




Understanding government social media communication strategies and public engagement during the COVID-19 crisis in Lebanon

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Citation: Bajjouk, H., & Ferré-Pavia, C. (2024). Understanding government social media communication strategies and public engagement during the COVID-19 crisis in Lebanon. *Online Journal of Communication and Media Technologies*, 14(2), e202417. <https://doi.org/10.30935/ojcm/14337>

ARTICLE INFO

Received: 16 Apr 2023

Accepted: 8 Feb 2024

ABSTRACT

The COVID-19 pandemic has prompted governments to adopt various online communication strategies, including the use of social media platforms. Drawing on the crisis and emergency risk communication model, this study investigates the Facebook communication strategies employed by the Ministry of Public Health (MoPH) during the COVID-19 crisis in Lebanon and examines the public engagement with these efforts. A content analysis was conducted on 2,001 posts related to COVID-19 from January 2020 to June 2021. The posts were classified into categories and the frequency and median were used to measure government posting activity and engagement. The study analyzed additional post features such as hashtags, mentions, captions, and language to provide further context to the findings. Trend analysis was also conducted to examine how the metrics varied with key events. The results show that MoPH predominantly used photos (72.00%) and the majority of its posts were published during the initial phase of the outbreak (74.20%). The most prevalent categories of posts were uncertainty reduction (54.57%), self-efficacy (30.33%), and vaccines and immunization (16.89%). MoPH's Facebook page witnessed a surge in followers during the post-COVID-19 period, increasing by over 300.00% from the pre-COVID-19 years. Posts content, media type, and crisis stage influenced the level of public engagement. The study reveals that Facebook is effective for strategic health crisis communication. Furthermore, it provides practical insights for public sector emergency managers responsible for online communication during outbreaks.

Keywords: COVID-19, Facebook, communication strategy, crisis and emergency risk communication, engagement, Lebanon

INTRODUCTION

Social media, including popular platforms such as Facebook, has become an indispensable tool for government communication during public health crises like the ongoing COVID-19 pandemic. As the demand for crisis-related information on social media grows during such emergencies (Ism et al., 2021), governmental organizations are utilizing their official social media accounts to facilitate risk and crisis communication and management. This is achieved through the timely dissemination of information pertaining to risks and recommended behavioral responses (Malik et al., 2021) and promoting citizen engagement (Pang et al., 2021). Besides, social media has also proven to be an effective tool for exploring public responses to government

This article, when published, will be part of the PhD process of the first author, with the second's one permission, in the Department of Media, Communication and Culture at the Autonomous University of Barcelona, Spain.

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policies during pandemics, providing valuable insights for policymakers and crisis managers (Drummond & Bozanta, 2022).

Developing effective strategies for disseminating information through government social media accounts during different crisis phases poses a key challenge, especially considering the diverse informational needs at each stage (Yudarwati et al., 2022). Another significant challenge stems from the complex dynamics of public engagement on these accounts, exhibiting variations across phases and eliciting diverse responses to government-provided information (Zhang et al., 2022). This emphasizes the importance of continuously monitoring and assessing both the content and nature of messages communicated by health authorities on social media throughout various pandemic management stages. These evaluations are vital for making policy adjustments and refining strategies in anticipation of future crises. Furthermore, investigating these strategies not only addresses immediate concerns but also contributes to the government's long-term understanding of its target audience, their online behaviors, and effective communication practices.

Lebanon, a Middle Eastern country, faced the early impact of COVID-19 in 2020 during a challenging period marked by a collapsing medical system and compounded crises such as economic downturn and political unrest (Moussallem et al., 2022). Despite these challenges, the Ministry of Public Health (MoPH) effectively managed to control the spread of COVID-19 in the subsequent months (Zahreddine et al., 2022). This success in curbing the pandemic, amidst resource constraints, is believed to be attributed to effective communication efforts that provided essential information to citizens (Melki, 2022). However, the specific strategies employed by the Ministry, especially on social media, remain underexplored in the existing literature. Consequently, this study aims to scrutinize the COVID-19 related communication strategies of MoPH on Facebook and assess public engagement with these strategies across different pandemic phases. Analyzing the Lebanese MoPH's use of Facebook for crisis communication holds three significant advantages. First, Facebook emerges as a primary social media platform in Lebanon (Taleb et al., 2021), and MoPH is the most followed government ministry on the platform among its counterparts. Second, MoPH serves as the central executor of the government's national communication strategy, overseeing both on-the-ground pandemic management and communication efforts through its social media accounts. Third, Lebanon is prone to crises, making an examination of government messaging strategies and public responses crucial for informing future preparedness efforts. To guide the investigation, the crisis and emergency risk communication (CERC) model (Reynolds & Seeger, 2005) is adopted as the theoretical foundation.

The authors' authorized access to MoPH's Facebook account improved data accuracy and reliability, unlike prior studies relying on scrapers or software that failed to identify paid posts, potentially distorting engagement metrics. Besides, employing *post reach* as a key metric to evaluate communication strategies is a novel approach, given that previous research has not delved into it due to restricted access to official social media accounts. For accuracy, data collection occurred in 2021, preventing potential alterations in metric indices due to the disappearance of reactions, comments, and shares associated with deactivated Facebook accounts in case of delayed data collection. Moreover, this study broadens its scope to encompass a more extended time frame, including vaccination campaigns. These enhanced data collection methods contribute to a more comprehensive analysis of MoPH's communication strategies during COVID-19 and its impact on public response.

LITERATURE REVIEW

Government Social Media Amid Disease Outbreaks

Researchers widely recognize social media as an effective tool for emergency and infectious disease management. First, these platforms facilitate the rapid exchange and diffusion of information, serving as valuable tools for governments to disseminate emergency messages during crises and promote citizen engagement (Pang et al., 2021). Second, the low barriers to social media contribute to the easy spread of health misinformation and rumors (Suarez-Lledo & Alvarez-Galvez, 2021). Consequently, governments use these platforms to combat misinformation and quell rumors (Lovari, 2020). Third, governments are using social media to improve citizen compliance and preventive behavior (Jiang & Tang, 2022).

The current body of literature addressing the use of government social media in health risk and crisis communications during outbreaks has employed diverse approaches. Studies from the government perspective analyze the content, style, and delivery of messages during disease outbreaks (Dalrymple et al., 2016; Górska et al., 2022; Liu & Kim, 2011; Lwin et al., 2020; Sandoval-Almazan & Valle-Cruz, 2021). In contrast, public perspective studies focus on online engagement and responses, examining interactions such as likes, comments, and shares, while also exploring both online and offline user behaviors and sentiments (Chen et al., 2020; Guo et al., 2021; Strekalova, 2016; Tang et al., 2021).

Mixed perspective studies, as the name suggests, integrate both government and public viewpoints. These investigations delve into government social media strategies and public engagement and responses. They explore how governments utilize social media for outbreak communication and how the users react to and engage with government messages (Alhassan & AlDossary, 2021; Guidry et al., 2017; Paul & Das, 2022; Syn, 2021). The present study further advances these insights by adopting an integrated perspective, expanding the analysis over an extended period, encompassing a wider range of content and media types. It leverages data from the official MoPH Facebook page, guided by CERC model.

CERC Model

CERC model underpins this study. The US Centers for Disease Control and Prevention developed CERC model to guide health communicators in addressing health crises, including outbreaks (Reynolds & Seeger, 2005; Veil et al., 2008). The original CERC research outlines message strategies to be employed across the phases of a public health crisis (Reynolds & Seeger, 2005). The model comprises five phases: pre-crisis, initial, maintenance, resolution, and evaluation. The pre-crisis phase begins before a crisis occurs when there are signals that an adverse event is looming. In the pre-crisis stage, the emphasis is on educating and preparing the public through creating risk and warning messages and promoting self-protection actions. The initial stage of a crisis is characterized by acute danger and heightened risk of death. At this stage, communicators aim to promote self-efficacy through explaining and encouraging individual preventive behaviors. Furthermore, communication efforts in this stage seek to reduce uncertainty by providing timely information and updates on the crisis and continuously reassuring the public. The maintenance stage is characterized by a reduction in the severity of the crisis, as most or all of the immediate harm has been contained (Alhassan & AlDossary, 2021; Tang et al., 2018). Communication messages during this phase emphasize communication objectives of earlier stages, including ongoing uncertainty reduction, explanation of ongoing risks, promoting self-efficacy, and reassurance. The communication also aims to address misinformation and foster public cooperation with response and recovery efforts. The resolution stage ensures posting updates on resolution, causes, and new understandings of risk, and informing and persuading people regarding available treatments and remedies. The final stage is the evaluation phase, involving assessing response and communication effectiveness and identifying lessons learned. CERC framework, grounded in theory and widely applied globally, has been adapted for social media contexts, proving effective for categorizing messages within government communication across diverse crises, including health emergencies and natural disasters such as hurricanes and extreme weather conditions (Kinsky et al., 2021; Miller et al., 2021).

Engagement Through Government Social Media During Health Crises

Engagement on government social media accounts involves active participation by users through actions such as commenting and sharing (Bonsón et al., 2017; Guo et al., 2018). During health crises, like the COVID-19 pandemic, public engagement on these accounts becomes crucial for effective pandemic communication and management. For governments, this engagement helps in better understanding public concerns, fostering dialogue, evaluating information quality, and enhancing communication strategies. On the citizens' side, engagement facilitates an enhanced awareness of the crisis, deepens understanding, fosters a sense of collaboration, and promotes increased responsibility and self-resilience (Chen et al., 2020). For example, commenting on government social media posts enables two-way communication and assists officials in assessing public sentiment and feedback, while sharing these posts can extend the reach of crisis-related content (Cheng et al., 2021; Guo et al., 2021). Moreover, promoting social media engagement can encourage online civic behavior (Islam et al., 2021) and motivate users to adopt online information security behavior against crisis-related scams (Tang et al., 2021).

The measurement of engagement on Facebook pages includes quantifiable interactions, including likes, comments, and shares (Bonsón et al., 2017). Facebook has expanded the like button by adding six extra emotional responses—love, care, haha, wow, sad, and angry—to provide users with more expressive options (Pang et al., 2021). These added responses, along with likes, collectively fall under the category of “reactions”. Consequently, the present study is focused on analyzing the number of reactions, comments, and shares. In addition to the aforementioned metrics, this study incorporates post reach as an outcome variable to further operationalize engagement. Post reach is defined as the number of unique users exposed to a post within their newsfeed (Hefler et al., 2020).

Previous research has shown that engagement levels can vary based on the crisis stage, content type, and media type (Fissi et al., 2022; Paul & Das, 2022; Zhang et al., 2022). However, an investigation into the changes in engagement on government social media across various crisis stages, and with diverse content and media types, remains unexplored in the context of Lebanon during the COVID-19 pandemic.

Research Questions

This study focuses on two primary research questions:

1. Using the theoretical lens of CERC, what specific communication strategies were employed by MoPH on Facebook during the COVID-19 pandemic?
2. How do crisis stages, types of content, and media shared by MoPH Facebook page impact public engagement during the COVID-19 pandemic?

METHOD

Data Collection

Quantitative content analysis was employed to collect the information needed to fulfill the objectives of this study. All Facebook posts from MoPH, whether originally created or shared on their page, were manually collected and stored. The data covered the period from January 15, 2020 (two days after the first international COVID-19 case) to June 13, 2021 (when Lebanon reported no COVID-19 deaths for the first time since the outbreak). Each post was systematically logged in an Excel spreadsheet with key columns for date, crisis phase categorization (pre-crisis, initial, maintenance), COVID-19 relevance, content type, media type, hashtags, mentions, caption, language, organic or paid status, and engagement metrics, including numbers of reactions, comments, shares, and post reach.

Data Cleaning & Preprocessing

A total of 2,415 posts were obtained. Initial filtering procedures were applied to exclude posts not pertinent to the COVID-19 context. The filtering process, rooted in manually reviewing each post’s content and using keywords like “covid” and “corona”, resulted in the identification of 2,095 posts directly linked to COVID-19. Posts diverging from the study’s focus, addressing alternative health topics (e.g., H1N1, cancer) or unrelated events such as the Beirut blast, were omitted from the analysis.

Following this, post updates related to page features, specifically changes in cover photos, were excluded from the analysis to maintain a primary focus on regular posts. Posts in the French language were also excluded. Additionally, posts with zero reach were omitted from consideration. As a result, we included 2,001 posts in the final analysis for our research. For engagement analysis purposes, all paid posts (n=52) were deliberately excluded. Sole consideration was given to organic posts in evaluating engagement levels. The exclusion of paid content, known for its potential to inflate metrics, was implemented to ensure the accuracy of the engagement study.

Codebook Development & Coding Procedures

COVID-19–related posts were categorized using a codebook adapted from scholars who developed it based on CERC framework (Alhassan & AlDossary, 2021; Lwin et al., 2018; Malik et al., 2021). This codebook consists of six major categories: risk messages, warnings, preparations, uncertainty reduction, self-efficacy, and reassurance, each with its relevant subcategories. After scanning the posts, the initial coding process

involved categorizing the content of each post based on predefined definitions from the adopted codebook. Continuous collaboration and communication, particularly when new themes emerged, involved regular discussions between authors. These discussions facilitated consensus-building on theme classification, validation of codebook definitions, identification of potential discrepancies, and refinement of the overall codebook.

Applying a grounded approach (Glaser & Strauss, 1967), two subcategories and five main categories emerged through open coding. Strauss and Corbin (1998) describe open coding as a process of identifying and categorizing data patterns without predetermined categories, allowing new themes to emerge during analysis. Two new subcategories, "clarification" and "methods of communication", were identified under the main category "uncertainty reduction". These additions, consistent with CERC literature (Malik et al., 2021; Reynolds & Seeger, 2005), resulted from discussions and consensus-building between the two authors. Additionally, new main categories, such as "vaccines and immunization," "mental health support," "digital health responses," "information on minister's activities," and "press releases," emerged. Covering diverse topics, these categories addressed vaccines, mental health advice for affected groups, the use of digital health apps for surveillance and contact tracing, updates on the Minister's activities, and the sharing of press releases featuring announcements and news of general interest. [Appendix A](#) outlines the content theme categories and sub-themes used for coding, offering clear definitions and providing practical examples.

Operationalization of Variables

Crisis stages

Unlike other natural disasters (e.g., earthquakes or floods), pandemic outbreaks such as COVID-19 may last weeks to months or even years, without clear boundaries between the stages (Fakhrudin et al., 2020). Therefore, our examination focused on the most critical stages of COVID-19 in Lebanon from mid-January 2020 to mid-June 2021, corresponding to over 93.00% of all deaths in the country (Abou-Abbas et al., 2022). This approach aligns with prior studies that operationalized phases using CERC framework, referencing specific events in their respective countries (Alhassan & AlDossary, 2021; Lwin et al., 2018; Tang et al., 2018). Given that the pandemic is not over yet, this study focuses on the first three stages of CERC (precrisis, initial, maintenance). Besides, the subsequent CERC stages (resolution and evaluation) focus on internal procedures, and thus have not been investigated (Ophir, 2018).

Pre-crisis stage (15 January 2020 to 20 February 2020): During this period, the emergence of COVID-19 outside China was observed; however, no cases had yet been identified in Lebanon.

Initial stage (21 February 2020 to 30 January 2021): The first confirmed case of COVID-19 in Lebanon was reported on February 21, 2020 (Abou-Abbas et al., 2022), which marked the beginning of the outbreak crisis and thus its initial stage. The initial stage was determined to last till 30 January 2021. Throughout this period, authorities declared a state of emergency, implemented lockdown measures, and the country witnessed a peak in infection cases and associated fatalities before experiencing a sharp decline.

Maintenance stage (31 January 2021 to 13 June 2021): This phase reflects the introduction of the vaccine and lifting of COVID-19 lockdown restrictions. Deaths continued to decline, and the country recorded no deaths on 13 June 2021.

The pre-crisis stage was coded as 1. The initial stage received a code of 2. The maintenance stage was coded as 3. This coding strategy was employed to establish a clear ordinal sequence, signifying a progression from the pre-crisis to the Initial, and subsequently to the maintenance stage.

Content type

This coding step follows established approaches used by prior researchers (Alhassan & AlDossary, 2021; Bonsón et al., 2015; Lwin et al., 2018). A single post may be assigned to multiple categories. During the coding process, each post was initially assigned to specific subcategories based on its visual content and associated caption. Subsequently, refinement occurred to consolidate these subcategories under their respective main theme categories.

The main categories (e.g., risk messages) were then coded as present (=1) if they included any of their relevant subcategories (e.g., disease information, symptoms, transmission mechanisms), and absent (=0) if

they did not. The content type analysis involved eleven theme categories, detailed in [Appendix A](#) along with their respective subcategories and sample posts.

Media type

We operationalized media types following Bonsón et al.'s (2015) categorization, adopting a non-hierarchical order:

- (1) video,
- (2) link,
- (3) photo,
- (4) text, and
- (5) others.

The "others" category was excluded from our analysis, and a new category was introduced specifically for live streaming videos, representing live content shared on MoPH page. Only Embedded videos were categorized as video, and links leading to video content were treated as links. Despite the presence of thumbnails in links on Facebook, they were categorized as links, not photos. Photos accompanied by text were classified as photos. Posts lacking links, videos, or photos were considered as texts.

Public engagement on MoPH Facebook

Like Lwin et al.'s (2018) approach, public engagement on MoPH Facebook was operationalized by capturing multiple dimensions, including quantitative metrics such as reactions, comments, shares, and post reach.

Inter-Coder Reliability & Data Analysis

To examine inter-coder reliability of the two coders, 10.00% (200 posts) of the entire sample was randomly selected for coding. Cohen's kappa values at or above 0.80 were considered reliable (Landis & Koch, 1977). While Cohen's kappa values for the majority of content categories exceeded 0.80, indicating "almost perfect" and "perfect" agreement, a level of "moderate" agreement was observed within the coding categories "recommendations (general)" and "personal preventive measures". To achieve better inter-coder agreement, ambiguities in distinguishing between these categories were identified and subsequently clarified through extensive discussions between the coders. To ensure the resolution of these issues, a new iteration was conducted, resulting in an immediate attainment of an acceptable level of agreement. Subsequently, the coders proceeded to code the remaining posts.

All evaluations were conducted using SPSS version 26. Initially, frequency counts and percentages were employed to identify the most prevalent categories in MoPH posts during each pandemic phase. Given non-normal distribution and skewness of continuous variables under examination, median served as a summary statistic for describing their distribution. Statistical analyses included Chi-square test and post hoc Z-tests, Benjamini-Hochberg adjustment, non-parametric Kruskal-Wallis test, Mann-Whitney U test, and negative binomial regression analysis with incidence rate ratio (IRR) computation, all at a significance level of .05.

RESULTS

The analysis of the dataset comprising 2001 posts revealed that uncertainty reduction was the most prevalent category in MoPH's communication strategy, with 1,092 (54.57%) posts containing such information. This was followed by self-efficacy, which was present in 607 (30.33%) of the posts. The third most frequent category was vaccines and immunization, which constituted 338 (16.89%) of all posts. Reassuring information was present in 284 (14.19%) of posts, while preparation-related messages were present in 187 (9.30%) of the posts. Risk messages and warning messages were less frequent, with 146 (7.30%) and 82 (4.10%) of all posts containing them, respectively. Trends in post categories throughout CERC phases are shown in [Figure 1](#).

Our findings also revealed that most of the posts (72.00%, n=1,440) included photographs, with smaller proportions containing links (12.11%, n=254), videos (11.70%, n=235), text (3.10%, n=62), and live broadcasts (0.50%, n=10%), indicating that photographic content is the favored media type employed by MoPH for their Facebook communication strategies, followed by links and videos.

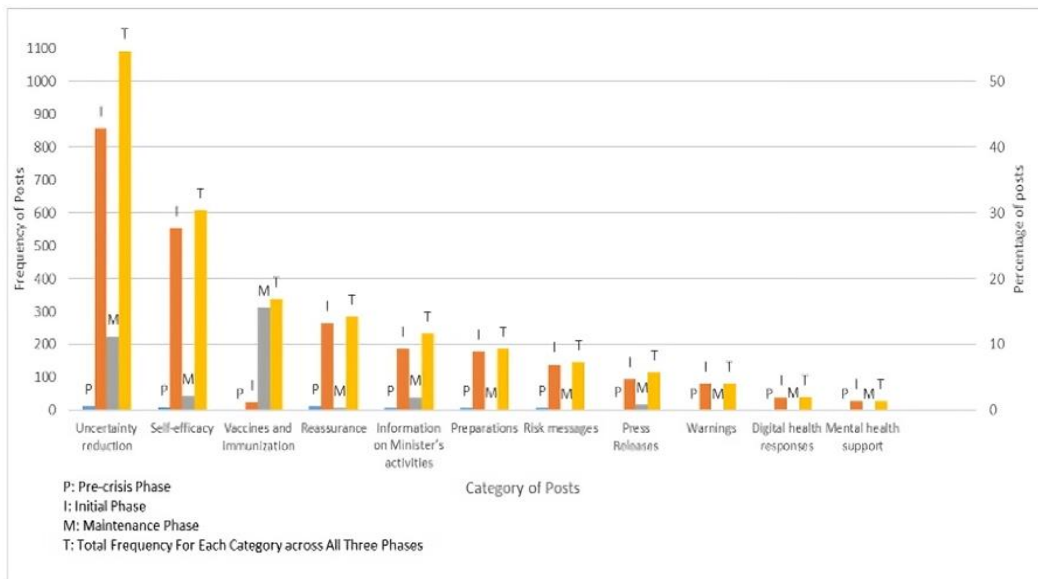


Figure 1. Trends in post-categories across CERC phases (Source: Authors)

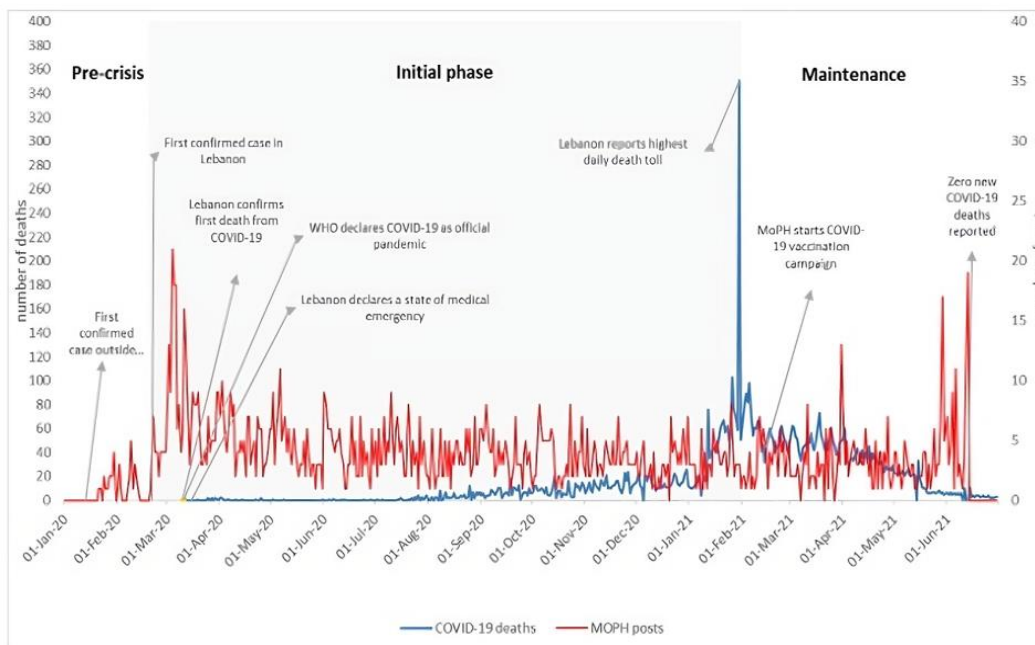


Figure 2. Lebanese MoPH's Facebook communication in relation to confirmed COVID-19 death cases (January 21, 2020, to June 13, 2021) (Source: Authors)

Government Response to COVID-19 on Facebook Across Phases of the Outbreak

In Figure 2, we provide a visual representation of MoPH's posting activity over the timeline of the COVID-19 outbreak. The graph plots daily count values of COVID-19-related posts in relation to the daily deaths caused by the virus. The first MoPH post mentioning COVID-19 appeared on January 21, coinciding with confirmed cases outside mainland China, sparking widespread concern.

In the pre-crisis stage, before any COVID-19 cases were reported in Lebanon, MoPH made only 37 posts (1.80% of the total posts), averaging 2.03 posts per day. After Lebanon reported its first imported case on February 21, 2020, the number of COVID-19-related posts substantially increased, averaging 4.29 posts daily throughout the initial phase. As of January 30, 2021, MoPH had posted 1485 times (74.20% of the total), reflecting a twofold growth in its average daily posts compared to the pre-crisis stage.

Table 1. Categories of message types across outbreak stages in Lebanon

Message type	Pre-crisis (n=37) (n%)	Initial (n=1,485) (n%)	Maintenance (n=479) (n%)	Overall (n=2,001) (n%)	p-value	χ^2 (df=2)
Risk messages	7 (18.92)	139 (9.36)	0 (0.00)	146 (7.30)	0.000	54.44
Warnings	0 (0.00)	82 (5.52)	0 (0.00)	82 (4.10)	0.000	29.71
Preparations	7 (18.92)	179 (12.05)	1 (0.21)	187 (9.35)	0.000	64.06
Uncertainty reduction	11 (29.73)	857 (57.71)	224 (46.76)	1,092 (54.57)	0.000	26.89
Self-efficacy	10 (27.03)	554 (37.31)	43 (8.98)	607 (30.33)	0.000	137.74
Reassurance	12 (32.43)	265 (17.85)	7 (1.46)	284 (14.19)	0.000	90.13
Vaccines & immunization	0 (0.00)	25 (1.68)	313 (65.34)	338 (16.89)	0.000	1,053.23
Mental health support	0 (0.00)	28 (1.89)	0 (0.00)	28 (1.40)	0.007	9.87
Digital health responses	0 (0.00)	39 (2.63)	2 (0.42)	41 (2.05)	0.008	9.59
Information on Minister's activities	7 (18.92)	186 (12.53)	39 (8.14)	232 (11.59)	0.013	8.76
Press releases	3 (8.11)	95 (6.40)	17 (3.55)	115 (5.75)	0.055	5.81

Starting January 31, 2021, a noticeable decline in daily number of COVID-19-related deaths in Lebanon was observed. From that date until June 13, 2021, MoPH consistently shared COVID-19 information, posting on average of 3.17 times per day (n=479, 23.90%). On June 13, 2021, Lebanon reported no daily deaths from COVID-19, a significant milestone considering the previous peak in daily deaths in January 2021.

Content Types Across COVID-19 Outbreak Phases

Chi-square test results revealed significant variations among all content types throughout different phases of the outbreak, except for press releases ($\chi^2=5.81$, p-value=0.055). A breakdown of the association between content types and crisis phases is presented in both [Table 1](#) and [Appendix B](#).

Reassurance posts exhibited a peak percentage in the pre-crisis phase (32.43%) and significantly decreased in subsequent stages, accounting for 17.85% of posts in the initial phase and only for 1.46% in the maintenance phase ($\chi^2=90.13$, p-value=0.000). The percentage of uncertainty reduction posts was significantly lower in the pre-crisis phase (29.73%) than in later stages. This percentage peaked in the initial phase (57.71%) before decreasing significantly to 46.76% ($\chi^2=26.89$, p-value=0.000).

Posts on self-efficacy and preparation share the same pattern across phases. Posts related to self-efficacy accounted for a high proportion in both the pre-crisis phase (27.00%) and the initial phase (37.31%) but decreased significantly to 8.98% in the maintenance phase ($\chi^2=137.74$, p-value=0.000). Posts related to preparation were also high in percentage during the pre-crisis (18.92%) and initial phases (12.05%) but reduced significantly to 0.21% in the maintenance phase ($\chi^2=64.06$, p-value=0.000).

The percentage of posts about vaccines and immunization rose significantly from 1.68% in the initial stage to 65.34% in the maintenance stage ($\chi^2=1,053.23$, p-value=0.000). Warning and mental health support posts were only present in the initial phase, accounting for 5.52% and 1.89% of posts, respectively. Risk messages posts decreased from 18.92% in the pre-crisis phase to 9.36% in the initial phase, with no posts in the maintenance phase ($\chi^2=54.44$, p-value=0.000).

Public Engagement With Government Posts on Facebook

Follower growth analysis

The number of followers on MoPH Facebook page has consistently increased since its creation in 2016, with 30,164 followers recorded in the pre-COVID-19 period. During the pre-crisis phase, the number of followers rose to 32,726 with an increasing rate of 8.49%. Following this, there was a significant growth in followers to 143,606 by the end of the initial phases, indicating a remarkable growth rate of 338.81%. By the end of the maintenance phase, the number of followers reached 157,351, reflecting a 9.57% increase from the previous phase. [Figure 3](#) shows the growth of MoPH Facebook followers before and after the COVID-19 outbreak.

Trend of engagement

The examination of engagement trends associated with COVID-19-related content on Facebook revealed consistent patterns across all variables, including reactions, comments, shares, and post reach, over time.

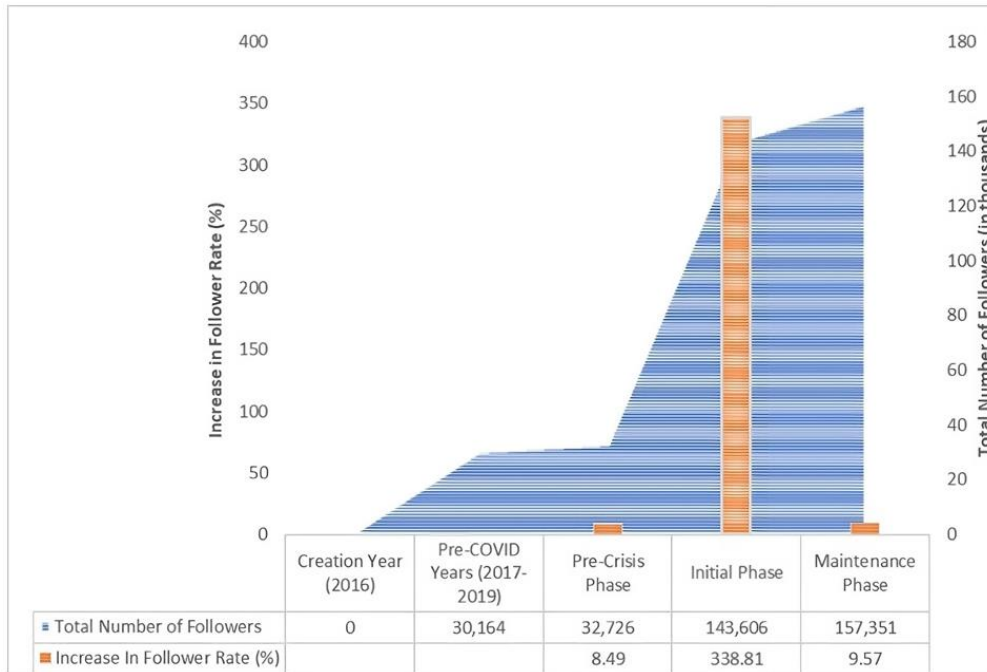


Figure 3. Growth of MoPH Facebook followers before & after the COVID-19 outbreak in Lebanon, 2016-2021 (Source: Authors)

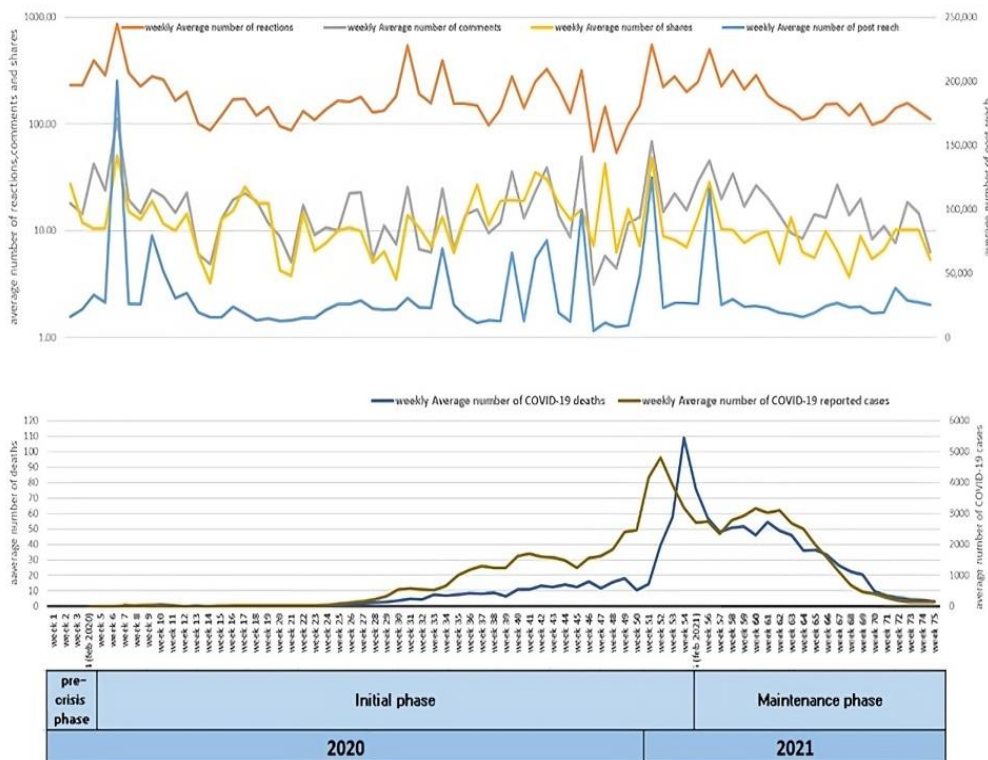


Figure 4. Trend of engagement in response to key COVID-19 events in Lebanon (Source: Authors)

Peaks in engagement aligned with key milestones in the pandemic’s progression. Specifically, the highest levels of engagement were recorded in response to the first occurrences of COVID-19 cases and fatalities reported in February-March 2020. Also, there was another peak of engagement during the transition toward the maintenance stage, coinciding with a substantial increase in cases and deaths at a later pandemic stage.

Figure 4 presents frequencies of public engagement variables in response to pandemic-related content. The analysis was conducted based on 1,949 organic posts, with 52 paid posts excluded from the dataset.

Table 2. Median public engagement across outbreak phases & content types

Message type	Reactions				Comments				Shares				Post-reach			
	AP	P	I	M	AP	P	I	M	AP	P	I	M	AP	P	I	M
All	121	64	125	116	6	5	6	5	4	7	6	3	19,895	5,370	19,344	21,774
Risk messages	98	68	104		3	2	3		14	9	14		13,315	5,689	14,311	
Warnings	129		129		8		8		5		5		18,934		18,934	
Preparations	143	29	145	47	6	2	6	8	7	1	7	6	16,569	4,211	17,189	17,554
Uncertainty reduction	124	68	139	110	5	3	7	2	4	8	7	2	20,402	6,508	20,137	21,547
Self-efficacy	199	84	212	169	8	6	9	6	11	25	12	4	24,034	6,041	24,847	20,533
Reassurance	139	45	141	214	6	6	6	17	4	4	4	6	19,258	5,346	19,396	28,558
Vaccines & immunization	129		112	130	8		8	8	3		3	4	23,226		17,385	23,564
Mental health support	96		96		2		2		15		15		14,016		14,016	
Digital health responses	89		93	22	3		3	1	5		6	1	15,188		16,242	5,710
Information on Minister's activities	107	42	124	59	5	5	6	5	2	3	2	1	18,415	5,403	18,954	17,260
Press releases	123	45	125	101	9	5	8	20	4		4	9	19,203	4,196	19,015	25,042

Note. AP: All phases; P: Pre-crisis; I: Initial; & M: Maintenance

Public engagement across pandemic phases

As the engagement variables did not exhibit a normal distribution, statistical comparisons were performed using median values instead of means. For MoPH posts, median values for reactions, shares, comments, and post reach were found to be 121, 4, 6, and 19,895, respectively. **Table 2** summarizes the median public engagement levels across outbreak stages and content types. The analysis revealed that the initial phase had the highest public engagement levels in terms of reactions and comments, with median values of 125 and 6, respectively. While the median value for shares peaked at seven during the pre-crisis phase, only slightly higher than the median value of 6 in the initial phase, and the median value for post reach was highest during the maintenance phase at 21,774, only slightly higher than the median value of 19,344 in the initial phase, both findings suggest that public engagement in terms of shares and post reach were also high in the initial phase. Additionally, a Kruskal-Wallis test was conducted to evaluate differences in the frequencies of reactions, comments, shares, and post reach among various outbreak phases. The results revealed significant differences only in the frequencies of reactions ($H=15.00$; $p\text{-value}=0.001$), shares ($H=51.941$, $p\text{-value}=0.000$), and post reach ($H=89.41$, $p\text{-value}=0.000$) across phases. However, the distribution of comments did not exhibit significant differences among the phases ($H=0.984$, $p\text{-value}=0.611$).

To explore the levels of public engagement with MoPH posts during different outbreak phases, Mann-Whitney U tests were employed for a detailed statistical analysis. **Table 3** provides valuable insights into the nature and extent of public engagement with different types of posts across various outbreak phases.

Table 3. Median public engagement for posts with or without message type at different phases of the COVID-19 outbreak in Lebanon

Phase	Variables	Median present	Median absent	Z-value	p-value
Initial	Uncertainty reduction				
	Comments	7.0	5.0	-2.682	0.007
	Post-reach	20,137.0	18,029.5	-5.072	0.000
Self-efficacy	Reactions	212.0	94.0	-11.991	0.000
	Comments	9.0	5.0	-5.652	0.000
	Shares	12.0	3.0	-16.304	0.000
	Post-reach	24,847.0	18,228.0	-8.340	0.000
Reassurance	Reactions	141.0	120.0	-3.369	0.001
	Shares	4.0	6.0	-3.557	0.000
Mental health support	Shares	14.5	6.0	-3.866	0.000
Digital health responses	Reactions	92.0	127.0	-2.241	0.025
	Comments	3.0	6.0	-2.475	0.013
Information Minister's activities	Shares	2.0	7.0	-8.301	0.000

Table 3 (Continued). Median public engagement for posts with or without message type at different phases of the COVID-19 outbreak in Lebanon

Phase	Variables	Median present	Median absent	Z-value	p-value
Maintenance	Uncertainty reduction				
	Reactions	109.5	132.0	-5.966	0.000
	Comments	2.0	16.0	-12.017	0.000
	Shares	2.0	4.0	-6.190	0.000
	Post-reach	21,547.0	21,937.0	-3.677	0.000
Self-efficacy	Reactions	169.0	114.0	-3.478	0.001
	Shares	4.0	3.0	-2.851	0.004
	Reassurance				
	Reactions	214.0	115.0	-3.298	0.001
	Comments	6.0	3.0	-2.617	0.009
	Post-reach	28,558.0	21,756.0	-2.141	0.032
Vaccines & immunization	Reactions	130.0	39.0	-9.160	0.000
	Comments	4.0	1.0	-6.734	0.000
	Shares	8.0	2.0	-8.245	0.000
	Post-reach	23,564.0	16,217.0	-9.045	0.000
Digital health responses	Reactions	21.5	116.0	-1.971	0.049
	Post-reach	5,710.0	21,852.0	-2.416	0.016
Information Minister's activities	Reactions	59.0	120.0	-3.174	0.002
	Shares	1.0	3.0	-3.888	0.000
	Post-reach	17,260.0	21,943.5	-3.409	0.001

In the initial crisis phase, it was observed that posts containing self-efficacy information received significantly higher reactions ($Z=-11.991$, $p=0.000$), comments ($Z=-5.562$, $p=0.000$), shares ($Z=-16.304$, $p=0.000$), and post reach ($Z=-8.430$, $p=0.000$) compared to posts without such information. Posts about mental health support received more shares ($Z=-3.866$, $p=0.000$), but fewer comments ($Z=-3.355$, $p=0.001$) and lower post reach ($Z=-2.458$, $p=0.014$) than other posts. During the maintenance phase, posts about vaccines and immunization received higher engagement levels in terms of reactions ($Z=-9.160$, $p=0.000$), comments ($Z=-6.734$, $p=0.000$), shares ($Z=-8.245$, $p=0.000$), and post reach ($Z=-9.045$, $p=0.000$) compared to posts about other message types.

Factors affecting public engagement

Table 4 provides a concise overview of outcomes derived from the negative binomial regression analysis. The statistical significance of the model was established by comparing it to the null model, revealing that the variables, as a group, significantly predicted the number of reactions ($\chi^2=458.627$; $p=0.000$), comments ($\chi^2=862.772$; $p=0.000$), shares ($\chi^2=1103.773$, $p=0.000$), and post reach ($\chi^2=663.154$, $p=0.000$).

Crisis stages: Posts published in the initial phase were linked to significantly higher levels of reactions compared to those posted in the pre-crisis stage (IRR=1.583, $p=0.007$ for reactions). Posts published in the initial and maintenance phases were linked to significantly higher levels of post reach (maintenance: IRR=5.325, $p=0.000$; initial: IRR=2.795, $p=0.000$). However, posts in the initial and maintenance phases were significantly associated with lower levels of shares compared to those posted in the pre-crisis stage (initial: IRR=0.658, $p=0.018$; maintenance: IRR=0.358, $p=0.000$).

Content type: The findings indicated that messages pertaining to self-efficacy and vaccination/immunization were associated with the highest levels of engagement. Posts related to self-efficacy demonstrated a significant association with increased levels of reactions, comments, shares, and post reach (reactions IRR=2.244, $p=0.000$; comments: IRR=1.956, $p=0.000$; shares: IRR=2.728, $p=0.000$; reach IRR=1.299, $p=0.000$). Similarly, content related to vaccine and immunization was significantly associated with higher levels of reactions, comments, and shares, and post reach (reactions IRR=2.654, $p=0.000$; comments IRR=3.065, $p=0.000$; shares IRR=2.394, $p=0.000$; reach IRR=1.239, $p=0.043$).

Table 4. Associations of post content, media type, & crisis phase with public engagement

	Reactions		Comments		Shares		Post-reach	
	IRR	p-value	IRR	p-value	IRR	p-value	IRR	p-value
(Intercept)	70.729	0.000	11.144	0.000	12.724	0.000	4,603.428	0.000
Caption	1.560	0.000	1.745	0.000	2.146	0.000	1.406	0.000
Hashtags	0.915	0.223	0.888	0.109	1.156	0.050	0.836	0.015
Mentions (@)	0.888	0.174	0.914	0.326	1.014	0.881	1.114	0.221
Content type								
Risk messages	0.900	0.302	0.630	0.000	1.296	0.016	0.818	0.057
Warnings	0.985	0.908	1.137	0.344	1.195	0.192	1.302	0.048
Preparations	1.078	0.378	0.931	0.427	1.207	0.033	0.799	0.008
Uncertainty reductions	0.744	0.000	0.715	0.000	0.661	0.000	0.741	0.000
Self-efficacy	2.244	0.000	1.956	0.000	2.728	0.000	1.299	0.000
Reassurance	1.687	0.000	1.512	0.000	0.974	0.743	1.154	0.060
Vaccines & immunization	2.654	0.000	3.065	0.000	2.394	0.000	1.239	0.043
Mental health support	0.894	0.610	0.387	0.000	1.214	0.394	0.629	0.032
Digital health responses	0.742	0.103	0.345	0.000	.781	0.203	0.888	0.516
Information on Minister's activities	1.011	0.903	0.640	0.000	0.428	0.000	0.709	0.000
Press release	1.351	0.014	1.253	0.077	1.450	0.004	1.239	0.086
Media type								
Pure text	Reference	NA	Reference	NA	Reference	NA	Reference	NA
Photograph	1.015	0.918	0.831	0.201	0.657	0.004	1.945	0.000
Video	0.955	0.776	0.470	0.000	0.851	0.332	1.679	0.002
Live streaming	1.173	0.651	2.702	0.005	1.027	0.943	1.629	0.166
Link	0.540	0.000	0.438	0.000	0.316	0.000	0.995	0.976
Language								
Arabic	Reference	NA	Reference	NA	Reference	NA	Reference	NA
English	0.532	0.000	0.415	0.000	0.623	0.000	0.591	0.000
Mixed	0.863	0.047	0.401	0.000	0.788	0.002	0.684	0.000
Crisis stage								
Pre-crisis	Reference	NA	Reference	NA	Reference	NA	Reference	NA
Initial	1.583	0.007	1.297	0.158	0.658	0.018	2.795	0.000
Maintenance	1.285	0.184	0.989	0.955	0.358	0.000	5.323	0.000

Note. IRR: Incidence rate ratio & NA: not applicable

Media type: Posts in the form of links exhibited significantly lower reactions (IRR=0.540, p=0.000), comments (IRR=0.438, p=0.000) and shares (IRR=0.316, p=0.000) compared to text-only posts. Photos showed a significantly lower number of shares (IRR=0.657, p=0.004), but a significantly higher post reach (IRR=1.945, p=0.000) compared to text-only posts.

Videos showed a significant lower number of comments (video: IRR=0.470, p=0.000) but a significantly higher post reach (videos: IRR=1.679, p=0.002) compared to text-only posts. Live streaming posts were associated with a higher number of comments (IRR=1.173, p=0.005) compared to text-only posts.

#hashtags: Use of hashtags was significantly associated with a fewer level of post-reach (IRR=0.836, p=0.015).

@mentions: The use of mentions (@) was not significantly associated with any engagement variable (reactions: IRR=0.888, p=0.174; comments: IRR=0.914, p=0.326; shares: IRR=1.014, p=0.881; post reach: IRR=1.114, p=0.221).

Captions: Using captions in posts was significantly associated with increased levels of engagement, including higher reactions (IRR=1.56, p=0.000), comments (IRR=1.745, p=0.000), shares (IRR=2.146, p=0.000), and post-reach (IRR=1.406, p=0.000).

Language: Compared to posts in Arabic, the use of English and mixed language (combining Arabic and English within the same post regardless of the portion of each) were associated with significantly lower numbers of reactions (English: IRR=0.532, p=0.000; mixed: IRR=0.863, p=0.047), shares (English: IRR=0.623, p=0.000; mixed: IRR=0.788, p=0.002), comments (English: IRR=0.415, p=0.000; mixed: IRR=0.401, p=0.000), and post reach (English: IRR=0.591, p=0.000; mixed: IRR=0.684, p=0.000).

DISCUSSION

Principal Findings

This paper is the first in-depth exploration of how the Lebanese government, through MoPH, utilized Facebook during the COVID-19 pandemic as a tool for crisis communication and citizen engagement. It sheds light on the fact that Facebook played a strategic role as a purposeful and timely communication platform, with patterns aligning closely with key events related to the pandemic in Lebanon (see [Figure 2](#)). Besides, it emphasizes the platform's potential for citizen outreach, evident in the dramatic increase in followership both following the crisis and consistently throughout its various phases (see [Figure 3](#)).

The first research question examined MoPH's crisis communication strategies on Facebook during COVID-19 based on CERC framework. This study found that MoPH partially followed CERC model's recommended response messages, without full consistency. In the pre-crisis phase, MoPH prioritized messages aimed at reassuring the public and enhancing self-efficacy. However, the dissemination of risk and preparation messages was limited, with a complete absence of warning messages, diverging from the recommended guidelines of CERC model. Similar observations have been documented in other countries in the region, such as Egypt (Ajwa, 2020) and Saudi Arabia (Alhassan & AlDossary, 2021), where minimal communication of risk and warning messages occurred during this phase of the pandemic. Han et al. (2021) suggested that the novelty of the virus and scientific uncertainty may explain this trend. Another contributing factor could be the internal confusion within the Lebanese MoPH, stemming from a change in leadership in January 2020, potentially resulting in challenges in developing a pre-crisis online communication plan.

Transitioning to the initial phase, CERC model suggests that communication should prioritize reducing public uncertainty and providing reassurance and efficacy messages. In accordance with this model, MoPH's Facebook page conveyed messages aimed at reducing uncertainty, including updates on case reports, and offering additional sources of information. MoPH also communicated messages emphasizing personal preventive measures and the public's shared responsibility in limiting the spread of COVID-19 for enhanced efficacy. Moreover, MoPH reassured the public primarily by providing information on government interventions against the virus. In the subsequent CERC model's maintenance stage, characterized by reduced crisis severity, communication efforts should continue reducing uncertainty, providing reassurance, and conveying efficacy messages. In Lebanon during this phase, the implemented communication strategies exhibited partial alignment with CERC messaging strategies. MoPH primarily posted messages related to vaccines and uncertainty reduction, with a moderate proportion of self-efficacy messages and a low proportion of reassurance messages. Although MoPH did not explicitly emphasize reassurance messages, updates on vaccination campaigns and progress can still provide a sense of reassurance to the public, reflecting the government's ongoing efforts.

The second research question aimed to explore how public engagement on MoPH Facebook varied across pandemic phases and with different types of content and media shared. Overall, the engagement trend analysis revealed that MoPH's Facebook posts had low interaction and audience reach before the crisis, but significantly surged during the initial phase when the disease began to spread ([Figure 4](#)). This surge was likely a response to the sudden growth in public attention on social media and the public's heightened need for information during the early stages of the crisis, a phenomenon observed in COVID-19 outbreaks in other countries (Pang et al., 2021; Syn, 2021). Despite fluctuations in MoPH engagement over time, it does not surpass the level observed during the initial outbreak. These patterns can be explained by dynamic processes influencing public concern, such as adaptability and surprise (Loewenstein & Mather, 1990). At the crisis onset, strong engagement was evident as people responded to unfamiliar messages disrupting their daily routines, but as the crisis progressed, people adapted to the new circumstances. The peak in deaths during the transition towards the maintenance phase surprised the public, causing panic and potentially leading to reinforce engagement. As time passed, people adapted again to the new conditions.

Regarding engagement patterns throughout pandemic phases, the public showed the highest levels of reactions and comments during the initial phase of the crisis. While other phases surpassed the initial stage in terms of shares and post reach, the difference was marginal, suggesting that the initial stage also experienced substantial engagement in these aspects. This highlights an actively engaged audience during

the acute stages of the pandemic, marked by lockdowns and social distancing measures, with individuals typically increasing their use of social media during such times (Saud et al., 2020). Alhassan and AlDossary's (2021) and Pang et al. (2021) research support this trend.

Concerning engagement with various content types, posts related to self-efficacy and vaccination garnered highest engagement across all variables, including reactions, comments, shares, and post reach, when compared to other content categories. More specifically, during the initial phase, self-efficacy posts received the highest engagement, and in the maintenance phase, vaccination-related posts obtained the highest engagement. This suggests an evident interest in acquiring information on personal protection against outbreaks, aligning with engagement patterns observed during Zika outbreak (Lwin et al., 2018). Furthermore, messages promoting self-efficacy often highlight social and common responsibility, which aligns with the "together" communication strategy used in Poland during the COVID-19 pandemic—an approach recognized for its effectiveness in driving high engagement levels (Górska et al., 2022). Besides, the results indicating high engagement for vaccination-related and self-efficacy posts can be attributed to media coverage influence, aligning with the agenda-setting theory (McCombs & Shaw, 1972), which posits that media has the capacity to shape public agendas or prioritize certain issues. A recent study in the USA observed a substantial prevalence of COVID-19 vaccine discussions on Twitter in 2021, capturing considerable online public attention (Chen et al., 2023). In Lebanon, during the initial phase, self-efficacy emerged as a prominent category in MoPH posts and garnered the highest engagement, while during the maintenance phase, vaccination-related content was the most prevalent and also received the highest engagement. This suggests a manifestation of media-driven agenda setting in shaping public interactions during the pandemic.

Within the same context, posts addressing mental health support received more shares than anticipated, emphasizing the importance of disseminating such messages to raise public awareness. Previous research suggests that emotional support drives the sharing of health information during crises, reinforcing the relevance of these findings (Guo et al., 2021; Saud et al., 2020; Tang & Zou, 2020). Furthermore, posts about the minister's activities received fewer shares during the initial phase and fewer reactions, shares, and lower reach during the maintenance stage. This could be due to a lack of interest from the public in the minister's work. Previous research has indicated that the public is generally uninterested in sharing information that can be perceived as organizational propaganda (Chung, 2017). Besides, the low engagement levels for digital health response posts suggest a reduced interest in its potential usefulness.

Across diverse media types, our study found that, compared to text-only posts, the use of photos resulted in fewer shares but a higher post reach, video posts received fewer comments but had a higher post reach, and posts with links showed lower engagement in terms of reactions, comments, and shares. These results align with previous studies on platforms like Sina Weibo and Twitter during COVID-19, suggesting that richer media, including links, photos, and videos, is associated with reduced engagement (Alhassan & AlDossary, 2021; Chen et al., 2020). This contrasts with prior findings indicating richer media leads to higher engagement on Facebook during the pandemic (Amores et al., 2022). Our findings contribute to the ongoing discussion on media richness and engagement, emphasizing the need for further exploration, especially during crises when individuals may prefer text posts over visuals (Chen et al., 2020; Paul & Das, 2022). However, our results hint at a nuanced relationship, suggesting that while photos and videos are associated with higher post reach, likely favored by Facebook's algorithm (Kite et al., 2016; Mathieu & Pavlíčková, 2017), they may encourage more passive consumption, resulting in lower engagement. Interestingly, posts incorporating live streams were associated with higher comments, consistent with Pang et al.'s (2021) findings, suggesting that these posts facilitated substantive discussions.

Furthermore, our study found that using hashtags was linked to lower post reach, possibly indicating Facebook's algorithmic preferences, though this was not statistically significant with other engagement variables. Similarly, mentions (@ function) showed no significant effect on engagement. These findings align with Paul and Das (2022), suggesting that using dialogic features such as hashtags and mentions alone may not be sufficient to drive engagement. Besides, our study revealed that using captions in posts led to higher levels of engagement, highlighting the need for thoughtful captioning. Additionally, posts in English and mixed language had significantly lower engagement than Arabic-only posts, reinforcing the World Health Organization's (WHO, 2020) suggestion to use the local language for effective community engagement during the pandemic.

Theoretical Contributions

The study contributes to existing literature in multiple ways. First, by adopting CERC model, it addresses a crucial challenge in researching government communication during health crises on social media—specifically, the lack of theoretical guidance (Malik et al., 2021). Second, despite CERC model's Western origin and testing, its application has been limited in non-Western countries, including the Middle East (Miller et al., 2021). Our findings enhance the utilization and applicability of CERC model, expanding research scope globally. Third, the study advances theory by refining CERC model for social media in health crises by introducing subcategories like addressing misinformation and clear communication methods, aligning with and extending the adapted CERC model proposed by Lwin et al. (2018). New categories on vaccinations, digital health responses, and mental health further enrich the theoretical framework.

Practical Implications

This study provides practical insights for practitioners. First, it demonstrates how Facebook can be used strategically and employed to implement CERC model. Practitioners can benefit from the integration of this model into preparation and response plans to guide communication efforts, given its highly predictive ability and its capacity to provide options tailored to each phase of a health crisis. Second, the dominance of reassurance-centric messages and limitations in disseminating risk and preparation information in MoPH's pre-crisis communication highlight the need for proactive communication planning before the onset of a crisis, particularly considering expert warnings against excessive reassurance (Alhassan & AlDossary, 2021). Practitioners should focus on developing robust pre-crisis online communication plans, recognizing the foundational role of pre-crisis stages in effective health emergency management (Fissi et al., 2022). Third, MoPH Facebook page's follower increase indicates users' preference for reliable sources during crises (Guo et al., 2018). Incorporating Facebook as a crisis communication tool is crucial, given the impact of social media capital—citizens are more attentive to government accounts with a high follower base (Zhang et al., 2022). Increasing followership on Facebook can be achieved through paid promotions, using ad goals like "promote your page." Verifying the Ministry's Facebook page, currently unverified, will enhance credibility and foster greater interest in the disseminated information. Fourth, the clear link between posting activity and heightened engagement (Fissi et al., 2022) underscores the importance of consistent high posting activity across crisis phases to sustain robust public engagement.

Fifth, it is imperative for practitioners to recognize that engagement levels vary across different phases of a crisis, being lower in some stages and higher in others. Strategically allocating resources and budgets to maintain a consistently high engagement is crucial. Sixth, government agencies should capitalize on the high engagement observed with content types such as self-efficacy posts, vaccination, and mental health support, given their resonance with the audience. It is essential to avoid excessive posting about propaganda, such as Ministerial activities. Emphasizing a positive tone that fosters solidarity and underscores common responsibility is particularly crucial, especially considering Lebanon's collectivist culture. In such cultural contexts, the emphasis on the value of "we" holds greater importance than individual identity (Cheng et al., 2022). Additionally, agencies should pay attention to low-engagement posts like digital health responses, investing in paid ads to enhance their reach, and adopting creative approaches, including humor, to make them more appealing, especially given the significance of technology during lockdowns. Seventh, choosing the media type for a post should go beyond a simple "visuals are better" approach. Government agencies must carefully align media richness with content type when crafting posts. The selection of media type should also be based on the specific objective of the post or campaign, with careful consideration for the effectiveness of plain text. For instance, videos and photos are suitable for maximizing reach, while live streaming may be more fitting for enhancing engagement and fostering discussions and public listening. They could also try different types of live streaming, such as interviews, panels, and Q&A sessions, to see what works best for their audience, and adjust their strategy accordingly.

Eighth, cautious consideration is advised when using hashtags and mentions in posts during a crisis. While, in the best case, it may not impact engagement, in some instances, it could potentially lower post reach. The use of hashtags or mentions may introduce message complexity and divert audience attention from the primary content, especially for users less familiar with social media. This caution is essential to prevent

unintended consequences, such as users being redirected to other pages when clicking on these elements. Ninth, it is recommended that captions are incorporated into posts especially in situations, where viewers may have difficulty accessing or understanding the visual content. Additionally, government agencies are advised to communicate crises in the local language for enhanced engagement and effective communication. Finally, government agencies should make smart investments in advanced artificial intelligence tools to monitor and understand shifts in public engagement during different stages of a crisis.

Limitations & Future Directions

This study has some limitations and potential future directions. Firstly, while the research focused on Facebook, it is crucial to examine other social media platforms like Twitter, Instagram, and TikTok, considering their unique features. Secondly, engagement analysis may be oversimplified by relying solely on metrics such as reactions, comments, shares, and post reach, as noted by Gherheş et al. (2023), neglecting emojis and linguistic texts that can modify meaning conveyed. Additionally, social media platform algorithms are undisclosed and may influence engagement and post reach. Future studies should consider sentiment analysis and additional reactions for more accurate engagement analysis. Thirdly, this study solely focused on the COVID-19 pandemic, which may limit the generalizability of the findings to other pandemics. Therefore, future research should explore communication strategies' effectiveness across different infectious diseases to better understand their applicability and usefulness. Fourthly, the study only examined MoPH as a representative of a governmental entity, and findings may not be generalizable to other sectors. Thus, future research should explore various governmental entities and sectors to understand social media communication strategies during outbreaks comprehensively. Lastly, geographically, this study only included Lebanon, and future studies may include multiple countries and regions to provide a more comprehensive understanding of social media's role in outbreak communication.

Author contributions: Both authors were involved in concept, design, collection of data, interpretation, writing, and critically revising the article. Both authors approved the final version of the article.

Funding: The authors received no financial support for the research and/or authorship of this article.

Ethics declaration: The authors declared that ethical approval was not required for this study as it involved the analysis of publicly available data from the Ministry of Public Health's Facebook page. No human participants were involved, and the data analyzed did not contain sensitive or confidential personal information.

Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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APPENDIX A

Table A1. Codebook





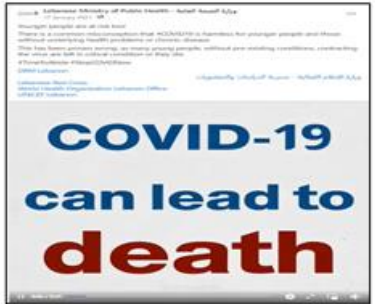
Theme category	Sub-theme	Definition	Examples
1. Risk messages	Disease information	General information about disease, definition, & treatments	
	Symptoms	Statements on symptoms associated with COVID-19	
	Transmission mechanisms	Statements on disease mechanisms	
2. Warnings	Risk factors	Statements with risk factors or risk groups associated with COVID-19	
	Danger	Statement that highlights risk of COVID-19 in Lebanon	

Table A1 (Continued). Codebook



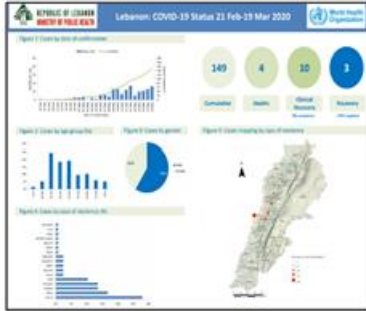


Theme category	Sub-theme	Definition	Examples
3. Preparations	Responders	Organizations/committees or persons who are responsible for emergency. Development of consensual recommendations by experts & first responders	
	Recommendations (general)	Requests, instructions, & advises on taking actions to prevent COVID-19 in certain situations like a travel, workplace, quarantine, holidays, & during pregnancy & breastfeeding	
4. Uncertainty reduction	Case report	Reports & updates of case number & deaths	
	Clarification	Alerting/dispelling myths, fake news, or misinformation about COVID-19 pandemic	
	Information resources	Sources that allow people to learn more about COVID-19	

Table A1 (Continued). Codebook





Theme category	Sub-theme	Definition	Examples
	Methods of communication	Hotlines & apps placed at service of citizens to communicate with Ministry of Health	
5. Self-efficacy	Personal prevention measures	Specific prevention actions one can take to prevent COVID-19	
	Common responsibility	Social & common responsibility	
6. Reassurance	Government interventions	Government intervention responses to COVID-19	
	Thanking & regards	Expression of thanks, approval, & regards. Tributes to health workers battling COVID-19 or those lost on frontline	

Table A1 (Continued). Codebook







Theme category	Sub-theme	Definition	Examples
	Calming	Statements that remove uncertainty or fears of COVID-19 threat	
7. Vaccines & immunization		Updates on COVID-19 vaccine development, Lebanon's vaccine agreements, national deployment plan, arrival of vaccine batches, administration data, adverse event reporting, registration tips, addressing misinformation, & delivery of vaccination services	
8. Mental health support		Given explanations on mental health problems associated with COVID-19 & providing related tips	
9. Digital health responses		Mention of digital health applications (e.g., digital screening, surveillance, & contact tracing)	
10. Information on Minister's activities		Ministerial meetings & discussions with other parties, tour, & visits, & events sponsored by the Minister	

Table A1 (Continued). Codebook

Theme category	Sub-theme	Definition	Examples
11. Press releases		<p>Official announcements related to various topics, including procedures for arrivals to country, timing of events, & other news of general interest.</p> <p>Information about funding, grants, & aid offered to Government in support of pandemic response</p>	

APPENDIX B

Table B1. Post-hoc pairwise comparisons

	Phase		
	Pre-crisis (A)	Initial (B)	Maintenance (C)
Risk messages	C (.000)	C (.000)	
Warnings		A (.001)	
Preparations			A (.045)
Uncertainty reduction		C (.000)	
Self-efficacy	C (.001)	C (.000)	
Reassurance			
Vaccines & immunization			B (.000)
Mental health support			
Digital health responses		C (.003)	
Information on Minister's activities	C (.040)	C (.026)	
Press releases			

Note. The results are based on two-sided tests, where key of category with smaller column proportion is shown in category with larger column proportion for each significant pair. Significance level for upper letters (A, B, & C) was set at 0.05. To account for multiple comparisons, tests were adjusted using Benjamini-Hochberg correction for all pairwise comparisons within a row of each innermost sub-table

