unite2FightCorona 97 deaths were reported in the last 24 hours. Seven States account for 87.63% of the new deaths.
Guidance for stakeholders	#LargestVaccineDrive #NewVaccineStrategy All stakeholders are given the flexibility to customise to local needs while everyone above the age of 18 is now eligible to be #vaccinated.
Information about the Government's handling of the crisis	#Unite2FightCorona It is clarified that Govt of India's procurement price for both #COVID19 vaccines remains Rs 150 per dose. GOI-procured doses will continue to be provided TOTALLY FREE to States. @PMOIndia @drharshvardhan @AshwiniKChoubey @DDNewslive @PIB_India @mygovindia

A word cloud is presented to visually highlight the differences and commonalities in term occurrence among the three content types, as shown in Figure 3.

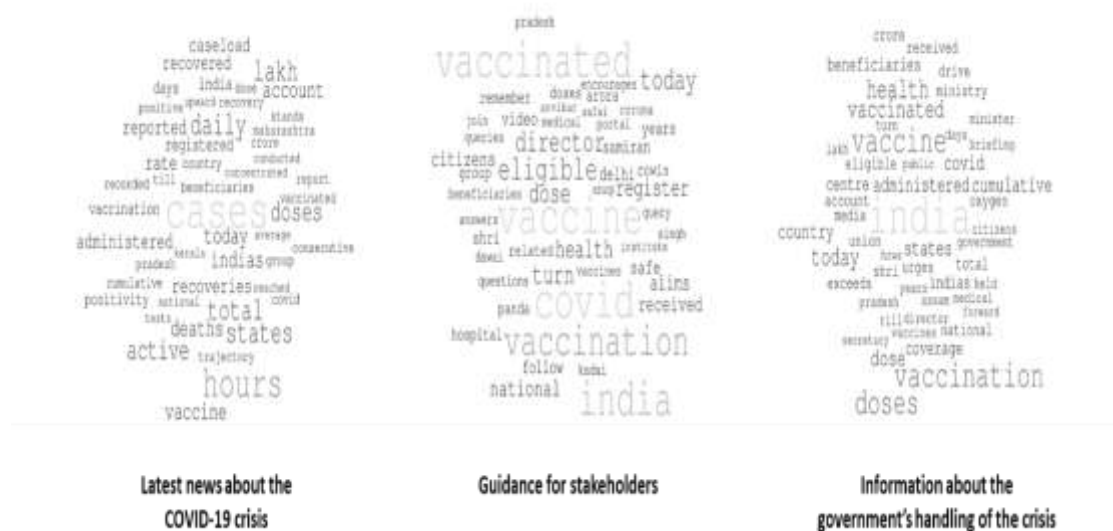


Figure 3. Word cloud of the most frequent words in tweets classified into three content types

The word cloud for the tweets on the latest news about the COVID-19 crisis content highlights the constant updates provided on the spread of COVID-19 infection. The related terms shown prominently are “cases”, “daily”, “active”, “deaths”, “recoveries”, “trajectory”, etc. The word cloud for the tweets on the guidance for stakeholders-related content shows the periodic directions given to the citizens to vaccinate. The related terms shown prominently are “vaccine”, “eligible”, “doses”, “query”, “register”, etc. The word cloud for the tweets on the information about the Government’s handling of the crisis details the action taken by the Government to control the crisis. The related terms are “India”, “doses”, “administered”, “coverage”, “media”, “briefing”, etc. Thus, the word cloud representation depicts that the tweet classification largely adheres to the defined content category.

Media type: Consistent with citizen engagement literature (Lappas et al., 2021), the media types of tweets are classified at three levels, namely: (1) videos (with or without photos or text or links), (2) photos (with or without text or links), and statuses (with or without text or links).

4.2.2. Dependent variable: citizen engagement

Consistent with research on the Twitter platform measures (Lahuerta-Otero, Cordero-Gutiérrez, & Prieta-Pintado, 2018; Li & Xie, 2020), the volume of contribution activities, namely the number of likes and the number of retweets recorded for each tweet is considered for measuring citizen engagement.

4.3. Inter-coder reliability and data analysis

An independent coder and the first author manually coded the data². The codes were explained to the independent coder. After coding an initial data sample, the coders consulted with the second author multiple times. The inter-coder reliability, measured

² Based on the suggestion by reviewers, we also carried out a post-hoc analysis using the computational linguistic method, i.e., the Naïve-Bayes classification method and support vector machine-based classification method. However, as our data set had only 3,742 tweets, and post classification was a pre-requisite for testing the model further, manual coding was preferred for its increased classification accuracy in this study. For reference, the results of this computational linguistic method analysis are appended in Appendix-1.

using Perreault and Leigh (1989) formula, was 0.891 and within the accepted range of 0.8-1.0. The differences in coding were scrutinised and resolved by the third author.

4.4. Model development:

We use a bivariate Poisson model to investigate the effect of content type and media type on citizen engagement, as the variables measuring citizen engagement, namely the like count and retweet count, are count variables. Further, the number of tweet likes and retweets exhibit a high correlation ($r=0.98$). To relax the independence assumption between models, the outcome is modelled as a simple bivariate Poisson model. The bivariate model estimates the effect of the predictor variables on the dependence structure among dependent variables with common covariance.

Let (Y_{1k}, Y_{2k}) denote the observed number of like counts and retweet counts for a post k , respectively. A simple Poisson model for each post can be described as follows:

$$Y_{1k} = \text{Poisson}(\lambda_{1k})$$

$$Y_{2k} = \text{Poisson}(\lambda_{2k})$$

Where λ_{1k} and λ_{2k} represent the mean rates for the number of likes and retweets.

The dependence structure between like counts and retweet counts is modelled using bivariate Poisson (BP) distribution. The joint model is given as

$$Y_{12k} \sim BP(\lambda_{1k}, \lambda_{2k}, \theta_{12})$$

If y_{1k} and y_{2k} denote the respective number of likes and retweets for post ' k ', then,

$$\log(\lambda_{ik}, \theta_i) = x'_{ik} \beta_i$$

where x_{ik} denotes the vector of predictor variables of the k^{th} post, and β_i the corresponding regression coefficient vector.

The model parameters are estimated using the Bayesian approach through the Markov Chain Monte Carlo (MCMC) method. MCMC is preferred as it can account for unobserved relationships between variables and is suitable to model over-dispersed

data (like: $M=107.24$, $SD=322.89$; retweet: $M=32.97$; $SD=140.82$). The approach estimates the model parameters by applying draws from the posterior distribution (Muthen & Asparouhov, 2012).

5. Results

5.1. Descriptive statistics

The official MOHFW Twitter handle started in June 2014, has over its lifetime shared over 63,200 tweets, and is followed by 2.7 million users as of November 30, 2021. Table 2 shows the summary statistics distribution of the selected variables for the period. The citizen engagement measures, like and retweet, seem to be affected to varying degrees by the independent variables – content types and media types.

Table 2. Summary statistics

Types		Tweet count	Like M	S.D.	Retweet M	S.D.
Content type	Latest news about the COVID-19 crisis	1473	55.31	76.37	15.11	20.18
	Guidance for stakeholders	1019	177.93	575.52	61.38	257.90
	Information about the Government's handling of the crisis	1101	111.28	133.63	30.57	38.38
Media type	Video	496	69.68	88.15	22.38	25.29
	Photo	1394	197.88	493.94	60.45	220.25
	Status	1703	43.98	88.33	13.56	30.52

Note: M denotes the mean. S.E. denotes the standard error.

5.1.1. Content type

Tweets sharing the latest news about the COVID-19 crisis were the most frequently used (41%), followed by information about the Government's handling of the crisis (31%) and guidance for stakeholders (28%). On the contrary, the engagement was

observed to have gained in reverse order with guidance for stakeholders gaining the most engagement.

5.1.2. Media type

The media type of status was the most frequently used (47.40%) media type, followed by photo (39%) and video (14%). Photos gained maximum engagement measures while status gained the least.

5.2. Overall relationship between post characteristics and citizen engagement

We modelled the post characteristics – media type and content type as the main effects with the number of likes and the number of retweets as the dependent variables. Table 3 provides the estimates of the main effects using posterior distribution.

Table 3. Predicting citizen engagement through post characteristics

	Like count		Retweet count	
	P.M.	S.E.	P.M.	S.E.
(Intercept)	2.92***	0.001	1.72***	0.001
Content Type (reference group: Latest news)				
Guidance	0.63***	0.001	0.71***	0.001
Government handling	0.60***	0.001	0.56***	0.001
Media Type (reference group: Status)				
Photo	1.50***	0.001	1.37***	0.001
Video	0.42***	0.002	0.47***	0.002
N	3593		3593	

Note: *** represents the significant level at 1%. P.M. denotes the posterior mean. S.E. denotes the standard error.

Source: Based on the author's estimations.

Content type: H1 stated that citizen engagement, measured as the number of likes and retweets, would be higher for social media content-sharing guidance for stakeholders. The variable representing the guidance for stakeholders ($\beta_{11}\text{Guidance} = 0.63$, $\text{SE} = 0.044$; $\beta_{21}\text{Guidance} = 0.71$, $\text{SE} = 0.047$) content type exhibited a significant and highest number of likes and retweets. A possible reason is that citizens may react to

tweets that gratify the need for integration and social interaction, specifically those that fulfil the second-order motivations of social identity and helping/ altruism (Muntinga, Moorman, & Smit, 2011). For instance, retweeting or liking the government-shared guidance may enable an individual to gratify one's need for building a social identity of being a responsible citizen and, equally importantly, enables one to help others in one's social network.

The variable representing government handling of the crisis ($\beta_{11}\text{Governmenthandling} = 0.60$, $SE = 0.039$; $\beta_{21}\text{Governmenthandling} = 0.56$, $SE = 0.043$) gained the second highest number of likes and retweets. Puri et al. (2020) propose using celebrities and politicians to maximise the dissemination of vaccination-related news. For instance, the quote of well-known music celebrity A.R.Rahman ("The new year brings a fresh ray of hope, and #COVID19 vaccine is the news we've all been waiting for.") on the MOHFW Twitter handle gained over 1,300 likes as against the average like count of just over 100 for the Government's handling of the crisis tweets.

A previous cross-country study on social media posts during COVID-19 found that political and health sources played the most prominent role during the pandemic (Mellado et al., 2021). Accordingly, post-hoc analysis of the content type categorised as popular personalities (celebrities, politicians) and others (e.g. physicians) validated that the citizens tend to exhibit more engagement with popular personalities than with others (Table 4). In the future, to encourage the citizens' engagement with its social media communication, the Government may consider leveraging popular personalities in its messaging related to its actions to control the crisis.

Table 4. Average engagement measure for comparable Government handling themes

Popularity	Tweet count	Like count	Retweet count
Popular (Celebrities, Politicians)	63	102.90	22.36
Others (Physicians)	129	65.50	20.13

Note: The significance of the observation is not tested and is based on descriptive statistics

The latest news about the COVID-19 crisis recorded the least number of likes and retweets among all content types. Smith, Smith, & Knighton, (2018) observe that crisis

communication is limited mainly to sharing information as a monologue and minimal efforts towards engaging in dialogic communication. A possible reason is that the communication shared by the government handle is oriented mainly towards the negative consequences of the crisis, such as the total number of fatalities and infections.

Communication literature recommends transparently sharing such undesirable information, thereby creating an effect of 'stealing thunder' and avoiding negative publicity (Sanjeev et al., 2021). Though the content shared reinforces citizens to minimise undesired behaviour as per the reinforcement theory of motivation (Skinner, 1938), it is possibly seen to be relatively inconsequential in increasing social media engagement.

Furthermore, the tweet content may not cater to the motive of helping others as it may not be directly helpful to a citizen's social network for positive action (Muntinga et al., 2011). In summary, the results on the content type indicated that, compared to the latest news about the COVID-19 crisis, government handling and guidance types showed an increased number of likes and retweets, thus supporting H1 at a 0.05 level of significance.

Media type: H2 stated that citizen engagement, measured as the number of likes and retweets, is likely to be higher for content-sharing photos. The media type of photos ($\beta_{12\text{Photo}} = 1.50$, $SE = 0.037$; $\beta_{22\text{Photo}} = 1.37$, $SE = 0.038$), and status, exhibited a significant and increased number of likes and retweets in comparison to video ($\beta_{12\text{Video}} = 0.42$, $SE = 0.051$; $\beta_{22\text{Video}} = 0.47$, $SE = 0.054$). The findings converge with traditional communication research findings that images increase the probability of a consumer response (Soboleva et al., 2021). Further, photos attract attention more quickly than other media types (Luarn, Lin, & Chiu, 2015). The lesser engagement for a tweet with a video can be attributed to the longer view time and increased effort to understand the video (De Vries, Gensler, & Leeflang, 2012).

The increased effort is also applicable for tweets sharing links, as the technical features of Twitter necessitate the public to click more often for a status tweet containing a link along with text than only a status tweet containing text as it redirects

to supplementary information (Chen et al., 2020; Luarn et al., 2015; Son et al., 2019). Post-hoc analysis of the status content categorised as only text and text with link validated that citizens tend to exhibit more engagement for only text than text with link (Table 5), thereby providing supporting evidence for the citizen's need to gratify their information requirements with minimal effort.

Table 5. Average engagement measure for comparable status content

Status content	Tweet count	Like count	Retweet count
Only text	271	94.89	28.88
Text with link	1434	34.38	10.67

Note: The significance of the observation is not tested and is based on descriptive statistics

In summary, the results on media type indicated that, compared to status, the video and photo showed an increased number of likes and retweets, thus supporting H2 at a 0.05 level of significance.

6. Discussion

6.1. Summary of results

Content-type sharing COVID-19 vaccination guidance for stakeholders to supplement their decision-making recorded the maximum social media engagement among the citizens. The content type, government handling of the crisis, received the second-highest likes and retweets.

The content providing the latest news about the COVID-19 crisis is restricted mainly to information sharing and constitutes over 40% of the tweets in our study. This content type received the least engagement measures. Thus, the need for social identity and helping drive the citizen to engage the maximum in the current context.

While the government handling content shared with the motive to manage the Government's reputation gained moderate engagement, the content sharing the latest news on COVID-19 attracted the least engagement. Tweets with photos gained the maximum engagement as against other media types. Despite a higher level of

vividness, a tweet with a video recorded lesser engagement than a tweet sharing other media types.

6.2. Theoretical and practical implications

Despite its importance to society and policy, extant literature has not sufficiently focused on the factors that affect the effectiveness of the Government's social media campaigns in the context of public health crises. This study makes several significant theoretical contributions towards the extant literature on crisis communication and social media user engagement and also responds to several calls to study effective communication in the context of the COVID-19 pandemic. This study contributes to the understanding the role of social media platforms, such as Twitter, in crisis communication. Empirical evidence suggests that likes and retweets representing citizen engagement are interrelated. This indicates that the affective and cognitive behaviours (Kim & Yang, 2017) are not much differentiated in citizen engagement. Effective Government communication during public health crisis is aided by high levels of citizen engagement. Since each engagement measure increases the tweet's reach and effectiveness, Government communication sources should leverage their synergic effects in deciding their Twitter content. Previous studies have identified various content characteristics that affect citizen engagement (Chen et al., 2020; Puri et al., 2020; Xie et al., 2017). We find the content type of guidance for stakeholders and the media type of photo to record the maximum level of citizen engagement on Twitter. These findings add to citizen engagement research in the context of social media.

Based on the U&G Theory and drawing on ELM, the study investigates the influence of two social media content characteristics, namely content and media type, on citizen engagement. It provides a nuanced understanding of what citizens look for (and engage with) in a Government's social media communication during a public health crisis. The study highlights that in terms of media richness, even though videos provide greater sensory stimulation, their effectiveness towards engaging citizens is lower than photos during a public health crisis. This finding contributes to extant social media communication literature by highlighting that the relationship between media type and engagement is context-dependent. The study also highlights that given the

relatively pessimistic and depressing nature of the communicated content during a crisis, citizens are less likely to engage with news, information, and the latest developments. Instead, the messages that provide actionable suggestions that appeal to the citizens' inherent tendency to help others and to help strengthen their social identity find the highest levels of engagement.

The study provides meaningful, straightforward and usable advice to country Governments and their agencies to effectively communicate over social media with citizens during public health crises such as the COVID-19 pandemic. For instance, to engage citizens with their social media messages, the Government may adopt Twitter messages that appeal to the citizens' inherent needs to help others and strengthen their social identity. In contrast, the Government should restrict messages that merely provide information during a crisis. Also, using messages with photos/ images, as against videos, is most effective and relatively easy to implement during crisis communication. Thus, during a crisis, the Government should not waste precious resources and time on creating videos but instead focus on Twitter messages with photos/ images to drive maximum citizen engagement.

6.3. Limitations and further research

Our study focuses on COVID-19 vaccination-related Twitter messages by the Government of India. Subsequent studies by gathering data on COVID-19 vaccination messages by other governments and their resultant effect on citizen engagement will help further generalise the findings. A multi-country study will likely reveal further interesting results, with cultural and other dimensions explored therein. Citizen engagement with other contexts of social media messaging by governments (in non-pandemic scenarios) can also be studied to understand whether all Government messaging elicits similar responses or whether the context of a pandemic has a peculiar effect on citizen engagement. Since this study is limited to the COVID-19 pandemic scenario, the considered data was relatively limited but adequate for manual coding which was chosen for increased accuracy. Future research involving more voluminous data may employ suitable computational linguistic methods, such as the Naïve-Bayes classification method and support vector machine-based

classification method (as elaborated in Appendix-1). Empirical studies using data from social media channels other than Twitter can reveal other interesting insights in this context.

6.4. Conclusion

In pandemics and public health emergencies, citizens look to the Government for a wide variety of information and guidance. The Government is also keen to communicate effectively, frequently, and clearly with its citizens. The Government's communication is intended to provide citizens with authentic information and help counter rumours and fake news. Most importantly, the Government is keen to influence the citizens' behaviour by providing guidance that helps citizens understand what to do and what behaviours to avoid in an evolving pandemic crisis. Increasingly, governments worldwide are choosing social media channels to communicate with their citizens.

If the citizens are engaged with the Government's messaging, they will help the Government's cause by further disseminating the messages in their social media networks. However, social media research shows that different types of message content and media result in different levels of citizen engagement. Therefore, governments must choose appropriate media and content types that maximise citizen-engagement response.

In conclusion, our study on COVID-19 vaccination-related Twitter messages by the Government of India provides this guidance. According to our results, citizens are likely to engage increasingly with content-sharing guidance to the stakeholders. Further, content delivered in a medium requiring minimal effort, such as photos, increases engagement. Thus, the Government needs to craft social media communication judiciously to gain increased citizen engagement and drive the COVID-19 vaccination drive.

Appendix-1

Based on the reviewer's suggestion, a post-hoc analysis of the data was conducted using methods from computational linguistics, as used in Spenger and Welpé (2010). The tweet content was classified into one of the three categories – Guidance, Government handling and Latest news was attempted using computational linguistics models.

Accordingly, two supervised machine learning models, namely Naïve Bayes (NB) classification model and support vector machine (SVM) based classification model were implemented. In the section below, we describe the classification models:

Naïve Bayes classification model:

NB classifier is a probabilistic classifier that is efficient and sensitive to the selected features. The probability of a document to belonging to a class is computed based on the probability of the features falling in that class. The model assumptions are appropriate for text models considering text as a Bag-of-Words. In such models, occurrence of each word in a document is considered independent of the other words and does not consider the position of the word in its document. Further, studies have shown that NB achieves a satisfactory performance on documents with short text (Lane, Clarke, & Hender, 2012).

For a given word t_i , the probability that it belongs to class c_k is given as:

$$p(c_k, t_i) = \frac{p(t_i/c_k) p(c_k)}{p(t_i)}$$

Based on the above equation the probability of a class given a word $p(c_k/t_i)$ is calculated based on $p(t_i/c_k)$. The document-level probabilities for each class, based on the words present in the document, is computed. The document is then classified to a particular class with the highest probability.

The document-level probability for a given class c_k is given as

$$p(c_k, t_i) = \frac{p(c_k/t_1, t_2, \dots, t_n)}{\text{total number of words appearing in a document } d}$$

Support vector machine (SVM) based classification model:

Contrary to NB, SVM is a classifier based on the principle of structural risk minimization. SVM uses hyperplanes that space that distinguishes different classes in the training data. The hyperplanes separate the data with maximum margins. The decision surface is made of effective components of the data that are crucial in creating the differentiation boundary. SVM addresses the multi-class problem by dividing the problem into multiple subproblems (Isa et al., 2008). Also, the algorithm offers the ideal solution for classifying sparse text data scattered into linearly separated classes (Hsu & Lin, 2002).

Method

The dataset consisted of a total of 3,593 tweets. Out of which, 1,437 tweets (40%) were used to build the model, using which the remaining tweets were classified. The 1,437 tweets were manually classified into either one of the three classes. Roughly, 30.5% were classified as Government handling, 28.4% as Guidance and 41.1% as Latest news. The text was pre-processed before building the model. First, all the text was converted into lower cases. Second, the url links, the user handles and the hashtags were removed. Third, the numbers, punctuations, and the stop words (using SMART word list) were removed. The remaining words were lemmatized and stemmed to decrease the sparsity of the words. Finally, the white spaces were removed and converted to a bag of words model using term frequency.

Since the dataset showed imbalance in classes, with class 'Guidance' representing only 28% synthetic minority oversampling technique (SMOTE) was used to increase the number of cases of that class and comparatively under sample the other majority classes in the dataset. This results in a relatively balanced dataset which enhances performance of the learning algorithms.

The manually classified tweets were split into training data and test data (70/30). The model learned using train data and evaluated using test data. The overall classification accuracy of NB was 40.93%, while that of SVM was 76.74%. The F-scores of each class was 61.13% (government handling); 45.33% (Guidance) and 14.27% (latest news).

Even though the overall accuracy of SVM was desirable, the F-scores of individual classes are low indicating poor performance of the classification model. A possible reason is the dependence of classifier performance on the type data. A high association between the text (features) and the classes would result in a better performance accuracy of the classifier. The classification algorithm learns the document distribution using the information of the features extracted and the labelled documents. But, compared to long texts, short texts like tweets are much more complex to classify due to the “brevity of the document and sparsity of the feature” (Alsmadi & Gan, 2019). Further, compared to binary classification problems, multiclass classification (involving more than two classes) is complex as the algorithm requires a greater number of class-specific predictive features to learn. Thus, multi-class classification problem involving short texts is much more complex to solve (Forman, 2004). Further, in spite of fairly homogeneous and well-balanced data, the existing features that can discriminate one class tend to ignore the other difficult classes, thereby increasing the precision/recall of the easier class and significantly decreasing the same on the other classes. Since only 3,742 tweets were considered and post classification was a pre-requisite for testing the model further, manual coding was preferred for its increased classification accuracy in this research.

References

- Alsmadi, I., & Gan, K. H. (2019). Review of short-text classification. *International Journal of Web Information Systems*.
- Annamalai, B., Yoshida, M., Varshney, S., Pathak, A. A., & Venugopal, P. (2021). Social media content strategy for sport clubs to drive fan engagement. *Journal of Retailing and Consumer Services*, 62, 102648.
- Austin, L., & Jin, Y. (2016). Social media and crisis communication: Explicating the social-mediated crisis communication model. *Strategic communication: New agendas in communication*, Routledge, Taylor & Francis Group, 163-186
- Benoit, W. L. (2014). *Accounts, excuses, and apologies: Image repair theory and research*. SUNY Press.
- Benoit, W. L., & Henson, J. R. (2009). President Bush's image repair discourse on Hurricane Katrina. *Public Relations Review*, 35(1), 40-46.
- Bonsón, E., Perea, D., & Bednárová, M. (2019). Twitter as a tool for citizen engagement: An empirical study of the Andalusian municipalities. *Government Information Quarterly*, 36(3), 480-489.
- Bonsón, E., Royo, S., & Ratkai, M. (2015). Citizens' engagement on local governments' Facebook sites. An empirical analysis: The impact of different media and content types in Western Europe. *Government information quarterly*, 32(1), 52-62.
- Brubaker, P. J., & Wilson, C. (2018). Let's give them something to talk about: Global brands' use of visual content to drive engagement and build relationships. *Public relations review*, 44(3), 342-352.
- Bundy, J., Pfarrer, M. D., Short, C. E., & Coombs, W. T. (2017). Crises and crisis management: Integration, interpretation, and research development. *Journal of Management*, 43(6), 1661-1692.
- Chatfield, A. T., & Reddick, C. G. (2018). All hands on deck to tweet# sandy: Networked governance of citizen coproduction in turbulent times. *Government Information Quarterly*, 35(2), 259-272.
- Chen, Q., Min, C., Zhang, W., Wang, G., Ma, X., & Evans, R. (2020). Unpacking the black box: How to promote citizen engagement through government social media during the COVID-19 crisis. *Computers in human behavior*, 110, 106380.

- Chou, W. Y. S., Oh, A., & Klein, W. M. (2018). Addressing health-related misinformation on social media. *Jama*, 320(23), 2417-2418.
- Coombs, W. T. (2007). Protecting organisation reputations during a crisis: The development and application of situational crisis communication theory. *Corporate reputation review*, 10(3), 163-176.
- Coombs, W. T. (2009). Crisis, crisis communication, reputation, and rhetoric. In *Rhetorical and critical approaches to public relations II* (pp. 249-264). Routledge.
- Coombs, W. T., & Holladay, J. S. (2012). The paracrisis: The challenges created by publicly managing crisis prevention. *Public Relations Review*, 38(3), 408-415.
- Daft, R. L., & Lengel, R. H. (1986). Organisational information requirements, media richness and structural design. *Management Science*, 32(5), 554-571.
- De Vries, L., Gensler, S., & Leeftang, P. S. (2012). Popularity of brand posts on brand fan pages: An investigation of the effects of social media marketing. *Journal of interactive marketing*, 26(2), 83-91.
- del Mar Gálvez-Rodríguez, M., Sáez-Martín, A., García-Tabuyo, M., & Caba-Pérez, C. (2018). Exploring dialogic strategies in social media for fostering citizens' interactions with Latin American local governments. *Public relations review*, 44(2), 265-276.
- Elbanna, A., Bunker, D., Levine, L., & Sleight, A. (2019). Emergency management in the changing world of social media: Framing the research agenda with the stakeholders through engaged scholarship. *International Journal of Information Management*, 47, 112-120.
- Ford, T. N. (2013). *Social media and crisis communication: Theories and best practices* (Doctoral dissertation, Carleton University).
- Forman, G. (2004, July). A pitfall and solution in multi-class feature selection for text classification. In *Proceedings of the twenty-first international conference on Machine learning* (p. 38).
- Hsu, C. W., & Lin, C. J. (2002). A comparison of methods for multiclass support vector machines. *IEEE transactions on Neural Networks*, 13(2), 415-425.
- Isa, D., Lee, L. H., Kallimani, V. P., & Rajkumar, R. (2008). Text document preprocessing with the Bayes formula for classification using the support vector machine. *IEEE Transactions on Knowledge and Data engineering*, 20(9), 1264-1272.

- Ji, Y. G., Chen, Z. F., Tao, W., & Li, Z. C. (2019). Functional and emotional traits of corporate social media message strategies: Behavioral insights from S&P 500 Facebook data. *Public relations review*, 45(1), 88-103.
- Jiang, S., & Beaudoin, C. E. (2016). Smoking prevention in China: a content analysis of an anti-smoking social media campaign. *Journal of health communication*, 21(7), 755-764.
- Jin, Y., Pang, A., & Cameron, G. T. (2012). Toward a publics-driven, emotion-based conceptualisation in crisis communication: Unearthing dominant emotions in multi-staged testing of the integrated crisis mapping (ICM) model. *Journal of Public Relations Research*, 24(3), 266-298.
- Johansson, E., & Johansson, K. M. (2021). Along the Government–media frontier: Press secretaries offline/online. *Journal of Public Affairs*, e2759.
- Kaur, M., Verma, R., & Otoo, F. N. K. (2021). Emotions in leader’s crisis communication: Twitter sentiment analysis during COVID-19 outbreak. *Journal of Human Behavior in the Social Environment*, 31(1-4), 362-372.
- Kim, C., & Yang, S. U. (2017). Like, comment, and share on Facebook: How each behavior differs from the other. *Public Relations Review*, 43(2), 441-449.
- Kouzy, R., Abi Jaoude, J., Kraittem, A., El Alam, M. B., Karam, B., Adib, E., ... & Baddour, K. (2020). Coronavirus goes viral: quantifying the COVID-19 misinformation epidemic on Twitter. *Cureus*, 12(3).
- Lachlan, K. A., Spence, P. R., Lin, X., Najarian, K., & Del Greco, M. (2016). Social media and crisis management: CERC, search strategies, and Twitter content. *Computers in Human Behavior*, 54, 647-652.
- Lahuerta-Otero, E., Cordero-Gutiérrez, R., & De la Prieta-Pintado, F. (2018). Retweet or like? That is the question. *Online Information Review*.
- Lane, P.C.R., Clarke, D. and Hender, P. (2012), “On developing robust models for favourability analysis: model choice, feature sets and imbalanced data”, *Decision Support Systems*.
- Lappas, G., Triantafillidou, A., & Kani, A. (2021). Harnessing the power of dialogue: examining the impact of facebook content on citizens’ engagement. *Local Government Studies*, 1-20.

- Lee, J., & Cho, M. (2021). The (in) congruency effects of message framing and image valence on consumers' responses to green advertising: Focus on issue involvement as a moderator. *Journal of Marketing Communications*, 1-20.
- Li, Y., & Xie, Y. (2020). Is a picture worth a thousand words? An empirical study of image content and social media engagement. *Journal of Marketing Research*, 57(1), 1-19.
- Liu, B. F., Austin, L., & Jin, Y. (2011). How publics respond to crisis communication strategies: The interplay of information form and source. *Public relations review*, 37(4), 345-353.
- Liu, B. F., Jin, Y., Austin, L., Kuligowski, E., & Young, C. E. (2020). The Social-Mediated Crisis Communication (SMCC) Model: Identifying the Next Frontier. In *Advancing Crisis Communication Effectiveness* (pp. 214-230). Routledge.
- Luarn, P., Lin, Y. F., & Chiu, Y. P. (2015). Influence of Facebook brand-page posts on online engagement. *Online Information Review*.
- MA, S., Pande, N., & PK, S. K. (2021). Role of effective crisis communication by the government in managing the first wave Covid-19 pandemic—A study of Kerala government's success. *Journal of Public Affairs*, 21(4), e2721.
- Mellado, C., Hallin, D., Cárcamo, L., Alfaro, R., Jackson, D., Humanes, M. L., ... & Ramos, A. (2021). Sourcing pandemic news: A cross-national computational analysis of mainstream media coverage of COVID-19 on Facebook, Twitter, and Instagram. *Digital Journalism*, 9(9), 1261-1285.
- Microsave (2020), "Navigating the new normal: Can behavioral sciences help?" Available at: <https://www.microsave.net/wp-content/uploads/2020/09/Navigating-the-new-normal-Can-behavioral-sciences-help.pdf> [Accessed December 23 2021].
- Mori, E., Barabaschi, B., Cantoni, F., & Virtuani, R. (2021). Local governments' communication through Facebook. Evidences from COVID-19 pandemic in Italy. *Journal of Public Affairs*, 21(4), e2551.
- Muntinga, D. G., Moorman, M., & Smit, E. G. (2011). Introducing COBRAs: Exploring motivations for brand-related social media use. *International Journal of advertising*, 30(1), 13-46.

- Muthén, B., & Asparouhov, T. (2012). Bayesian structural equation modeling: a more flexible representation of substantive theory. *Psychological methods*, 17(3), 313.
- Neely, S., Eldredge, C., & Sanders, R. (2021). Health information seeking behaviors on social media during the COVID-19 pandemic among American social networking site users: survey study. *Journal of medical Internet research*, 23(6), e29802.
- Olsson, E. K. (2014). Crisis communication in public organisations: Dimensions of crisis communication revisited. *Journal of Contingencies and Crisis management*, 22(2), 113-125.
- Perreault Jr, W. D., & Leigh, L. E. (1989). Reliability of nominal data based on qualitative judgments. *Journal of marketing research*, 26(2), 135-148.
- Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In *Communication and persuasion* (pp. 1-24). Springer, New York, NY.
- Puri, N., Coomes, E. A., Haghbayan, H., & Gunaratne, K. (2020). Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalised infectious diseases. *Human vaccines & immunotherapeutics*, 16(11), 2586-2593.
- Rémy, V., Zöllner, Y., & Heckmann, U. (2015). Vaccination: the cornerstone of an efficient healthcare system. *Journal of market access & health policy*, 3(1), 27041.
- Rosenthal, U., Hart, P. T., & Kouzmin, A. (1991). The bureau-politics of crisis management. *Public administration*, 69(2), 211-233.
- Rossiter, J. R., & Percy, L. (1980). Attitude change through visual imagery in advertising. *Journal of advertising*, 9(2), 10-16.
- Salmon, D. A., Moulton, L. H., Omer, S. B., Dehart, M. P., Stokley, S., & Halsey, N. A. (2005). Factors associated with refusal of childhood vaccines among parents of school-aged children: a case-control study. *Archives of pediatrics & adolescent medicine*, 159(5), 470-476.
- Sanjeev, MA., Pande, N., & Santosh, PK. (2021). Role of effective crisis communication by the Government in managing the first wave COVID-19 pandemic—A study of Kerala government's success. *Journal of Public Affairs*, 21(4), e2721.
- Scannell, D., Desens, L., Guadagno, M., Tra, Y., Acker, E., Sheridan, K., ... & Fulk, M. (2021). COVID-19 vaccine discourse on Twitter: A content analysis of persuasion

techniques, sentiment and mis/disinformation. *Journal of health communication*, 26(7), 443-459.

- Singh, S., Dixit, A., & Joshi, G. (2020). "Is compulsive social media use amid COVID-19 pandemic addictive behavior or coping mechanism?. *Asian journal of psychiatry*, 54, 102290.
- Skinner, B. F. (1938). *The behavior of organisms: An experimental analysis*. BF Skinner Foundation.
- Smith, B. G., Smith, S. B., & Knighton, D. (2018). Social media dialogues in a crisis: A mixed-methods approach to identifying publics on social media. *Public relations review*, 44(4), 562-573.
- Soboleva, A., Burton, S., Mallik, G., & Khan, A. (2017). 'Retweet for a Chance to...': an analysis of what triggers consumers to engage in seeded eWOM on Twitter. *Journal of Marketing Management*, 33(13-14), 1120-1148.
- Son, J., Lee, H. K., Jin, S., & Lee, J. (2019). Content features of tweets for effective communication during disasters: A media synchronicity theory perspective. *International Journal of Information Management*, 45, 56-68.
- Sturges, D. L. (1994). Communicating through crisis: A strategy for organisational survival. *Management communication quarterly*, 7(3), 297-316.
- Sundaram, D. S., Mitra, K., & Webster, C. (1998). Word-of-mouth communications: A motivational analysis. *ACR North American Advances*.
- The Economic Times (2020). Government launches dedicated Twitter handle for COVID-19 updates. Available at: <https://economictimes.indiatimes.com/tech/internet/government-launches-dedicated-twitter-handle-for-COVID-19-updates/articleshow/74917478.cms?> [Accessed December 23 2021].
- Unnava, H. R., & Burnkrant, R. E. (1991). An imagery-processing view of the role of pictures in print advertisements. *Journal of Marketing Research*, 28(2), 226-231.
- Wang, Y., & Fesenmaier, D. R. (2003). Assessing motivation of contribution in online communities: An empirical investigation of an online travel community. *Electronic markets*, 13(1), 33-45.

- World Health Organization (2022). WHO Coronavirus (COVID-19) dashboard. Available at: [https:// covid19.who.int/](https://covid19.who.int/) [Accessed January 31 2022].
- Xie, Y., Qiao, R., Shao, G., & Chen, H. (2017). Research on Chinese social media users' communication behaviors during public emergency events. *Telematics and Informatics*, 34(3), 740-754.
- Yesiloglu, S., Memery, J., & Chapleo, C. (2021). To post or not to post? Exploring the motivations behind brand-related engagement types on social networking sites. *Internet research*.