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Crisis Management Through Citizen Engagement On Twitter: The Case Of The Covid-19 Pandemic In Latin American Municipalities

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Figure 1. *COVID-19 phases of the first wave in Latin America*

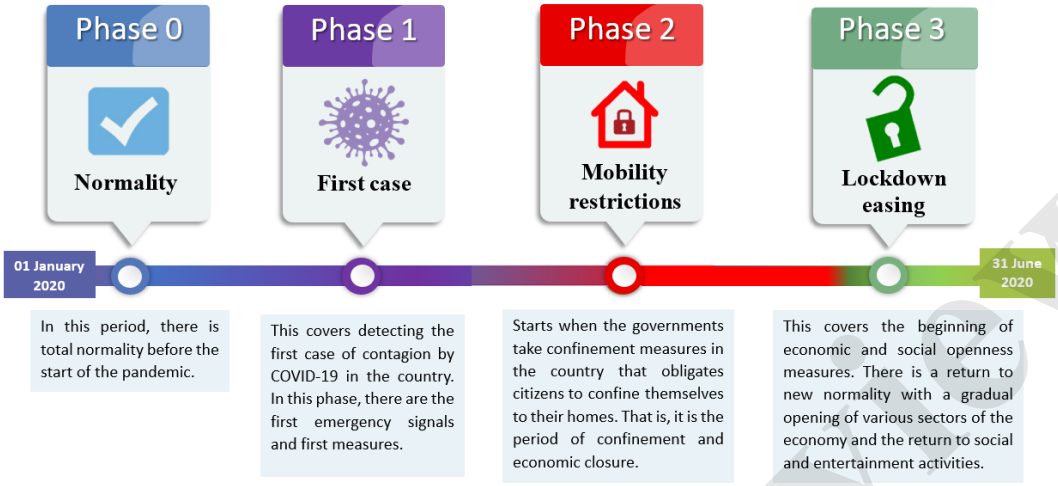


Figure 2. *The process to classify tweets in interaction levels*

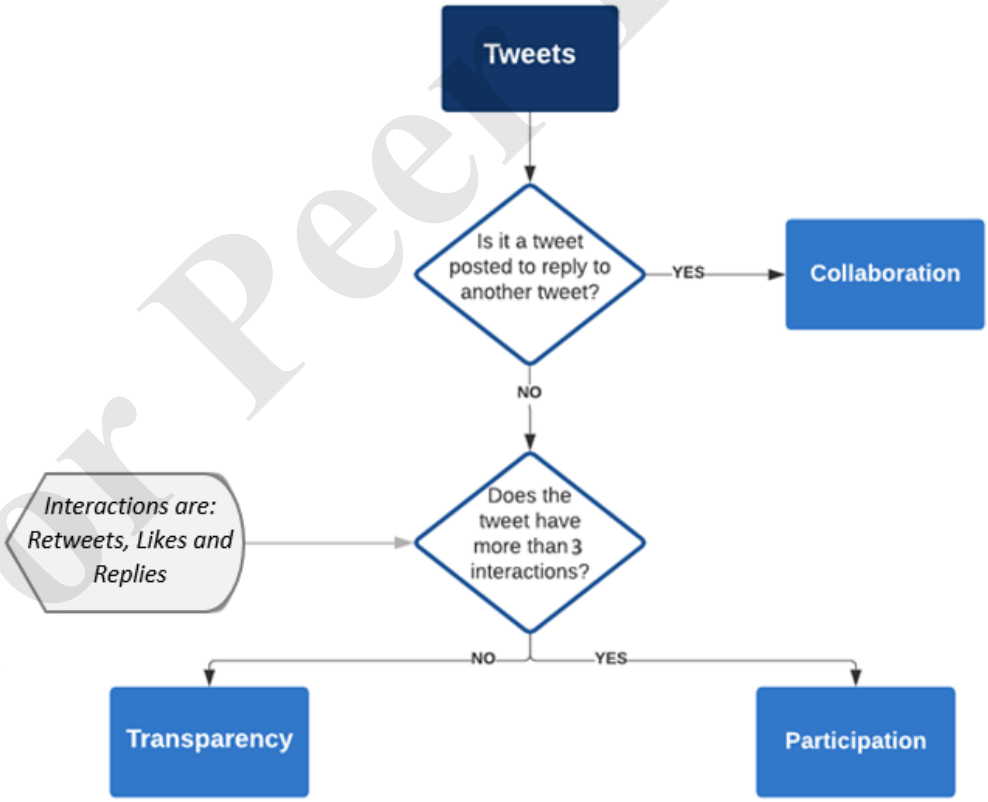
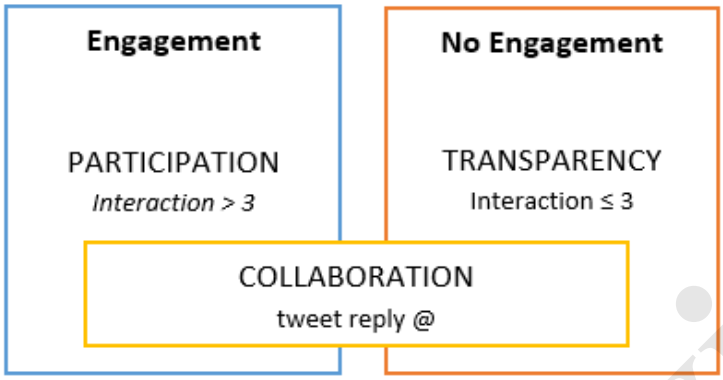


Figure 3. *Implicit citizens' engagement in the interaction levels*



TABLES

Table 1. Overview of phases of Covid-19 in Latin American Countries

PHASES (*Ph*)	**Country**	**Ph0**	**Ph1**	**Ph2**	**Ph3**	end
WITH	Argentina	*01-Jan*	*03-Mar*	*20-Mar*	*13-Apr*	*30-Jun*
	Bolivia	*01-Jan*	*10-Mar*	*22-Mar*	*11-May*	
	Colombia	*01-Jan*	*06-Mar*	*25-Mar*	*11-May*	
	Ecuador	*01-Jan*	*29-Feb*	*12-Mar*	*05-May*	
	El Salvador	*01-Jan*	*18-Mar*	*21-Mar*	*14-Jun*	
	Guatemala	*01-Jan*	*13-Mar*	*05-Apr*	*14-Jun*	
	Honduras	*01-Jan*	*11-Mar*	*20-Mar*	*08-Jun*	
	México	*01-Jan*	*27-Feb*	*26-Mar*	*18-May*	
	Panamá	*01-Jan*	*08-Mar*	*25-Mar*	*13-May*	
	Paraguay	*01-Jan*	*07-Mar*	*20-Mar*	*04-May*	
	Perú	*01-Jan*	*06-Mar*	*17-Mar*	*04-May*	
	Venezuela	*01-Jan*	*13-Mar*	*17-Mar*	*1-Jun*	
	Average duration (days)	*66*	*14*	*57*	*44*	
WITHOUT	Chile Costa Rica Cuba Nicaragua República Dominicana Uruguay	*01-Jan*				*30-Jun*

Table 2. Summary sample

	Phases		Total
	WITHOUT	WITH	
Country	6	12	**18**
Municipalities	33	70	**103**
Population	81,019,367	25,409,125	**106,428,492**
Tweets	14,717	92,208	**106,925**
Followers	552,262	11,952,096	**12,504,358**

Table 3. *Metrics for citizens engagement (Bonsón y Ratkai, 2013)*

Metrics	Code	Calculation
Popularity	P1	*Number of tweets favourited / total tweets*
	P2	*Total number of times favourited / total tweets*
	P3	*(P2/number of followers) × 1000*
Commitment	C1	*Number of tweets commented / total tweets*
	C2	*Total number of comments / total tweets*
	C3	*(C2/number of followers) × 1000*
Virality	V1	*Number of tweets retweeted / total tweets*
	V2	*Total number of retweets / total tweets*
	V3	*(V2/number of followers) × 1000*
Engagement		*P3 + C3 + V3*

Table 4. Average demographics and Social Media activity by municipalities

	Phases	
	WITHOUT	WITH
Population	769,973.48	1,157,419.53
Followers	16,735.21	170,744.23
Index penetration	2.17%	14.75%
Tweets	445.96	1317.25

Table 5. Tweets per day extracted by phases

Phases	*Tweets*	*Days*	***Tweets per day***
Ph0	25,470	66	386.40
Ph1	8,120	14	583.47
Ph2	29,443	57	518.82
Ph3	29,175	44	670.69

Table 6. Citizens engagement

		Engagement
General		*6.35*
Phases	WITHOUT	8.93
	WITH	5.13

Table 7. Citizens engagement by phases

Phases (Ph)	**Engagement**
Ph0	3.39
Ph1	3.68
Ph2	6.81
Ph3	5.52

Table 8. Twitter interactions in the local governments

Interactions	Phases	
	WITHOUT	WITH
Transparency	31.79%	20.85%
Participation	56.05%	68.17%
Collaboration	12.16%	10.98%

Table 9. Twitter interactions in the local governments by phases

Interactions	***Ph0***	***Ph1***	***Ph2***	***Ph3***
Transparency	26.06%	21.87%	15.57%	20.45%
Participation	64.85%	68.78%	72.25%	67.34%
Collaboration	9.09%	9.35%	12.18%	12.20%

APPENDIX

APPENDIX 1

Country with phases	**Local governments**
Argentina	Buenos Aires Cordoba Rosario San Miguel de Tucumán Salta Santa Fé Corrientes
Bolivia	La Paz Santa Cruz de la Sierra Cochabamba Oruro

	Trinidad Tarija
Colombia	Bogotá Medellín Cali Barranquila Cartagena Bucaramanga Cúcuta
Ecuador	Quito Guayaquil Cuenca Santo Domingo Machala Durán Manta
El Salvador	San Salvador Santa Ana San Miguel Santa Tecla Sonsonate Usulután
Guatemala	Ciudad de Guatemala Totonicapán Quetzaltenango Escuintla Huehuetenango
	Tegucigalpa

Honduras	San Pedro Sula Comayagua Santa Barbara
México	Ciudad de México Puebla de Zaragoza Guadalajara Monterrey Culiacán Rosales Mérida Hermosillo
Panamá	Panamá Colón David Chitré Santiago La Chorrera
Paraguay	Asunción Encarnación Pilar
Perú	Lima Callao Cusco Coronel Portillo Tacna
Venezuela	Maracaibo Valencia Girardot - Maracay Bolivar - Barcelona

	San Cristóbal Maturín Mérida

APPENDIX 2

Country without phases	Local governments
Chile	Santiago de Chile Valparaiso Concepción La Serena Antofagasta Temuco Iquique
Costa Rica	San José Cartago
Cuba	La Habana Santiago de Cuba Camagüey: Pinar del rio Cienfuegos SanctiSpíritus Las Tunas
Nicaragua	Managua Boaco Estelí San Carlos. Río San Juan
	Santo Domingo

República Dominicana	Santo Domingo Este Santiago de los Caballeros San Cristóbal La Romana Higüey
Uruguay	Montevideo Salto Paysandú Maldonado Rivera Tacuarembó San José de Mayo

Crisis Management Through Citizen Engagement On Twitter: The Case Of The Covid-19 Pandemic In Latin American Municipalities

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Abstract

COVID-19 created significant challenges in crisis management worldwide, especially for local governments that needed to communicate with citizens about health risks, policy decisions, and real-time information related to the pandemic. We analyse the evolution of the engagement between citizens and local governments on Twitter during the different phases of the first wave of the pandemic in Latin America, employing social media intelligence techniques to analyse 106,925 tweets from 103 local governments. Our results show enhanced engagement, especially in participation and collaboration, during the phases studied. Moreover, the increased use of social media as a communication channel was associated with mobility restrictions during the pandemic. Our research contributes to a deeper understanding of the role of social media as a communication channel between governments and citizens in the different phases of crisis management.

Keywords:

Crisis management; citizen engagement; social media; Latin America; local governments

INTRODUCTION

Crises caused by natural and man-made events have increased in different parts of the world in recent years, causing human, economic, and social consequences for the affected people (Ogie et al., 2022; Singla and Agrawal 2024). The importance and impact of these events have sparked interest in analyzing them (Fauzi, 2023) to address various needs of society. Furthermore, crisis management requires governments to control the situation and to provide solutions to citizens and others affected, including the capacity of the public administration to manage the information during emergencies

(Li, Chandra, and Kapucu 2020). Governments must generate closeness with citizens in crisis by disseminating information that demonstrates commitment (Padeiro, Bueno-Larraz, and Freitas 2021).

In crisis management, communication is essential because it provides real-time information about the situation and related decisions (Kim, Bae, and Hastak 2018; Rizza, 2023; Zhang et al. 2019). Since the middle of the decade of 2000s, people have used social media as a communication channel during disasters (Reuter and Kaufhold 2018; Singla and Agrawal 2024) through the access and use of official government social media accounts to the participation and interaction of citizens in crisis management (Guo et al. 2021; Ogie et al. 2022).

For this purpose, social media has become a relevant communication channel for attending emergencies (Lam et al. 2023; Singla and Agrawal 2024). The COVID-19 pandemic created significant challenges for crisis management worldwide, affecting citizens, governments, and organizations. It evidenced the necessity to inform the citizens about the situation and maintain close communication with the affected in real-time. For this reason, social media became a fundamental channel for crisis management because of the rapid spread of the pandemic (Landi et al. 2022; Pérez-Escoda et al. 2020), which required information and fast decisions, in the early stages of the pandemic, many individuals, including government agencies, used social media to present news and opinions related to the coronavirus (Manguri, Ramadhan, and Amin 2020) and allowed government authorities to issue and disseminate information at a moment's notice of restrictive isolation measures (Zhu and Hu 2023).

Social media has brought about a significant change in the way governments communicate with their citizens and access innovative stakeholder knowledge. These

tools have resulted in more efficient and effective processes and direct and fluid communication with citizens, especially Twitter, which has been considered an appropriate communication tool (Kumar and Jaiswal 2020). They are social media most used by governments for local discussion (Haro-de-Rosario, Sáez-Martín, and Caba-Pérez 2018) and citizen participation (Bonsón, Perea, and Bednárová 2019). However, previous studies have shown that merely using social media for communication does not necessarily guarantee effective engagement or interaction between governments and citizens because two-way interactive communication often remains at an initial level (Chen et al. 2020), although there are few studies related to the topic (Bonsón et al. 2019; Landi et al. 2022).

Given this context, we investigate the following research question: *How did Latin American local governments engage with citizens on Twitter during the first wave of the COVID-19 pandemic?* To answer this question, we analyse the scope of the tweets of 103 local governments of 18 Latin American countries during the first half of 2020, representing 106,925 tweets. Our results show increased citizen engagement by Latin American local governments on Twitter during the first wave of COVID-19, and we probe collaboration levels by analysing the interactions between citizens and government. Our research contributes to understanding how local governments report information through Twitter during an unprecedented health crisis in a region with socioeconomic difficulties that deepened during the pandemic. In addition, our study contributes to the literature on crisis management communication and the practical planning required for effectively responding to health and other emergencies.

The rest of the paper is structured as follows. After this brief introduction, we present the literature review regarding social media in government-citizen communication during crisis management. The third section describes the methodology,

including detailed tweet collection procedures, analysis techniques, and sample selection. In the fourth section, we present the results and discuss them in the fifth section. Finally, the sixth section presents the limitations, implications, and future lines of research.

LITERATURE REVIEW

Social Media in Crisis Management

A crisis is a public event that threatens social systems and ethical values (Luo et al. 2021). They are associated with natural hazards (tsunamis, hurricanes, cyclones, earthquakes, floods) and man-made disasters (shootings, terrorist attacks, civil unrest). Disasters have increased in frequency and intensity in recent years, causing human, economic, social, and even psychological losses (Fauzi 2023; Ogie et al. 2022; Singla and Agrawal 2024). Due to the impact of these events, crisis management (crisis or disaster management as synonyms) has become a topic of interest to the authorities and the public (Fauzi 2023) through effective and reliable communication (Guo et al. 2021; Kapucu and Garayev 2016). Various actors participate in this communication to assess the severity and impact of the events (Kim et al. 2018), including government agencies, public organizations, victims, and volunteers (Chen et al. 2020; Guo et al. 2021; Padeiro et al. 2021).

Although communication has been considered fundamental in crisis management, it has proven challenging to have fluid communication between those involved during emergencies. In this context, Information and Communications Technology (ICT) have converted into an effective method to address the different challenges related to communication, especially social media, which, in recent years, has been widely recognized as a valuable tool for crisis management (Han et al. 2022;

Singla and Agrawal, 2024; Zhu and Hu, 2023). The literature highlights the research on social media in crises (Fauzi 2023; Lam et al. 2023; Zhang et al. 2019) caused by events such as wildfires, floods, storms, terrorist events, and others in different countries (Padeiro et al. 2021; Stieglitz et al. 2022) and disaster management (Singla and Agrawal 2024; Zhang et al. 2019).

Social media facilitates quick and effective crisis response through communication and coordination (Mori et al. 2021; Luo et al. 2021; Rizza 2023). It helps convey warnings, prepare for events, and foster community bonds post-crisis (Kim et al. 2018), allowing interested parties to collect and analyze information and understand public attitudes (Abd-Alrazaq et al. 2020; Garcia and Berton 2021). Platforms like Twitter are particularly suitable for emergencies due to their features enabling virtual linkages and user collaboration (Fauzi 2023; Lam et al. 2023; Ruz et al. 2020). Twitter supports two-way content development and enhances interactions with organizations (Landi et al. 2022; Sundstrom and Levenshus 2017), and it helps governments increase openness and transparency (Yaqub et al. 2017).

In the case of public administration, governments have used social media extensively for risk and crisis communication, keeping the public informed, countering misinformation, addressing victims' families, and receiving external support (Han et al. 2022; Luo et al. 2021; Reuter and Kaufhold 2018; Guo et al. 2021). Therefore, social media have become a means for governments to explain, make decisions, and act in a coordinated manner with citizens (Chen et al. 2020), considering that the information released by government agencies allows for greater credibility among users because it is subject to validation and verification (Zhu and Hu 2023), with cost-effectiveness and

advantages that other media cannot provide (Guo et al. 2021), even among emergency response agencies and disaster-affected communities (Kim et al. 2018).

As a result, public and emergency management agencies widely use social media (Guo et al. 2021). From the users' perspective, social media and traditional channels are critical for staying informed and sharing experiences, especially during the uncertain early stages of crises (Stieglitz et al. 2022). In this regard, the citizens use government social media accounts to facilitate communication because these applications allow "a user to comment on a post, share (repost) a post, click the like button on a post, or simply save (bookmark) the post for future reference" (Guo et al. 2021, 3).

Despite the advances in the study of social media in public administrations (Guillamón et al. 2016) and research that has highlighted the importance of social media in crisis management (Landi et al. 2022; Padeiro et al. 2021), there is a paucity of research on public disclosure of government information crises (Guo et al. 2021).

Management Crisis During COVID-19 In The Social Media Era

The crisis has increased in recent years for multiple causes and in different geographical areas (Fauzi 2023; Ogie et al. 2022; Singla and Agrawal 2024). It has implied the leadership of national and local governments and emergency authorities to manage the situation and received international support from countries and organizations. However, COVID-19 was a crisis unprecedented in the last century due to its duration (Zeemering 2021), its rapid spread, magnitude, and global impact, which obligate to the governments quickly make decisions to control the emergency (Kruspe et al. 2020; Padeiro et al. 2021), especially for the signals of alarm in the world and

confined measures of people in your homes in most countries to mitigate the spread of the virus (Pérez-Escoda et al. 2020).

One of the immediate effects during the emergence of COVID-19 was the increase of social media use in crisis management (Pérez-Escoda et al. 2020) to obtain information and receive guidance and get involved in decisions related to the crisis to dialogic approach (Landi et al. 2022; Padeiro et al. 2021). Furthermore, social media became "an opportunity to share information and engage with the public, and the interactive characteristics of social media communication offer a lens on government coordination" (Zeemering 2021, 2).

The local governments had to adapt quickly to the situation for service delivery and decision-making and used social media to inform citizens about these issues (Padeiro et al. 2021; Zeemering 2021) due to the pressure to regular communication and collaboration between the community and other actors involved in the emergency management (Zeemering 2021) to the closets level with daily activities of the citizens and impact in the territories and people of the local government in comparison of the national governments (Rocca et al. 2020), and capacity to influence in the dialogue and participation between the citizens and governments (Gálvez-Rodríguez et al. 2018; Haro-de-Rosario et al. 2018).

The COVID-19 pandemic posed unique challenges for Latin America, a region with a substantial population and significant health and social management difficulties, especially in urban areas (World Bank 2020). The pandemic's economic impact worsened issues in informal sectors and affected those with limited remote work options (Hevia and Neumeyer 2020). Economic shocks included collapsing commodity prices, capital flows, and tourism (Djankov and Panizza 2020). Effective government

communication was crucial to addressing citizens' needs and implementing support policies. The health emergency led to a surge in internet usage, with around 430 million users in 2020. Research on social media engagement in Latin America remains scarce, with most studies focusing on developed countries like the United States, Spain, and Italy (Bonsón et al. 2019; Haro-de-Rosario et al. 2018). It highlights the need to analyze engagement in regions with different socioeconomic contexts where government communication is vital, especially during emergencies like COVID-19 (Zhang, Chen, and Lukito 2023).

Dialogical Theory for Crisis Management in Social Media

From a theoretical perspective, to explain the study of the relationship between governments and social media, the dialogical communication is one most crucial theoretical approach that allows explaining the creation and maintenance of online social relationships (Gálvez-Rodríguez et al. 2018; Landi et al. 2022; Stone and Can 2020; Wang and Yang 2020) despite this, there is a lack of studies that relate the dialogic communication theory and social media of public administration (Landi et al. 2022; Sáez Martín et al. 2015)

Dialogic Communication Theory (Kent and Taylor 1998; Taylor and Kent 2014) considered that "two-way symmetrical communication's theoretical imperative is to provide a procedural means whereby an organization and its publics can communicate interactively" (Kent and Taylor 1998, 323). According to Kent (2013), dialogic communication requires, on the one hand, participation, where managers, leaders, and professionals communicate with individual people rather than through collective messages. On the other hand, more appropriate channels for members of the organization and stakeholders to collaborate and interact freely, even if social media,

such as Facebook and Twitter, do not comply fully with that purpose. In crisis management, dialogic communication allows the citizens and other users to have a voice to communicate their needs and concerns and for governments to gather direct information to manage the crisis (Zhu and Hu 2023), which is considered relevant to improving resilience in disasters (Lam et al. 2023).

Dialogic communication can help organizations manage crises by allowing them to connect with their stakeholders through real-time feedback on the information they publish and engage in conversations (Bellucci and Manetti 2017; Manetti and Bellucci 2016). That support allows the interaction and discussions between the government and citizens in a bidirectional way (Agostino 2013; Zhu and Hu 2023). From a perspective, there is the "Pull strategy" that contributes to engagement to the extent that it allows citizens to actively participate in the topics of interest, unlike the "Push strategy" that aims at a traditional information mechanism (Mergel 2013).

Due to the above, the dialogic communication approach allows analysis of the interactions between local governments and the participation or reactions of citizens (Rocca et al. 2020) to understand the strategies of communication in social media with the governments during the crisis of COVID-19. Previous studies have shown that governments use social media mainly from a one-way communication logic (Padeiro et al. 2021; Zeemering 2021) or a combination of the two strategies (Arshad and Khurram 2020).

Engagement and Interaction Levels in Public Sector Social Media

Research indicates that social media usage changes during crises, but specific engagement behaviors during a global crisis like COVID-19 need to be better understood (Azer, Blasco-Arcas and Harrigan 2021). Landi et al. (2022) demonstrated

that public agencies generated public participation through social media during COVID-19 by enhancing communication to keep citizens informed and empowered, meeting their information needs (Pesci, Costa, and Andreaus 2020). It led to a new communication model where public agents achieved engagement levels comparable to or even higher than specialized digital health media (Pérez-Escoda et al. 2020), and it aligns with literature suggesting social media can provide operational and emotional support during health crises, helping reduce citizens' uncertainty and anxiety (French 2011).

It has allowed us to identify social media's evolving role in emergencies, aiming to enhance collaboration through information dissemination, relationship management, and user expression (Rizza 2023). Scholars have increasingly analysed citizen-government interactions during crises (Han et al. 2022; Reuter and Kaufhold 2018), as well as the distribution of information on social media, which illuminates citizen engagement with entities (Mergel 2013; Zavattaro, French and Mohanty 2015). This scholarly interest underscores the growing importance of understanding communication dynamics and engagement strategies between governments and citizens (Bonsón et al. 2019; Bonsón, Royo and Ratkai 2015; Guillamón et al. 2016).

Citizen engagement is known as citizens' participation or involvement in political and social issues or public affairs (Agostino and Arnaboldi 2016; Bonsón et al. 2019; Haro-de-Rosario et al. 2018) for establishing a relationship between the government and citizens, to 'becoming more accessible and transparent, lowering barriers to interaction, and providing a low-cost means of information dissemination' (Stone and Can 2020, 2). Additionally, it is known as 'an individual or collective behaviour for resolving social problems in the community' (Bonsón et al. 2019, 482) that improves public relations with a focus on citizens and ensures public agencies'

representation in all available channels (Mergel 2013). Hence, users want two-way communication with entities to express their perceptions and to receive an appropriate and real-time response; even so, the benefits of social media are not enough to generate citizen engagement.

Additionally, Zavattaro et al. (2015) define digital engagement as citizen participation in the government administrative system through social media at the local level, using Mergel's (2013) framework as an analytical guide. This framework outlines three ways that government entities and citizens interact via social media: **1) transparency**: Social media represents agencies in online channels, providing government information in the news feeds citizens frequently check; this seeks to make information accessible to the public on widely used websites (Mergel 2013). **2) participation:** Agencies go beyond unidirectional information flow to involve citizens in communications, allowing interaction and feedback through social media to enhance decisions' legitimacy (Grimmelikhuijsen and Feeney 2017). **3) collaboration**: The highest engagement level, establishing a reciprocal relationship where public entities and citizens interact and co-create government innovations. It encourages public entities to respond to user content, address concerns, and collaborate in public affairs. This level enhances exchange, collaborative work, and co-production of political and social matters (Zavattaro et al. 2015). This progression signifies a shift from government control to citizens as equal partners (Bryer 2013). This research applies these definitions of transparency, participation, and collaboration through social media to understand expressions of (digital) engagement.

Despite being a decade since Mergel's (2013) initial proposal on citizen interaction via social networks, its theoretical framework remains relevant today. Local governments consistently utilize platforms such as Twitter for transparent and

collaborative communication, with minimal changes to their functionality emphasizing their ongoing usefulness. Current scholars frequently reference Mergel's framework (Criado and Villodre 2021; Al Sulaimani and Ozuem 2022), demonstrating its continued relevance, especially in critical areas like disaster management (Hondula and Krishnamurthy 2024; Villodre and Criado 2020), notably during the COVID-19 pandemic (Lovari, D'Ambrosi and Bowen 2020).

Among the reasons for analysing the use of social media for public engagement, we highlight the following: (1) the potential to improve public trust, accountability, transparency, and participation (Williams et al. 2018); (2) contribute to citizens' political knowledge (Skoric et al. 2016); (3) offer the possibility of changing the traditional relationship between citizens and governments (Agostino 2013) and, (4) encourage citizen participation in public decision-making (Gálvez-Rodríguez et al. 2018).

METHODOLOGY

Sample

The sample in this research comprises the seven principal municipalities (capitals or most populated) of each Hispanic American country, 18 of 20 analysed countries that conform to the Latin American zone. We excluded two Latin American countries from our analysis. The first is Puerto Rico, an unincorporated territory of the United States, where the U.S. Constitution applies partially (Torruella 2007). The second is Brazil for two reasons: its official language is different from other Latin American countries (it is Portuguese, not Spanish), and this country is considered an outlier country in terms of the number of infections and response to the coronavirus

concerning the rest of the Latin American zone (Bandeira and Carranza 2020; Nacher et al. 2021).

We selected the Latin American zone because it has socioeconomic characteristics that differ from those analysed in previous studies. In this case, the government has an essential role in meeting the needs of the inhabitants, especially in the COVID-19 emergency that requires governmental support for communication to resolve different difficulties. In addition, this region has high user numbers on social media, and few studies are related to developing countries (Bonsón et al. 2019; Haro-de-Rosario et al. 2018).

To answer the research question, we retrieved the Twitter accounts verified by local governments. The account information was collected by following the Twitter icon link on the official municipality website or the Twitter platform; we identified 103 verified Twitter accounts of the 126 municipalities considered in the sample. The analysis period was the first six months of 2020, from January 1 to June 31, 2020, representing different pandemic stages. We have divided these into the following phases, as shown in Figure 1:

<<< Insert Figure 1 about here>>>

Although the period analysed is the first half of 2020, the duration of the phases is different in each country. As shown in Table 1, each phase's start date differs according to the event described previously in the phases. Phase 0 has the most extended duration in days. It is followed by Phase 1, Phase 3, and Phase 2. Table 1 also shows the countries that did not have confinement measures or undergone de-escalation. For this reason, dividing the analysed period into phases was impossible. Thus, we have two groups of countries: on the one hand, countries with phases (see Appendix 1),

which have applied confinement and de-escalation phases, and countries without phases (see Appendix 2), which have not taken these measures.

<<< Insert Table 1 about here>>>

Data extraction

The data were collected in August 2020 using the OSINT tool Twint, an advanced Twitter scraping tool written in Python that allows the scraping of tweets from Twitter profiles without using the Twitter API (Zacharias and Poldi 2018). Applying these social media intelligence techniques (SOCMINT), 100% of the original tweets of each account are obtained, with their corresponding metadata. In this way, we received 106,925 tweets from the leading Latin American municipalities, and we will analyse the reactions to these publications of their 12,504,358 followers.

Table 2 summarizes all the sample data separated by the countries' groups with and without phases. Six countries that did not apply confinement measures represent 33 local governments' Twitter accounts with 14,717 tweets, to which their 552,262 followers should react. On the other hand, we analysed 12 countries with well-differentiated phases corresponding to 70 local governments with verified Twitter accounts, extracted their 92,208 tweets, and identified how their 11,952,096 followers interacted.

<<< Insert Table 2 about here>>>

3.3. Interaction analyses

Once we had scraped the tweets, we analysed the data using the free R software (R Core Team 2018) to understand how citizens interact with what their municipalities disclose on Twitter. Before the analysis, the tweets were cleaned and checked for

duplicate entries using the R "tm" library (Feinerer, Hornik, and Meyer 2017), ensuring the absence of duplicate tweets.

We assessed citizen participation as detailed in Table 3, employing the Twitter metrics developed by Bonsón et al. (2019). These metrics are an adaptation of those initially designed for Facebook (Bonsón and Ratkai 2013) and subsequently also tailored for use on Instagram (Perea, Bonsón and Bednárová 2021). The previous literature considers the popularity metrics for the favourite interaction, the commitment metric for the comment interaction, and virality for retweeting."

<<< Insert Table 3 about here>>>

Based on the framework proposed by Mergel (2013) for evaluating interactions on social media in the public sector, which revolves around three fundamental dimensions: transparency, Participation, and collaboration, we utilize the number of interactions tweets receive to measure different levels of engagement. Considering the relationship between Open Government metrics and social media metrics is essential, as the effective use of social media in the governmental context contributes to Open Government objectives (Grover and Kar 2020).

Therefore, Mergel's comprehensive approach provides a complete framework for analysing and understanding the interaction dynamics of social media in the public sector. In the transparency dimension, the aim is to provide educational information through a unidirectional push approach, measuring transparency through the number of tweets without interactions and seeking to build trust in accountability. In the Participation dimension, active engagement of the public is pursued through a bidirectional pull approach, evaluating interactions on Twitter such as retweets, likes, and replies to achieve consultation, deliberation, and satisfaction. Lastly, the

collaboration dimension focuses on fostering cross-border action, using bidirectional interactivity tactics such as networking and co-design of services by responding to citizens' tweets, with the desired outcome of building online communities and thematic networks.

Figure 2 explains the process followed to classify a tweet into the three levels of interaction. The process begins by identifying whether a tweet is posted to generate collaboration. In this case, this will be when the tweet in question is a tweet that responds to a previous tweet. On the other hand, if it is an original initial tweet, it will be included in the levels of participation or transparency according to its interaction number. If the tweet receives more than three retweets, likes, or replies, we will treat it as generating participation. However, if the tweet gets fewer interactions, it has been tweeted to grant transparency. In this way, we can classify tweets into three levels of interaction: (1) transparency, the most basic level of interaction; (2) participation, the medium level; and (3) collaboration, the highest level of engagement.

<<< Insert Figure 2 about here>>>

As indicated in Figure 3, depending on the levels of interaction, it is implied whether it generates engagement or not. Transparent tweets do not generate engagement since they barely interact; on the other hand, participatory tweets generate engagement through many interactions. The case of collaborative tweets is peculiar because they may or may not generate engagement: it is not possible to know this since, to reach this level, the interactions are not considered, if not their purpose of publication: if it has been tweeted to respond to a previous tweet or if it is an original tweet.

<<< Insert Figure 3 about here>>>

RESULTS

In this section, we explore the evolution of engagement and interactions on Twitter by local governments in Latin America during the first wave of the pandemic. We start with general statistical data from the sample of municipalities, including demographic factors like population size and social media engagement metrics such as followers, penetration index, and tweets (Table 1). We also analyse the frequency of daily tweets by local governments across different pandemic phases to contextualize our findings.

Next, we focus on the evolution of engagement and interactions on Twitter. By examining trends in engagement metrics and interaction patterns between local governments and citizens, we aim to understand how communication dynamics unfolded during the pandemic's early stages. This analysis will shed light on the effectiveness of local governments' communication strategies and their ability to foster meaningful engagement with the public during a crisis, contributing to a deeper understanding of social media's role in government-citizen interactions.

Contextual Background: demographics and social media activity

Table 4 compares local governments with and without confinement measures (with and without phases, respectively). Local governments without confinement have an average population of 769,973 inhabitants, while those with confinement have 1,157,420 inhabitants, a 33.47% increase. Additionally, local governments with confinement have 90.20% more Twitter followers (170,744) than those without (16,735 followers). The population penetration of following official Twitter accounts is higher in countries with phases (14.75%) versus those without (2.17%).

The number of tweets published is also higher in municipalities with confinement phases, averaging 1,317 tweets compared to 446 tweets in those without phases.

<<< Insert Table 4 about here>>>

Regarding tweeting activity during different phases, Table 5 shows that local governments tweeted the least before the first COVID-19 case (Phase 0). Tweeting increased to 583 tweets per day during the appearance of the first cases (Phase 1), slightly decreased during the complete lockdown (518 tweets per day in Phase 2), and rose to 671 tweets per day during the easing of lockdown (Phase 3), representing a 73.58% increase in daily tweets from Phase 0 to Phase 3.

<<< Insert Table 5 about here>>>

Citizens' engagement

Table 6 shows that citizen engagement with local government Twitter accounts in Spanish-speaking countries averages 6.35 points. However, this varies significantly between countries with and without containment measures. Engagement is higher in countries without phases (8.93 points) than those with phases (5.13 points).

<<< Insert Table 6 about here>>>

Further analysis of countries with phases reveals a bell curve in engagement throughout the health emergency (Table 7). Early 2020 saw 3.39 engagement points, which rose to 3.68 as the first COVID-19 cases appeared. Engagement peaked at 6.81 points during total lockdown and slightly decreased to 5.52 points during de-escalation.

<<< Insert Table 7 about here>>>

Twitter interactions in the local governments

Table 8 outlines Twitter interactions, measured by transparency, participation, and collaboration, in local governments with and without confinement measures.

<<< Insert Table 8 about here>>>

Transparency was most significant in municipalities of countries without phases, where 31.79% of tweets aimed to generate transparency. In contrast, municipalities with phases focused on participation, with 68.17% of tweets encouraging citizen involvement. Collaboration levels were slightly higher in countries without phases but remained similar across both groups, with 11-12% of tweets responding to citizens.

Table 9 examines interactions across different phases, highlighting transparency, participation, and collaboration trends in countries with confinement measures.

<<< Insert Table 9 about here>>>

The level of transparency has decreased from Phase 0 to Phase 3, where there was a slight increase in transparency compared to Phase 2. However, while the level of transparency decreased, the levels of participation and collaboration increased, except in Phase 3, where participation decreased slightly compared to the previous phase. On the other hand, collaboration increased smoothly without reduction in any of the phases.

At the difficult time of the first wave of the pandemic, in Phase 2, the sample showed the most minor level of transparency but obtained the highest level of participation. Collaboration will increase slightly more in Phase 3, considerably reducing the difference between the levels of transparency and collaboration. The level of collaboration approaches that of transparency in this phase. This difference before the appearance of the first case of a patient with COVID-19, Phase 0, was quite marked.

Before the start of the pandemic (Phase 0), the local governments hardly collaborated and were mainly dedicated to generating participation and transparency; however, with the beginning of the confinement (Phase 2) and subsequent lockdown easing (Phase 3), the local governments reached a greater collaboration by having to respond to their citizens, abandoning tweeting to generate transparency.

DISCUSSION

In the study of social media, several aspects of interest stand out: firstly, the engagement analysis has become a topic of interest for researchers to analyse the interactions between different users (Bonsón et al. 2015; Haro-de-Rosario et al. 2018). Secondly, Twitter has gained popularity recently because it allows users to express their opinions concisely and in real-time on different topics, and it is relevant for analyzing public interest issues (Stone and Can 2020). Thirdly, although regions such as Latin America have gained ground in the use of social media and citizens are using these tools to stay informed and share opinions on social or political issues (Gálvez-Rodríguez et al. 2018), there are few studies related to interactions in social media in this region in terms of disaster management. Finally, COVID-19 changed communication between people, and there has been an increase in the use of social media during health emergencies. It has become a means of communication for users to receive related information (Pérez-Escoda et al. 2020).

In this study, we analysed 103 capital local governments in Latin America with active Twitter accounts, highlighting that it is a sample with differences in the number of inhabitants, activity (number of messages), audience (number of followers), and interaction (likes, comments, and replies) and decisions related with the management of COVID-19 (with phases or without phases). This result shows that most Latin American local governments, 81.75% (103/126), are present on Twitter with an active official

account and that citizens recognize Twitter as a communication channel with a total penetration rate of 11.74%. Additionally, Twitter demonstrates excellent potential for amplifying messages regarding emergency management despite the limitations of social media access for populations in different regions or socioeconomic levels. During the analysis, citizen engagement in Latin America was 6.35, which is higher than the results obtained in other studies on Twitter in different regions (Bonsón et al. 2019).

As indicated by Pérez-Escoda et al. (2020), the unprecedented health crisis points towards a new communication model in health issues, creating a new space for entities such as public agencies whose content achieves a level of engagement comparable to or even higher than specialized digital media in health communication. In this case, Latin American local governments do not match up to Italian local governments as they are in an early stage of the process both in acquiring social communication skills and in defining a communication strategy to strengthen their social relationships (Mori et al. 2020). According to Zhang et al. (2019), disaster management agencies that effectively use social media are the ones who listen to the public. Furthermore, due to restrictions on people's mobility during COVID-19, social media became the preferred channel for people to communicate with people close to them and to find out about the decisions made by health and government authorities and the evolution of the virus.

Regarding the management of COVID-19, national governments have taken measures to counter the level of contagion, with 12 of the 18 countries analysed taking strict quarantine measures for citizens, making changes according to the evolution of the virus (with phases). The remaining countries adopted other measures without restricting the mobility of citizens during the health emergency (without phases). However, these decisions also affected citizen engagement, identifying those countries with phases with

an engagement score of 5.13, which is lower than the overall engagement. In contrast, the engagement of the group of countries without phases increased and stood at 8.93.

The main reason for the variation is related to the audience (measured by the number of followers), which differs significantly in the analysed groups: the group with phases has, on average, 170,744.23 followers, and the group without phases has 16,735.21 followers, on average, which has a negative relationship to engagement, i.e., the lower the number of followers of an account the higher the engagement (Bonsón et al. 2019). On the other hand, the uncertainty of the number of infections and the greater flexibility in the mobility measures explain the higher engagement in countries without phases, which use social media as the primary communication channel to learn about the decisions made by local governments. Whereas in the countries with phases, the decisions related to COVID-19 were more extensive, which reduced the uncertainty so that citizens at home could use other media to review the health situation (T.V., radio, newspapers).

These results allow us to identify citizens who started interacting more with local government accounts during the identified phases; in Phase 0, when there was low information about and attention paid to the virus, engagement was 3.39. Subsequently, this increased in Phase 1 to 3.68, confirming the first case in each country analysed.

In Phase 2, when the authorities extended the period of confinement and adopted other measures, the citizen engagement was 6.81. This result shows the incidence of the quarantine decisions taken by the governments and how it was going to affect citizens who began to resort to real-time information on Twitter and to interact more with other users, as uncertainty about the changes and the implications in economic matters and social aid, generated greater engagement with citizens. Furthermore, according to Stieglitz et al. (2022), the use of social media increases particularly in the early stages of

crises due to the uncertainty and ambiguity of the event. In contrast, with Phase 3, the gradual opening of the economy and lifting of many restricted activities reduced engagement to 5.52. These results show that expectations of government decisions and the evolution of the health emergency influenced how citizens interact with governments via Twitter. Thus, this social media is a communication channel with variations in citizen authorities' relations´.

In the second part of the study, we analyse the relationship between engagement and communication interaction (transparency, collaboration, and Interaction) to identify governments' role and objective in using social media during health emergencies. According to the results in Table 8, local governments in Latin America are moving towards improving interaction with citizens and establishing two-way communication, highlighting 68.17% (with phases) and 56.05% (without phases) of participation through likes, comments, and responses to messages, establishing a closer relationship between citizens and generating a bidirectional flow (Chen et al. 2020). The systematic use of social media, with the issuance of emergency messages and warnings, allows for a high level of engagement, interaction, and collaboration (Lindsay 2011).

Some progress in interaction also evidences the commitment of local governments to improve a two-way relationship on Twitter by identifying that 10.98% and 12.16% of messages had a direct response from local governments with phases and without phases, respectively, representing higher levels of engagement (Agostino and Arnaboldi 2016). These results differ from studies conducted in other regions that have concluded that the main objective of public entities in social media is a one-way communication focused on transparency (Mergel 2013; Zavattaro et al. 2015) with low

engagement, with 31.79% and 20.85% of the interactions that governments have had with phases and without phases, respectively.

The evolution of local government communications during the phases adopted for the management of COVID-19 is similar to general analysis (Table 9). The results highlight the commitment of local governments to establish participation and collaboration with citizens in the different stages of the pandemic, showing a positive trend in the increase in participation and collaboration. The results are related to the need to explain the different measures adopted by the local government after the confinement, which generated concerns among citizens and increased the response capacity. This tendency establishes dialogical communication as governments interact with citizens and other stakeholders through a bidirectional conversation (Chen et al. 2020; Mori et al. 2020). Participation slightly decreased from Phase 2 to Phase 3 (72.25% to 67.34%) due to the authorities' decisions to open the economy and the gradual return to normal activities, which reduced citizens' uncertainty about managing the pandemic. Therefore, the behaviour of the virus and the management of local authorities did impact the levels of engagement and interaction on Twitter and the commitment of local governments in Latin America to take advantage of the benefits of social media to strengthen their relationship with citizens during the first wave of the pandemic.

In brief, there is an evolution towards more interactive and bidirectional communication, with increased participation and collaboration between local governments and citizens through Twitter during the different phases of pandemic management. The results allow different characteristics of the engagement in local government in Latin America to be identified, especially in pandemic times. First, the

results show that citizens communicate with the governments through social media about health and socioeconomic difficulties that require the most attention from public authorities to address their citizens' needs. Second, there was an increase in citizen engagement and interaction during the phases of the COVID-19 health emergency due to uncertainty regarding the pandemic evolution and the constant measures associated with their management. Lastly, there was a compromise of the local government of communication interaction with the citizens through Twitter, with more participation and interaction, which highlights the use of the tools of Web 2.0.

CONCLUSIONS

In the region and period analysed, an evolution and a transition to the true purpose of using social media governments can be observed. As the considerable rise in high levels of engagement has shown, measures to halt the advance of the pandemic have tightened. Therefore, this reflects a more significant communication interaction between local governments and citizens by increasing participation and collaboration on Twitter during the most challenging moments of the first wave of the pandemic. In this way, municipalities achieved the purpose of social media and the highest levels of interaction associated with Open Government.

This study highlights the differences in the use of social media in Latin America compared to other regions that have been analysed previously and concludes that the principal aim of social media is to transmit information in a unidirectional way to local governments (Haro-de-Rosario et al. 2018; Stone and Can 2020; Zavattaro et al. 2015) with a lower level of engagement (Agostino and Arnaboldi 2016). Additionally, this research provides evidence of the advances of local government in crisis management through the use of social media for interaction with citizens and generating a two-way

relationship, creating spaces for participation and collaboration in an unprecedented health crisis.

Theoretical and Practical Implications

This study makes several theoretical contributions. It adds new evidence to the literature on governmental use of social media to promote citizen engagement (Criado, Sandoval-Almazan, and Gil-Garcia 2013), a topic of increasing interest but limited studies, especially in crisis and developing countries (Zavattaro et al. 2015). It also analyses the evolution of citizen engagement during different emergency phases, highlighting changes in citizens' communication behaviours with the government.

Additionally, this study reveals the progress of Latin American municipalities in using social media for two-way communication, contrasting previous findings that suggested low interactive participation (Haro-de-Rosario et al. 2018). This research diverges from the traditional one-way approach where public agencies primarily use social media for information dissemination and transparency (Mergel 2013; Zavattaro et al. 2015). It also showcases how local governments leverage social media during serious risk situations. Another significant theoretical implication is the potential inclusion in the prestigious Disaster Information Reference Library (DIRL), an ongoing project by Professor Scholl (2023) at the University of Washington, which would enhance knowledge dissemination and foster academic collaboration.

This study's practical implications are especially relevant for local governments during the COVID-19 crisis. It emphasizes the importance of understanding crisis management through social media across various scenarios. Latin American municipalities effectively used Twitter during the pandemic's first wave, demonstrating

the need for continued engagement to foster two-way communication beyond the health crisis. Municipalities should monitor citizen publications on social media to identify concerns and enhance responsiveness (Liao et al. 2020). Valuing all interactions, including likes and responses, is crucial, particularly in health risk communication (Ngai et al. 2020). This research encourages local governments to view social media as an information tool and a vital communication platform in health crises.

Limitations and Future Research

This study has several limitations that need to be discussed in future research. Firstly, the analysis focused only on Twitter interaction metrics (likes, retweets, and responses) and did not consider tweet content. Future studies should include a content analysis to understand the topics driving engagement during different pandemic phases. Additionally, examining how local governments use Twitter to promote accountability, communicate public policies, and respond to citizens is essential; it could reveal the impact of social media on transparency, accountability, and public trust in local authorities.

Another limitation is the collective analysis of all Latin American countries without considering their unique sociocultural aspects. Future studies should incorporate Hofstede's cultural dimensions for a more individualized country analysis (Hofstede 2001), recognizing the cultural differences within Latin America (Hidalgo Campos et al. 2007).

Generalizing these results to other regions is problematic, as the study did not consider whether engagement spikes were due to regional events or the pandemic. Future research should compare countries similarly affected by the pandemic to determine broader applicability.

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