Grappling with the COVID-19 health crisis: Analysis of communication strategies and their effects on public engagement on social media

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Abstract

Background: COVID-19 has posed an unprecedented challenge to governments worldwide. Effective government communication of COVID-19 information with the public is of crucial importance.

Objective: We investigated how the most-read government-owned newspaper in China, People's Daily, utilized a social networking site, Sina Weibo, to communicate about COVID-19 and whether this could engage the public. The specific objective of this study was to develop an integrated framework to examine the effects of content frames in health crisis, message style and interactive features on public engagement on the largest social media network in China.

Methods: Content analysis was employed to scrutinize 608 COVID-19 posts, and the public's engagement in the form of the number of shares, comments and likes on People's Daily's Sina Weibo account from 20 January 2020 to 11 March 2020 to reveal the association between different levels of public engagement and communication strategies.

Results: We found that although the content frames of new evidence, action and reassurance delivered in a non-narrative style were predominant in COVID-19 communication by the government, posts related to new evidence and a non-narrative style were strong negative predictors of the number of shares. In terms of generating a high number of shares, it was found that disease prevention posts delivered in a narrative style were able to achieve this purpose. Additionally, an interaction effect was found between content and style. The use of a narrative style in disease prevention posts had a significant positive effect on generating comments and likes by Chinese public while links to external sources fostered sharing.

Conclusions: These results have implications for governments, health organizations, medical professionals, the media and researchers on their epidemic communication to engage the public. Selecting suitable communication strategies may foster active liking and sharing of posts on social media, which in turn, might raise the public's awareness of COVID-19 and motivate them to take preventive measures. The sharing of COVID-19 posts is particularly important because this action can reach out to a large audience, potentially helping to contain the spread of the virus.

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Original Manuscript

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Abstract

Background: COVID-19 has posed an unprecedented challenge to governments worldwide. Effective government communication of COVID-19 information with the public is of crucial importance.

Objective: We investigated how the most-read state-owned newspaper in China, *People's Daily*, utilized an online social networking site, Sina Weibo, to communicate about COVID-19 and whether this could engage the public. The objective of this study was to develop an integrated framework to examine the content, message style, and interactive features of COVID-19-related posts, and determine their effects on public engagement in the largest social media network in China.

Methods: Content analysis was employed to scrutinize 608 COVID-19 posts and coding was performed on three main dimensions: content, message style, and interactive features. The content dimension was coded into six sub-dimensions: *(C1) Action*, *(C2) New evidence*, *(C3) Reassurance*, *(C4) Disease prevention*, *(C5) Healthcare services*, and *(C6) Uncertainty*, while the style dimension was coded into the sub-dimensions of *(S1) Narrative* and *(S2) Non-narrative*. As for interactive features, they were coded into: *(I1) Links to external sources*, *(I2) Use of hashtags*, *(I3) Use of questions to solicit feedback*, and *(I4) Use of multimedia*. Public engagement was measured in the form of the number of shares, comments, and likes on the *People's Daily*'s Sina Weibo account from 20 January 2020 to 11 March 2020 to reveal the association between different levels of public engagement and communication strategies. One-way ANOVA followed by post-hoc Tukey test, and negative binomial regression analysis were employed to generate the results.

Results: We found that although the content frames of *(C1) Action*, *(C2) New evidence*, and *(C3) Reassurance* delivered in a *(S2) Non-narrative* style were predominant in COVID-19 communication by the government, posts related to *(C2) New evidence* and a *(S2) Non-narrative* style were strong negative predictors of the number of shares. In terms of generating a high number of shares, it was found that *(C4) Disease prevention* posts delivered in a *(S1) Narrative* style were able to achieve this purpose. Additionally, an interaction effect was found between content and style. The use of a *(S1) Narrative* style in *(C4) Disease prevention* posts had a significant positive effect on generating

comments and likes by the Chinese public while links to external sources fostered sharing.
Conclusions: These results have implications for governments, health organizations, medical professionals, the media, and researchers on their epidemic communication to engage the public. Selecting suitable communication strategies may foster active liking and sharing of posts on social media, which in turn, might raise the public's awareness of COVID-19 and motivate them to take preventive measures. The sharing of COVID-19 posts is particularly important because this action can reach out to a large audience, potentially helping to contain the spread of the virus.

Keywords: COVID-19 communication; public engagement; social media; message style; health content frames; interactive features

Introduction

The first known COVID-19 case was reported in China on 17 November 2019 [1], and on 23 January 2020, the government in China imposed a strict lockdown in Wuhan, the epicenter of the virus. Despite a massive containment effort, by late February, 80,000 cases had emerged [2]. By March, COVID-19 was confirmed in many countries globally and the World Health Organization declared COVID-19 a pandemic on 11 March 2020 [3,4]. Pandemics in the past such as the 2003 severe acute respiratory syndrome (SARS) and 2009 novel influenza (H1N1) have had significant impacts on people's lives, socio-economic activities and population movement [5]. COVID-19 also presented similar impacts but its spread was even faster [6]. A pandemic requires large-scale immediate actions by the government to connect with the public and a change in behavior of the public to combat the rapid spread of the disease [7]. For a new disease such as COVID-19, effective epidemic communication is crucial to inform the public about the latest updates of the disease, motivate them to adopt preventive measures to minimize the transmission of the disease, and reassure them that the government is capable of handing the situation [8-11]. Many studies on epidemic and pandemic communication exist on traditional media [8,12,13], suggesting that the public learns about the health risks associated with the pandemic from the media [14,15], which affects how they respond to the epidemic or pandemic [16]. In recent years, social media play an increasingly important role in promoting health risk communication during an epidemic [17,18]. Research on the use of social media to investigate public attention to new epidemics has been conducted such as H7N9 [19-21], the Ebola outbreak [9], and the H1N1 pandemic in 2009 [22]. However, there are few studies that have adopted social media analysis in examining government media communication with the public

and the public's response to the new COVID-19 epidemic [10,11]. Because timely public action is needed to contain the spread of the new disease, it is of urgent importance to investigate how the government media communication engages the public. This information can provide insights on what the media, health organizations, and government can further do to disseminate information to the public so that the latter can take appropriate measures to stem the spread of the virus.

In terms of what organizations emphasize in their epidemic/pandemic communication, a prior study [22] found that most corporate and government organizations in the U.S. relied on the content frames of health crises, health issues, and disasters in communicating messages about the 2009 H1N1 flu pandemic with the public. Government organizations were more likely than corporate organizations to frame the H1N1 pandemic as a general health issue and emphasized uncertainty, disease detection, and preventive measures [22]. The style of communication can also have an impact on public engagement in that a narrative style has a positive effect on preventive and detection health behaviors [23] while arguments and facts may be used too [23]. Researchers have pointed out that narratives promote health behavior change [24,25], yet there is a lack of research on the use of narratives in pandemics for effective health communication apart from Sandell et al. [13] who revealed that positive narratives were effective in raising the public's awareness of health risks and the preventive measures to curb the spread of the 2009 H1N1 pandemic [13]. Additionally, interactions on social media can affect health behavior and attitudes [26], and thus, the creation of the dialogic loop via the use of interactive features [27,28] is important on social media. This can be done via allowing the public to post questions and receive feedback [27,29], and using interactive features such as multimedia and hashtags [30]. A previous study has found a positive relationship between CEOs' use of hashtags and public engagement with respect to likes, shares, and comments on social media [28]. However, a research gap exists in understanding the interactive features used by the government in its communication with the public on social media with regards to a pandemic.

Synthesizing the above literature, our study was guided by the observation that there is scant research on the use of social media to disseminate information about COVID-19 and public engagement with this information [10,11]. In particular, there is a research gap in understanding the content frames employed by the government's media in the Chinese context, its style of communication, and the use of interactive features in its communication with the public regarding a new epidemic. Therefore, in this study, we investigated how the most-read government-owned newspaper in China, *People's Daily*, serving as the main vehicle for the government's dissemination of information to the public,

employed a social networking site, Sina Weibo, to communicate and possibly engage the public with COVID-19.

As of 2014, China had 649 million Internet users [31]. To utilize the power of the Internet, the main Chinese state-owned media, such as *People's Daily* and *CCTV News*, have shifted the paradigm of media coverage by placing more emphasis on communication with the public via social media [32]. They have also switched to a more interactive style to better connect with the public [32]. In China, where Facebook is blocked, Weibo, a social media platform under *People's Daily* introduced by the Chinese commercial corporation, Sina, has taken over and become the largest social media network [33]. In 2018, Weibo had over 462 million active users [34], and was used by approximately 200 million people every day [35].

With years of the government's continued efforts, the reputation of the Chinese state-owned media has improved significantly in the eyes of the Chinese public [36]. State-owned media such as *People's Daily* now maintains a strong web presence and a user-friendly image rather than an authoritative image [37]. *People's Daily* encourages its audience to participate in discussions and demonstrates a strong tendency to adopt positive and persuasive messages [38]. For example, on a topic of haze-related issues, instead of providing pictures of haze with a negative valence, *People's Daily* posted positive images that encouraged the public to appreciate the beauty of nature, accompanied by persuasive messages that suggested substantial improvements to be made in the future [38]. This is vastly different from how *China Daily* handled the same topic, which displayed a cartoon with Santa Claus hitting a tree due to haze [38]. This example demonstrates that the state-owned media in China, *People's Daily*, and its online platform, Sina Weibo, have actively adapted their styles of interactive communication to better engage the public.

In terms of health emergency communication, previous studies have found that social media platforms, such as Twitter and even the photograph-based Instagram, played a significant role in guiding the public during the Zika virus outbreak in 2016 [18,39]. For China, Sina Weibo performs a similar role during pandemics since the government, news media, and the public heavily relied on it as an online platform for communicating information during the current COVID-19 outbreak [11]. Sina Weibo serves as a pivotal communication platform for the government to interact with the public and disseminate information about COVID-19, such as its symptoms, preventive measures, and adopted health policies [11]. Therefore, we contend that *People's Daily* would also communicate

information about COVID-19 and interact with the public on its social media platform, Sina Weibo. In our study, we integrated factors, including health crises framing in the media context [22,40,41,42], message style in health communication [13,23], and interactive features [27,28] to examine epidemic communication and public engagement in China. Then, we developed an integrated framework to investigate the relationship between these factors and the levels of public engagement. Since our study also investigated public engagement in the form of likes, comments, and shares, it might offer insights on how effectively social media platforms such as Weibo can be used for epidemic communication.

Developing an Integrated Framework

The World Health Organization has advised governments to take proactive steps to communicate with the public about epidemics as the sharing of critical information about the epidemic can minimize the spread of the disease and foster the public's collaboration with the government [10,43,44]. Social media serve as a major communication platform for the government and public health authorities to provide timely health information to the public [11,22,45,46,47]. The contribution of this study is that we incorporated three key dimensions in health emergency communication on social media, namely the framing of health crises and issues [22,40,41,42], message style [13,23], and the interactive loop [27,28] to examine COVID-19 communication by the government-owned media and public engagement in China. Our findings shed light on how responses to the epidemic are framed by the media and what encourages the public to engage with such communication and take appropriate actions to slow the spread of the virus. In the following, we explain the three dimensions adopted in our study: content frame, message style, and interactive features.

Content Frame Dimension

Communication related to health risks depends on persuasion for the framing of the message that informs the public about important information and motivates them to act [48]. Framing refers to how a text or message defines an issue and provides the necessary context [49,50]. Entman [51] pointed out that "to frame is to select some aspects of a perceived reality and make them more salient in a communicating text" (p. 20). Drawing on framing analysis, one can identify how organizations and the government frame their messages pertaining to critical issues for the public [52], thereby impacting the effectiveness of the information disseminated [53].

In the management of a health crisis, the media and government tend to employ six frames in message delivery: conflict (aspects of crises that bring tensions between parties); action (past or current crisis response actions); consequence (the effects or severity of the crisis); new evidence (discovery of new evidence that contributes to the crisis understanding); uncertainty (aspects such as the spread of the epidemic, treatment, and what is unknown); and reassurance (reassuring the public) [22,41]. When handling communication of health issues, five frames in the delivery of health messages are noted, namely disease detection (symptoms to indicate how the disease is spreading), disease prevention (taking preventive measures), healthcare services (the actions that the healthcare system is taking), scientific advances (discovery of new evidence showing how the disease is spread), and lifestyle risk factors (personal habits that are likely to lead to the disease) [22,40,42]. In the application of these frames, Liu and Kim [22] noted that most corporate and government organizations in the U.S. used the frames of health crises and health issues much more via traditional media than social media in disseminating messages about the 2009 H1N1 flu pandemic [22]. Yet corporate organizations framed the pandemic as a health crisis rather than as a general health issue, meaning that they did not emphasize the long-term actions that could prevent the health issue from arising in future. In addition to this, Liu and Kim [22] noted that government organizations were more likely to use uncertainty subsumed under the health crisis frame whereas corporate organizations tended to use the conflict indicator [22]. In another study, Shih et al. [41] noted that the frames of governmental action and consequence were predominantly used by journalists to craft stories about epidemics including mad cow disease, West Nile virus, and avian flu in the print version of New York Times [41]

Given that COVID-19 was a health crisis and health issue emerging in China, and required immediate action from the public, we contend that framing this epidemic using the health crisis frames of action, new evidence, uncertainty, and reassurance would be of relevance to communication with the public, while the frame of health issues, namely, disease prevention and healthcare services, are of salient importance too since information is lacking on the details and duration of the epidemic. As highlighted by Shih et al. [41], the government may attempt to minimize loss by reassuring the public with actions and new evidence via its influence on the media and its frames [41]. Therefore, the above frames could be effectively used in the media coverage of the epidemic. For a new epidemic, vaccines and medicine are not available to the public, so disease detection and scientific advances are tasks that only medical professionals can undertake, and thus,

may not be able to engage the public. Disease prevention is vital and includes information about what preventive measures the public should adopt to reduce the risk of infection [12,43]. A prior study [22] found that government organizations in the U.S. were more likely to incorporate uncertainty into their crisis responses to the H1N1 pandemic and with the implications of their results, we incorporated uncertainty into our framework, since the newspaper we examined is the main vehicle used by the government in China to communicate with the public. Uncertainty is useful because by indicating what is unknown, more transparency of information is provided, possibly generating trust [14,43]. Conflict was primarily used by corporate organizations as opposed to government organizations for the H1N1 pandemic in the U.S. [22], and thus not deemed of specific value in our framework.

The frames that we employed are in line with the information that the WHO recommends that the media should provide to the public: offering accurate and transparent information to the public, encouraging appropriate attitudes, actions, and behaviors, and helping prevent unnecessary fear [44]. As a result, we combined the eleven frames of health crises and issues into six frames for the investigation of COVID-19 content frames in social media posts, namely *(C1) Action*, *(C2) New evidence*, *(C3) Reassurance*, *(C4) Disease prevention*, *(C5) Healthcare services,* and *(C6) Uncertainty*. Since these frames are all content-related, we termed them “sub-dimensions” under the “content frame” dimension.

Message Style Dimension

Since a key objective of epidemic communication is to persuade the public to change their behavior to limit the spread of the disease [11] while the public has a need for real-time information [47], effective messages need to be designed, requiring some form of appeal. In this regard, the effectiveness of narratives in health communication on disease detection and prevention has been explored [54-56]. Narratives refer to stories that people use and tell, and consist of anecdotes and personal stories with plots [23,24]. Narratives engage the public because they make them concentrate on the story events instead of disputing the presented information, while eliciting emotional reactions and being both entertaining and informative [23,46,55,57,58]. On the other hand, non-narrative messages depend on the use of arguments and facts presented logically and are considered as informative [23].

Studies on the effectiveness of narratives in brand advertisement connection with customers and in

the area of health communication have been conducted [58-60]. For example, a narrative film was effectively employed to communicate the need for vaccination against the human papillomavirus (HPV) [25]. Scholars have increasingly recognized the role of narratives in promoting health behavior change [24], but studies on the use of narratives in pandemics for effective health communication are scarce with the notable exception of Sandell et al. [13] who found that positive narratives were powerful in raising the public's awareness of health risks and preventive measures for the 2009 H1N1 pandemic [13]. Based on the above, we categorized *(S1) Narrative* and *(S2) Non-narrative* as sub-dimensions under the "message style" dimension.

Interactive Features Dimension

The interaction (i.e. one-to-one or one-to-many) on social media sites can influence health behavior and attitudes [26], and consequently, the promotion of the dialogic loop with interactive features [27,28] is crucial on such sites. An interactive dialogic loop allows the public to post questions and receive feedback as well as post comments and share them [20,27]. A wide range of interactive features are available on sites, including multimedia (e.g. videos, audio, photos, podcasts), stay-up-to-date tools (e.g. hashtags) and comments on content [30]. Hashtags enable users to find relevant shares on an issue [61] and facilitate in making synchronous conversations on Twitter, thereby fostering engagement [62], with a study noting a positive relationship between CEOs' use of hashtags and engagement in terms of likes, shares, and comments [28]. To encourage users to return to the site, an attractive site and relevant links are necessary. Regarding conservation of visitors, the site should include useful external links [27]. In health-related communication, it is known that social media posts with interactive features leave a deep impression on the public when compared with posts in plain text [63]. Hence, we assigned "interactive features" as the third dimension, comprising the four sub-dimensions of *(I1) Links to external sources*, *(I2) Use of hashtags*, *(I3) Use of questions to solicit feedback*, and *(I4) Use of multimedia*.

Although prior studies have recognized the importance of the content frames [22,40,41,42], message style [13,23], and interactive features [27,28] in health-related communication, the question as to whether these three dimensions can facilitate the communication of COVID-19 on the government's social media platform remains unclear. Therefore, our first research question is derived:

RQ1: How frequently did the official social media employ the sub-dimensions of content frames, message style, and interactive features in its communication of COVID-19?

A clearer indication of the public's awareness of the information communicated by the government can be revealed through their actions of liking, sharing, and commenting on the government's posts. Therefore, it is pertinent to investigate the effects of the content frames, message style, and interactive features on different levels of public engagement [62,64,65]. Social media users may use "likes" to indicate their interest in a health issue [66,67], while by commenting and sharing, the public can let others know that the issue is important, thereby serving as disseminators of the original message posted [9]. To investigate differences in public engagement with health information posted by the government in response to COVID-19, our second research question is posed:

RQ2: Did the sub-dimensions of content frames, message style, and interactive features have different levels of impact on public engagement?

Different dimensions may function synergistically to impact public engagement. As has been found in a study, an interaction effect between content and style of communication on public engagement in brand social media communication was observed [68]. It is therefore likely that interaction effects might exist between some of the dimensions or sub-dimensions on public engagement in COVID-19 communication. Thus, our third research question is as follows:

RQ3: Could the dimensions (i.e. content frames, style, and interactive features) or sub-dimensions interact synergistically to increase or decrease the levels of public engagement with the government's communication of COVID-19?

By examining the impact of content frames, message style, and interactive features on public engagement in COVID-19 communication, our study aims to provide meaningful and critical information for governments, health organizations, communication professionals, and researchers regarding the health emergency communication strategies employed and their effectiveness in raising the public's awareness of and urgent need for taking preventive measures against COVID-19.

Methods

Data Collection

We selected the government-owned social media platform - *People's Daily*'s Sina Weibo account for data collection. *People's Daily* is the official newspaper of the Central Committee of the Communist Party of China [69] for disseminating government information to the Chinese public [70]. It is the most influential and authoritative newspaper in China, having a circulation of three million, and is ranked as one of the world's top 10 newspapers [71]. With 117 million followers, Sina Weibo of *People's Daily* is also one of the top followed and most visited Sina Weibo sites in China. Due to the prominent use of Sina Weibo for social media communication in China [34] with 462 million active online users in 2018, we captured all posts and the public's responses communicated between the government and public on COVID-19 from *People's Daily* for the investigation of government communication of COVID-19 and its interaction with the public.

Sample Period

A text corpus containing all posts on Sina Weibo of *People's Daily* pertaining to COVID-19 from 20 January 2020 to 11 March 2020 was constructed. The sampled period began on 20 January 2020 when the Chinese State Council officially announced the management of COVID-19 as a public health emergency issue and the corresponding preventive measures were launched to tackle COVID-19 [72,73]. The sampled period ended on 11 March 2020 when WHO declared the COVID-19 outbreak a pandemic, meaning that the regional epidemic had become a global public health emergency [4]. Subsequently, all online posts related to COVID-19 were manually extracted from Sina Weibo's account of *People's Daily,* and in total, 3255 posts were collected.

Sample Size and Sample Data Collection

To generalize a sample size to represent the target population (3255 posts), we employed the sample size calculator developed by the Australian Statistics Bureau to estimate a sample size of 620, giving a confidence level of 95%, a confident interval of 0.035, and standard error of 0.018. A random sampling method was employed. The 620 posts and their corresponding public responses (i.e. number of shares, comments, and likes) on *People's Daily*'s Sina Weibo account from 20 January 2020 to 11 March 2020 were harnessed for quantitative content analysis. To systematically detect

statistically-valid outliers, we employed z-score to quantify the unusualness in the observations [74]. Twelve posts (2%) were identified as outliers and removed from the data pool. These outliers included posts that were significantly longer or shorter, which would have otherwise caused problems during content analysis as the length of the posts would affect the number of counts in content themes, style, and interactive features. Consequently, 608 posts and the related public responses were included in the corpus for content analysis.

Content Analysis and Coding Scheme

Content analysis was employed to examine COVID-19 communication in the 608 posts of *People's Daily's* Sina Weibo. Content analysis is a widely employed method in the study of technical and media communication [75]. It is concerned with the context in which the occurrences of words, phrases, signs, and sentences are recorded and analyzed to provide an in-depth understanding [75]. Researchers can design a variety of categories based on their interactions with the data to develop an integrated framework for quantitative studies [76]. Content analysis can be applied to "virtually any form of linguistic communication to answer the classic questions of who says what to whom, why, how, and with what effect" [77]. Therefore, it is well-suited to a coding operation involving a developed framework in the media communication context [78]. Through an in-depth analysis of mainstream media communication, we were able to reveal and establish the relationship between the variables in the proposed conceptual framework.

To answer RQ1, we drew on previous studies of epidemic communication, health crisis communication, and public relations studies [11,40] to code the topics of the content dimension exhibited in the government's COVID-19 communication into the following six sub-dimensions on a sentence basis: *(C1) Action*, *(C2) New evidence*, *(C3) Reassurance*, *(C4) Disease prevention*, *(C5) Healthcare services*, and *(C6) Uncertainty*. Secondly, to examine the communication styles of COVID-19 posts from *People's Daily*, we built on prior studies [55,58] and coded the two message styles in the style dimension into the sub-dimensions of *(S1) Narrative* and *(S2) Non-narrative* on a sentence basis. To determine whether the narrative style of communication was employed, we examined if the post had a temporal or spatial sequence and revealed the writer's feelings or thoughts. Lastly, we built on prior public relations studies [27,38,68] and coded the number of interactive features used to facilitate the creation of the interactive dialogue loop. These interactive features included: *(I1) Links to external sources*, *(I2) Use of hashtags*, (I3) *Use of questions to solicit*

feedback, and *(I4) Use of multimedia*. See Appendix 1 in Supplementary Files for the exemplifications of coding items and examples extracted from the collected posts (Supplementary Files).

Regarding RQ2 and 3, we recoded the dimensions of content, style, and interactive loop using the dominant category for performing the ANOVA tests on content, style, and interactive loop on public engagement. For example, we found 43% of the sentences in post no. 128 belonging to CI and 29% to C4; 57% of sentences employing a narrative style of communication while 43% being non-narrative; 1 link providing an external source; 2 pairs of hashtags and 1 multimedia feature. Then, we recorded the content as C4 based on the dominant content topic; style as S1 based on the dominant use of narrative sentences and interactive loop as I2 based on the dominant use of hashtags. If the count of sentences or interactive features was the same, the primary coder checked the title, topic sentences, and context of the post to determine the dominant category.

To address RQ2 and 3, we recorded the number of shares, comments, and likes of the sampled posts to investigate the relationship between *People's Daily* communication and its impact on public engagement. Regarding the negative binomial regression analysis, the coding results of RQ1 were adopted to investigate the effect of all sub-dimensions on public engagement. The count number of shares, comments, and likes in RQ2 and 3 was also included for statistical analyses.

Intercoder Reliability

The coding was conducted by the third author, the primary coder, and a well-trained coder who all possess a postgraduate degree in communication. To ensure intercoder reliability on the coding of dimensions and sub-dimensions and public engagement, the coder was repeatedly trained on the coding scheme. Any disagreement between the author and coder was discussed in the coding process. The measure of intercoder reliability was based on the co-coding of 120 posts from the data pool (19% of the total number of posts sampled) [75]. For all categories, the average agreement was higher than 0.83, and the average Cohen's Kappa was greater than 0.8, indicating an almost perfect agreement [76]. See Appendix 2 in Supplementary Files for intercoder checking results of all categories (Supplementary Files).

Statistical Analyses

To analyze the differences in the frequencies of the use of each sub-dimension in the communication of COVID-19-related news by the official social media (RQ1), we coded the presence of sub-dimensions in each of the 608 posts, and then calculated the mean counts for each of the twelve sub-dimensions. We then employed one-way ANOVA and the post-hoc Tukey test in SPSS to reveal the differences in the use of content, style, and interactive features in COVID-19 social media communication (RQ1) and the difference in the number of shares, comments, and likes in relation to the sub-dimensions of content, style, and interactive dimensions (RQ2). Two-way ANOVA was performed to examine the interaction effect of content and style on public engagement in the form of shares, comments, and likes (RQ3). * P<0.05, ** P<0.01, *** P<0.001, **** P<0.0001. All histograms depict mean ± S.E.M.

To test the assumptions of normality in ANOVA, we performed the Kolmogorov-Smirnov and Shapiro-Wilk tests on the normality of the variables. Most variables were not normally distributed, but we decided to continue using ANOVA as it has proven to be robust and valid in testing the difference between independent variables, even if the normality assumption is violated [77]. In addition, we conducted the test of homogeneity of variances when performing ANOVA. When the assumption of homogeneity of variances was violated, the ANOVA results were replaced with those of Welch ANOVA.

As for RQ2, which involved examining the relationship between the 12 sub-dimensions (independent variables) and the public's responses in terms of the count number of shares, comments, and likes (dependent variables), we first employed Poisson regression, a count regression model in SPSS [78,79]. However, real-world dataset is commonly known to violate the assumption in Poisson regression with respect to over-dispersion of outcome variables [80]. As expected, such a violation was detected in our dataset, and thus, we followed the common practice of replacing Poisson regression with Negative binomial regression (NB2) [80] to improve the Goodness of Fit, especially Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC). NB2 is effective in fitting various types of data arising in technical and communication research [81], and NB2 is a more general model that relaxes the strong assumption that the underlying rate of the outcome is the same for each included participant [81].

Results

In response to RQ1 regarding the differences in the frequencies of the use of each sub-dimension in the communication of COVID-19-related news by the official social media, we found that *(C2) new evidence* in the content dimension was the most used sub-dimension (0.749 ± 0.05) and significantly used much more than any other sub-dimensions (Fig. 1a). *(C1) Action* was the second most prevalent sub-dimension (1.210 ± 0.08) while *(C3) Reassurance* was the third most frequently used one (0.506 ± 0.05). *(C4) Disease prevention* (0.276 ± 0.04) and *(C5) Healthcare services* (0.315 ± 0.04) ranked fourth and fifth respectively, while *(C6) Uncertainty* was the least used sub-dimension (0.077 ± 0.02) (Fig. 1a). In relation to the style dimension, the *(S2) Non-narrative* (2.259 ± 0.09) style was used approximately twice as much as the *(S1) Narrative* (1.110 ± 0.07) one (Fig. 1b). Concerning the interactive dimension, the *(I4) Use of multimedia* (1.586 ± 0.08) and *(I2) Use of hashtags* (1.411 ± 0.02) were the most prevalent sub-dimensions, with the *(I4) Use of multimedia* being slightly but significantly higher than that of the *(I2) Use of hashtags* (Fig. 1c). By contrast, both *(I1) Links to external sources* (0.402 ± 0.02) and *(I3) Use of questions to solicit feedback* (0.097 ± 0.02) were used infrequently, with the *(I3) Use of questions to solicit feedback* being used significantly less in comparison to all other sub-dimensions (Fig. 1c).

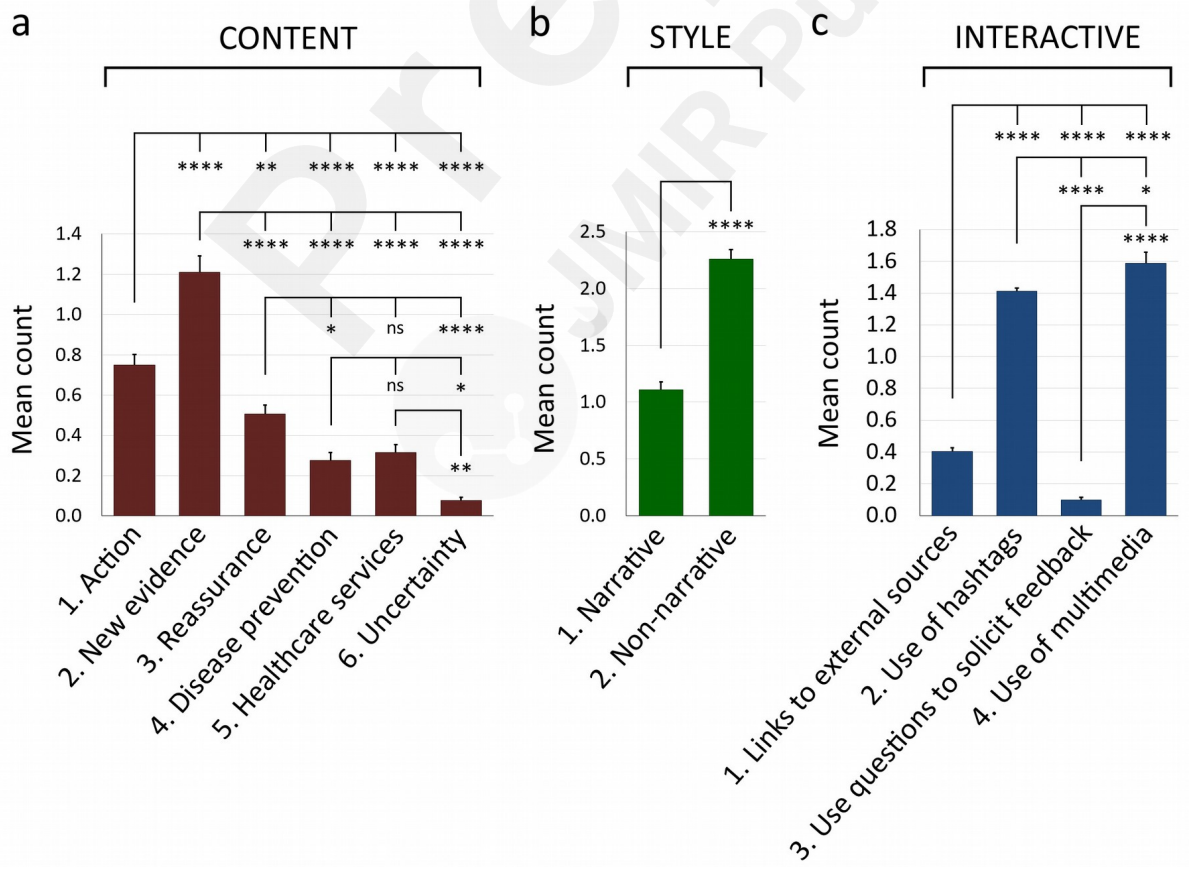

Figure 1. Comparison of the mean counts of sub-dimensions within each of the three dimensions. (**a**) Mean counts of sub-dimensions under the content dimension; (**b**) Mean counts of sub-dimensions under the style dimension; (**c**) Mean counts of sub-dimensions under the interactive dimension. * $P<.05$, ** $P<.01$, *** $P<.001$, **** $P<.0001$. All histograms depict mean ± S.E.M.

Regarding the levels of impact on public engagement from individual sub-dimensions in COVID-19 social media posts (RQ2), our results showed that posts of *(C2) New evidence* generated the least number of shares of all six sub-dimensions (1327.81 ± 165.90). Posts of *(C2) New evidence* had significantly fewer shares than posts of *(C3) Reassurance* (4065.32 ± 689.88), *(C4) Disease prevention* (4455.71 ± 604.95), and *(C6) Uncertainty* (5033.35 ± 2242.13) (Fig. 2a). However, the six sub-dimensions of content did not show differences in their impact on comments and likes (Fig. 2b, c). For the style dimension, *(S1) Narrative* posts generated significantly more shares than *(S2) Non-narrative* posts (*Narrative* = 3544.03 ± 379.80 vs *Non-narrative* = 2237.06 ± 204.18) (Fig. 2d). Similar to content, the message style did not exert any impact on the number of comments and likes (Fig. 2e, f). As for the interactive dimension, no significant differences were observed among the four sub-dimensions in terms of shares, comments, and likes (Fig. 2g-i). Surprisingly, although they were the most frequently used sub-dimensions (Fig. 1a, b), *(C2) New evidence* and the *(S2) Non-narrative style* had the least impact on the number of shares in their own respective dimensions (Fig. 2a, d).

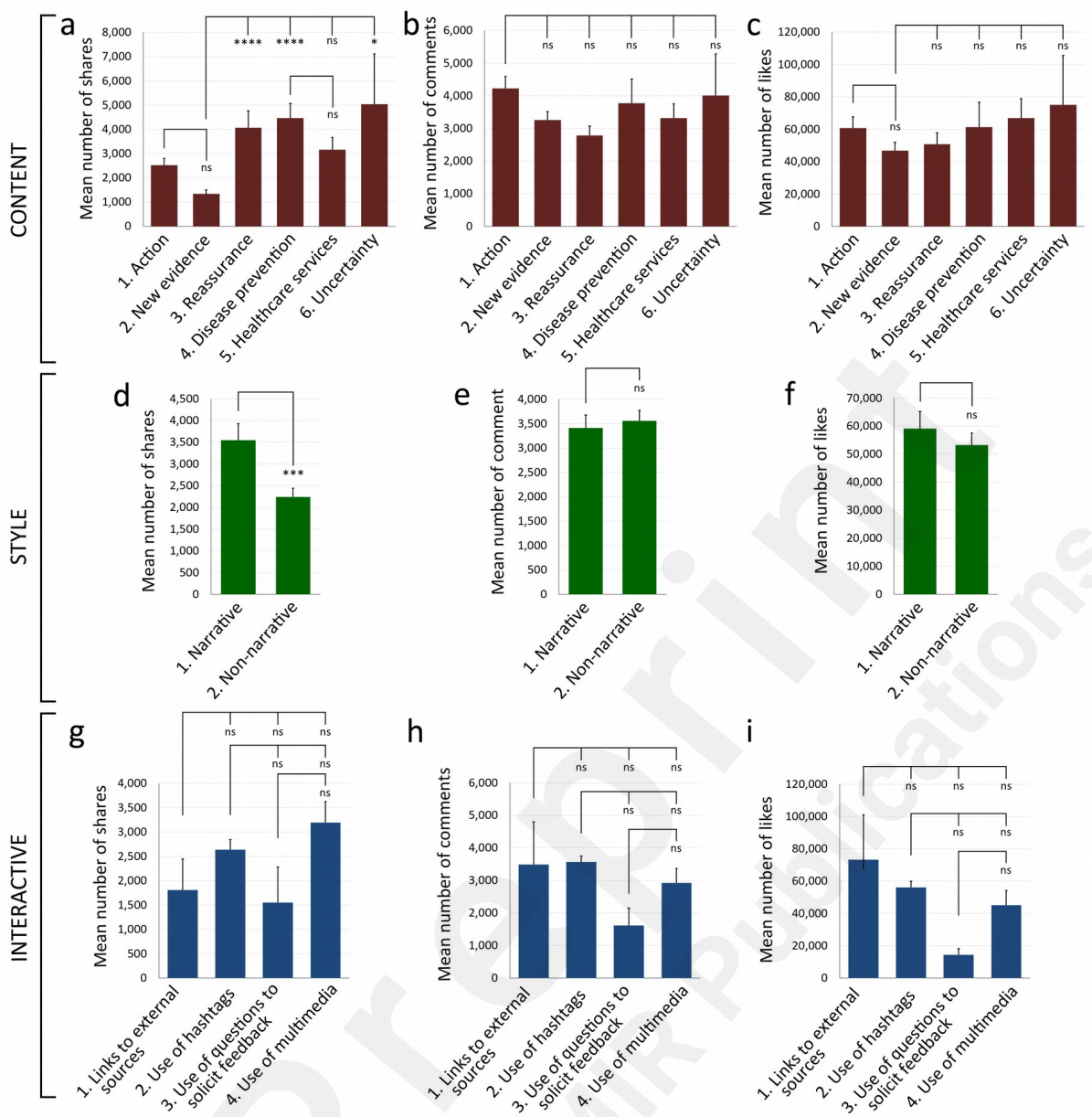

Figure 2. Comparison of the mean number of shares, comments, and likes for posts of each sub-dimension. Mean number of (**a**) shares, (**b**) comments, and (**c**) likes of the sub-dimensions of the content dimension. Mean number of (**d**) shares, (**e**) comments, and (**f**) likes of the sub-dimensions of the style dimension. Mean number of (**g**) shares, (**h**) comments, and (**i**) likes of the sub-dimensions of the interactive dimension. * P<.05, ** P<.01, *** P<.001, **** P<.0001. All histograms depict mean ± S.E.M.

To determine which of the twelve sub-dimensions were effective positive/negative predictors of public engagement in COVID-19 communication (RQ3), we fitted the share, comment, and like count data to a negative binomial regression (NB2) model. Our results above in Fig. 1 and Fig. 2 indicated that although *(C2) New evidence* was the most used content sub-dimension (Fig. 1a), its posts received the lowest number of shares (Fig. 2a), suggesting a negative correlation between *(C2)*

New evidence and the number of shares. In our NB2 analysis, we confirmed that *(C2) New evidence* was a strong negative predictor of the number of shares (β = -.253 ± .068, *P* < .001) (Table 1). Similarly, *(S2) Non-narrative* was the most frequently used style (Fig. 1b), but generated a lower number of shares as opposed to the *(S1) Narrative* one (Fig. 2d). Again, we confirmed that the *(S2) Non-narrative* style was indeed a strong negative predictor of the number of shares (β = -.223 ± .068, *P* = .00) (Table 1). By contrast, the *(S1) Narrative* style was found to be a strong positive predictor of the number of shares (β = .283 ± .064, *P* < .001) (Table 1). For the interactive dimension, *(I1) Links to external sources* were a strong positive predictor of the number of shares (β = .319 ± .087, *P* < .001) whereas the *(I4) Use of multimedia* was a weak positive predictor of the number of shares (β = .057 ± .023, *P* = .02) (Table 1). Finally, we noted that the *(I3) Use of questions to solicit feedback* was a strong negative predictor of the number of comments (β = -.177 ± .087, *P* = .04) and likes (β = -.290 ± .111, *P* = .01) (Table 1).

Table 1. Identification of positive/negative predictors of the number of shares, comments, and likes using a negative binomial regression model.

Dimen-sion	Sub-dimensions	Shares				Comments				Likes			
		β	SE	CI	*P*	B	SE	CI	*p*	β	SE	CI	*p*
Content	C1. Action	-0.071	0.068	[0.816, 1.063]	0.29345	0.096	0.063	[0.973, 1.244]	0.12602	0.049	0.080	[0.899, 1.228]	0.53379
	C2. New evidence	-0.253	0.064	[0.685, 0.881]	**0.00008**	0.003	0.060	[0.893, 1.128]	0.95376	-0.053	0.077	[0.816, 1.102]	0.48796
	C3. Reassurance	-0.053	0.072	[0.824, 1.092]	0.46164	-0.080	0.066	[0.812, 1.049]	0.21871	-0.059	0.086	[0.797, 1.116]	0.49531
	C4. Disease prevention	0.057	0.078	[0.909, 1.234]	0.46321	-0.019	0.074	[0.848, 1.134]	0.79305	-0.054	0.097	[0.783, 1.145]	0.57488
	C5. Healthcare services	-0.097	0.077	[0.780, 1.055]	0.20796	0.029	0.067	[0.902, 1.174]	0.66546	0.070	0.089	[0.902, 1.276]	0.42894
	C6. Uncertainty	-0.090	0.138	[0.697, 1.197]	0.51172	-0.012	0.115	[0.788, 1.239]	0.91651	0.019	0.150	[0.759, 1.368]	0.89985
Style	S1. Narrative	0.283	0.064	[1.170, 1.506]	**0.00001**	0.069	0.055	[0.961, 1.194]	0.21270	0.129	0.074	[0.984, 1.316]	0.08042
	S2. Non-narrative	-0.223	0.068	[1.094, 1.427]	**0.00101**	0.037	0.061	[0.921, 1.169]	0.54105	0.108	0.078	[0.955, 1.299]	0.16933
Interactive	I1. Links to external sources	0.319	0.087	[1.160, 1.633]	**0.00026**	0.022	0.071	[0.889, 1.175]	0.76064	0.088	0.090	[0.915, 1.303]	0.32854
	I2. Use of hashtags	0.079	0.081	[0.923, 1.268]	0.33039	0.059	0.070	[0.925, 1.216]	0.39790	0.016	0.092	[0.848, 1.217]	0.86553
	I3. Use of questions to solicit feedback	-0.121	0.106	[0.720, 1.092]	0.25680	-0.321	0.090	[0.608, 0.865]	**0.00036**	-0.463	0.116	[0.501, 0.790]	**0.00006**
	I4. Use of multimedia	0.057	0.023	[1.011, 1.108]	**0.01530**	-0.010	0.022	[0.948, 1.033]	0.63870	-0.046	0.029	[0.903, 1.011]	0.11104

Bolded blue font indicates a significant relationship.

Sub-dimensions are likely to function synergistically in affecting public engagement. To examine whether there was an interaction among the dimensions on public engagement (RQ3), we performed a two-way ANOVA analysis on the mean number of shares, comments, and likes of the dimensions. Our results confirmed a significant interaction effect between content and style on the number of likes (Table 2). However, neither was there any interaction effect between content and the interactive dimension itself nor between style and the designated interactive dimension (Table 2).

To investigate the interactions between specific sub-dimensions, we performed simple main effect analyses to examine the interactions between specific sub-dimensions on the number of shares, comments, and likes. Between content and style, the different content sub-dimensions showed no significant differences in the number of shares between *(S1) Narrative* and *(S2) Non-narrative* styles (Fig. 3a). However, for the number of comments, the *(S1) Narrative* style was significantly higher than that of *(S2) Non-narrative* in *(C4) Disease prevention* posts (*S1* = 5978.83 ± 972.37 vs *S2* = 2446.33 ± 753.19; $F(1,597) = 8.249$, $P = .00$, $\eta_p^2 = .014$) (Fig. 3b). Likewise, a higher number of likes was observed for the *(S1) Narrative* style as opposed to *(S2) Non-narrative* in *(C4) Disease prevention* posts (*S1* = 104881.00 ± 20416.43 vs *S2* = 35092.87 ± 15814.50; $F(1,597) = 7.303$, $P = .01$, $\eta_p^2 = .012$) (Fig. 3c). These results indicate that the pairing of *(C4) Disease prevention* content with a *(S1) Narrative* style generated a higher number of comments and likes.

Between the content and the interactive dimensions, no significant differences were observed in the number of shares, comments, or likes for the *(S1) Narrative* and *(S2) Non-narrative* styles (Fig. 3d-f). Between the style and the interactive dimensions, the *(S1) Narrative* style received significantly more shares than the (S2) *Non-narrative* one on the *(I2) Use of hashtag* posts (*S1* = 3685.92 ± 359.02 vs *S2* = 2145.31 ± 245.16; $F(1,601) = 12.558$, $P < .001$, $\eta_p^2 = .021$) (Fig. 3g), highlighting that the pairing of *(S1) Narrative* style with the *(I2) Use of hashtags* generated a higher number of shares. For the number of comments and likes, no significant differences were found (Fig. 3h, i).

Table 2. Test of interaction effect between content, style, and the interactive dimension.

		Shares					Comments					Likes				
		df	MS	*F*	*P*	η_p^2	*Df*	MS	*F*	*p*	η_p^2	*df*	MS	*F*	*p*	η_p^2
CONTENT X STYLE	Content	5	74362796.0	3.627	0.00306	0.0295	5	13679259.3	0.804	0.54720	0.0067	5	1600144996.5	0.213	0.95689	0.0018
	Style	1	2955797.2	0.144	0.70432	0.0002	1	644487.0	0.038	0.84577	0.0001	1	856248211.1	0.114	0.73562	0.0002
	Content x Style	5	14294815.4	0.697	0.62577	0.0058	5	35061851.2	2.060	0.06875	0.0170	5	17759392993.4	2.367	**0.03840**	0.0194
	Error	597	20504947.6				597	17018927.7				597	7502954304.2			
CONTENT X INTERACTIVE	Content	5	14588523.9	0.706	0.61893	0.0059	5	7622337.7	0.452	0.81196	0.0038	5	2892590073.7	0.384	0.85985	0.0032
	Interactive	3	12299580.7	0.595	0.61819	0.0030	3	15422984.7	0.914	0.43359	0.0046	3	8720670460.3	1.158	0.32520	0.0059
	Content x Interactive	9	7690008.8	0.372	0.94826	0.0056	9	12698088.8	0.753	0.66030	0.0114	9	6061808678.1	0.805	0.61201	0.0121
	Error	590	20657294.6				590	16865817.6				590	7532498681.0			
STYLE X INTERACTIVE	Style	1	4166367.8	0.195	0.65928	0.0003	1	543790.1	0.032	0.85828	0.0001	1	454343258.8	0.060	0.80644	0.0001
	Interactive	3	8001481.9	0.374	0.77200	0.0019	3	13205355.1	0.775	0.50824	0.0039	3	5564405021.7	0.736	0.53084	0.0037
	Style x Interactive	3	11004271.3	0.514	0.67280	0.0026	3	4937789.1	0.290	0.83279	0.0014	3	882821621.1	0.117	0.95027	0.0006
	Error	600	21411044.7				600	17039291.1				600	7560858471.6			

Bolded blue font indicates a significant interaction effect.

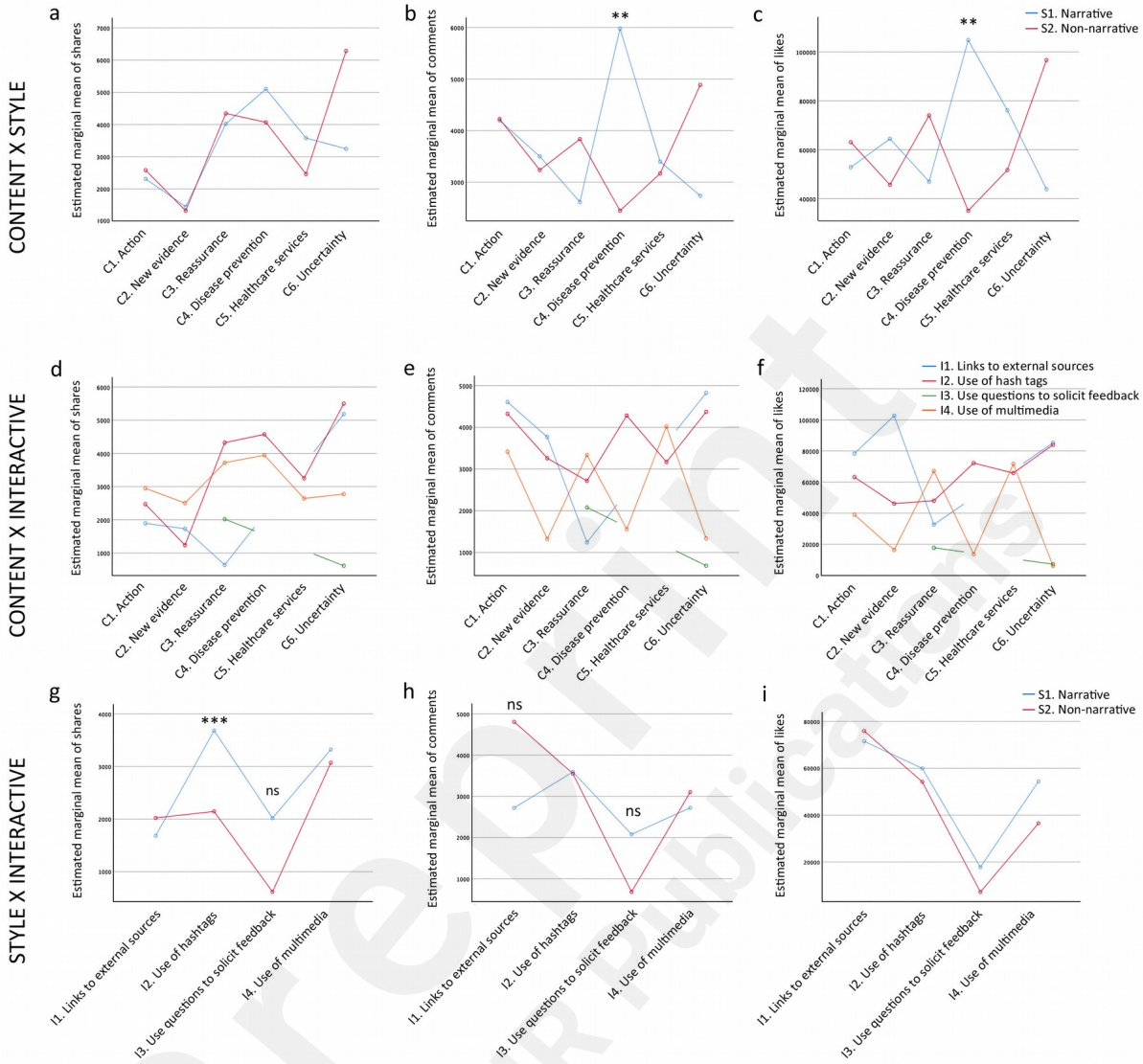

Figure 3. Simple main effects between the sub-dimensions on the number of shares, comments, and likes. Simple main effects between the sub-dimensions of content and style on the number of shares, comments, and likes (**a-c**). Simple main effects between the sub-dimensions of content and interactive loop on the number of shares, comments, and likes (**d-f**). Simple main effects between the sub-dimensions of style and interactive loop on the number of shares, comments, and likes (**g-i**). ** *P*<.01, *** *P*<.001.

Discussion

Principal Results

Our results showed that a range of content frames, message styles, and interactive features was employed by the government to communicate about COVID-19 with the

public on social media with a view to handling the health crisis. Yet different levels of engagement were revealed. In particular, (C2) *New evidence* and the (S2) *Non-narrative style* had the least impact on the number of shares (Fig. 2a, d) although they were the most frequently used sub-dimensions (Fig. 1a, b). Additionally, our NB2 results confirmed that *(C2) New evidence* and *Non-narrative style* were strong negative predictors of the number of shares (Table 2). On the other hand, the two-way ANOVA indicated that the pairing of *(C4) Disease prevention* posts with a *(S1) Narrative* style generated a higher number of comments and likes (Fig. 3b, c), while the NB2 results confirmed that the *(S1) Narrative* style was a strong positive predictor of the number of shares (Table 2). As found in an earlier study [47], posts on preventive and safety measures related to COVID-19 were most frequently employed by public health organizations in Singapore, the U.S. and England, and our results on disease prevention posts are consistent with this study. In line with previous studies, our results also revealed the strong effect of the narrative style on public engagement [23,46,55,57,58]. A narrative style of communication fosters the public's identification and emotional involvement through the character's sharing in a story event [54,58]. Through this, health narratives can possibly raise the public's awareness of health risks and encourage them to take actions to curb the spread of the disease [13,23,25,55,60].

A previous study has demonstrated an interaction effect between content and style [68], and therefore, we expected an interaction between these two dimensions. Indeed, our data showed a significant interaction between content and style on the number of likes (Table 2). With respect to the interaction between the sub-dimensions, our results showed that more shares were generated for posts related to *(C4) Disease prevention*, *(C3) Reassurance*, and *(C6) Uncertainty* (Fig. 2a), delivered in a *(S1) Narrative style* (Fig. 2d). *(I1) Links to external sources* and *(I4) Use of multimedia* were also positive predictors of the number of shares (Table 2). A "share" indicates a high engagement level because it involves a cognitive action of disseminating the post to others, which can potentially reach a large audience [82-84]. Disease prevention is fundamental in a new epidemic [40-42] and uncertainty needs to be addressed, because by indicating what is unknown, more transparency of information is provided, thereby helping to build trust [14,43]. The public has a tendency to rely on social media during crises as the sites offer emotional support

[85-87], indicating that the communication of uncertainty and reassurance might have served the purposes of offering emotional support and allaying anxiety. Our novel findings regarding the interaction between the sub-dimensions provide important insights for enhancing public engagement in epidemic communication on social media.

Implications, Limitations and Future Work

This study contributes to the understanding of what drives the public to be engaged with COVID-19 communication by the government and adds to the body of knowledge on public engagement with epidemic communication on social media. First, our integrated, comprehensive framework of public engagement with government health communication regarding COVID-19 in China was empirically tested. *People's Daily* currently has 117 million followers, but Sina Weibo on its own is widely used for social media communication in China [34], with 462 million active online users in 2018. Existing followers of *People's Daily* can influence other Weibo users through sharing the posts, fostering a sense of community with them, and potentially helping to contain the spread of COVID-19. Both "comments" and "likes" were noted for disease prevention posts delivered in a narrative style (Fig. 3b, c). A "comment" is indicative of a high engagement level because it requires the user to read a post and respond to it [88] but the interpretation of a "like" is subject to change depending on the context. For example, one study suggested that a "like" is indicative of a lower engagement level [82], although within the context of epidemic communication, a "like" might be perceived as a user's approval of the post's importance. In view of this, both "likes" and "comments" are regarded as good indicators of health risk communication.

Second, *People's Daily*'s approach of predominantly employing new evidence posts disseminated in a non-narrative style in COVID-19 communication was not perceived as the ideal strategy to engage the public. We have gained insights into the sub-dimensions that can effectively enhance public engagement with epidemic communication; for instance, disease prevention posts delivered in a narrative style are viewed favorably. It is imperative for health organizations, governments, and researchers to utilize the public's preferred sub-dimensions to increase the number of shares, comments, and likes with a

view to effectively disseminating new epidemic information.

One of the limitations of this study pertains to the sampling period. Because we only captured the posts from only a certain period of time, the results might vary in different time periods of an evolving epidemic. Our developed framework on COVID-19 communication with the public can be further empirically tested to assess the strength of the three dimensions and applied to other cultural contexts. As social media are frequently accessed by young people while there are demographics that still utilize traditional mass media in different ways, COVID-19 communication can be examined in terms of impact through other channels of behavior or practice too. An investigation into the use of other popular social media platforms (e.g. WeChat) in China to disseminate COVID-19 information can be conducted to gain more insights into this topic.

Conclusions

In summary, this study presents a novel, comprehensive framework of the factors that engage the public in COVID-19 communication by the government on social media through empirically testing the measures of health content frames, style of messages, and interactive features. By drawing on this knowledge and harnessing the power of social media, governments and health organizations can determine which aspects to emphasize in an attempt to reduce the spread of the new disease.

Conflicts of interest

The authors declared no conflict of interest.

Supplementary Files

Appendix 1. Exemplifications of the content dimension, style dimension, interactive dialogic loop dimension, and relevant expressions identified from the corpus

Appendix 2. Summary of intercoder reliability statistics

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Supplementary Files

Multimedia Appendixes

Exemplifications of the content dimension, style dimension, interactive dialogic loop dimension and relevant expressions identified from the corpus.
URL: https://asset.jmir.pub/assets/5084cbf608ca6305fcbf1bdb8f8037d6.docx

Summary of intercoder reliability statistics.
URL: https://asset.jmir.pub/assets/c512949584b0f5e7ae10a584b796dfcb.docx

Figures