



# Dealing with the COVID-19 crisis: Theoretical application of social media analytics in government crisis management

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## ABSTRACT

Little theory-grounded research addresses how to use social media strategically in government public relations through machine learning. To fill this gap, we propose a way to optimize social media analytics to manage issues and crises by using the framework of attribution theory to analyze 360,861 tweets. In particular, we examined the attribution of crisis responsibility related to the spread of COVID-19 and its relations to the negative emotions of U.S. citizens on Twitter for six months (from January 20 to June 30, 2020). The results of this study showed that social media analytics is a valid tool to monitor how the spread of COVID-19 evolved from an issue to a crisis for the Trump administration. In addition, the federal government's lack of response and inability to handle the outbreak led to citizens' engagement and amplification of negative tweets that blamed the Trump White House. Theoretical and practical implications of the results are discussed.

## 1. Introduction

On January 21, 2020, the first case of the novel coronavirus disease (hereafter COVID-19) was confirmed in the United States in a man who had returned from Wuhan, China (Schumaker, 2020). In the early stage of the COVID-19 pandemic, the number of infections and deaths in the United States rose faster than in any other country worldwide (Elflein, 2021). Despite the declaration of a national emergency on March 13, 2020, the federal government in the U.S. struggled to cope with the public health disaster during the early phase of the COVID-19 pandemic (Diamond, 2020, April 16).

When catastrophic events strike, public sector organizations ought to protect affected citizens and rebuild the nation with immediate aid and relief (Broom & Sha, 2012). Generally, citizens expect a higher standard from their government than from private-sector organizations amid a public health disaster (Liu & Horsley, 2007). History has shown that catastrophic events which are poorly managed by governments can result in government crises (Chon, 2019).

As social media allows citizens to communicate with others and with organizations in the digital age, government communicators in particular should listen to citizens' voices before an issue becomes a crisis. The use of social media for monitoring has significantly increased in crisis communication research (Eriksson, 2018). Scholars have studied the

role of government agencies in dealing with crises in the early stage of the COVID-19 pandemic (Chang, 2020; Kim & Kreps, 2020). They have especially focused on social media to examine how organizations in the public sector diffuse COVID-19 information that helps citizens (Wang, Hao, & Platt, 2021). Aside from these efforts, however, there has been little research in public relations on how a government listens to the voices of citizens and monitors issues through social media analytics from the view of issues and crisis management.

To fill this gap, this study aims to propose a theory-grounded framework for using social media analytics to investigate how a potential issue becomes a government crisis. Utilizing social media data during the early stages of the COVID-19 pandemic in the U.S., this study analyzes how the federal government has been coping with the public health disaster as it became a government crisis. As theoretical backgrounds, we first propose the importance of social media for issues and crisis management through the model of strategic management of public relations (Grunig, Grunig, & Dozier, 2002). Second, the social-mediated crisis communication model (SMCC, Austin, Fisher Liu, & Jin, 2012) is proposed to understand dynamic communication between a government and its digital publics before and during a crisis. Third, we revisit attribution theory (Weiner, 1986), which provides a theoretical rationale to explain the relationships between crisis origin (i.e., locus of control) and perception of crisis responsibility toward a government.

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The revised SMCC model also encourages organizations to investigate attribution of crisis responsibility and crisis response strategies through the crisis origin (Jin, Liu, & Austin, 2014).

Therefore, guided by the model of strategic management of public relations (Grunig et al., 2002), the social-mediated crisis communication model (Austin et al., 2012), and attribution theory (Weiner, 1986), this study suggests how social media analytics can be used to monitor issues and predict government crises based on a PR theory-grounded framework. A study overview is shown in Fig. 1. Considering that there is scarce theory-grounded research, we believe the results of this study contribute to building ways to strategically approach issues and crisis management via social media analytics.

## 2. Study background

On January 29, 2020, President Trump announced the formation of the White House Coronavirus Task Force. Following the declaration by the World Health Organization (WHO) of the global health emergency (January 30), the White House also declared a public health emergency (February 3). However, health experts note that the Trump administration tended to overlook experts' warnings about the pandemic in the early stages (Crowley, Thomas, & Haberman, 2020). The first COVID-19 death in the U.S. on February 29 caused many people and experts to have concerns about already-ongoing community infection (Comfort, Kapucu, Ko, Menoni, & Siciliano, 2020).

In March, the federal government started to introduce shutdown policies, such as stay-at-home orders, business lockdowns, and travel bans. On March 11, the WHO officially declared a pandemic. President Trump, however, still downplayed the virus. For example, on February 24, Trump posted the tweet, "The Coronavirus is very much under control in the USA. We are in contact with everyone and all relevant countries. CDC & World Health have been working hard and very smart. Stock Market starting to look very good to me!" He also compared COVID-19 to the flu on Twitter (March 9) and delivered misinformation about the approval of Hydroxychloroquine as a treatment by the Food and Drug Administration (FDA). On March 19, Trump labeled SARS-

CoV-2 the "Chinese Virus" in an effort to shift blame to China (Peters, 2020). The pandemic also caused an economic crisis in mid-April. Due to the biggest job loss since the Great Depression, 22 million unemployed people were receiving aid. Nevertheless, the president's message was to criticize China, the WHO, Joseph Biden, and Democratic governors. Downplaying COVID-19, ignoring experts, and shifting blame may have caused U.S. citizens to perceive that the pandemic could have been controlled better if the Trump White House had effectively dealt with the health crisis.

## 3. Literature review

### 3.1. Understanding issues and crisis management in public relations

Dealing with conflict and controversial situations between organizations and publics is an important public relations activity (Kim & Ni, 2013). The role of public relations to manage issues and crises is shown in the model of strategic management of public relations (Grunig et al., 2002). In the overall strategic management of an organization, public relations practitioners scan potential issues and identify active publics who can affect the organization's decision making across the three stages (Grunig & Repper, 1992) (See Fig. 2).

Fig. 2 shows the role of an excellent public relations department in the overall strategic management process of an organization; this is useful to understand how strategic issue management can be used in all phases of the public relations process. The role of public relations managers in strategic management is to "scan the environment of organizational stakeholders to identify potential publics who might be affected by the consequences of decisions, or who might be attempting to set the agenda for an organizational decision by seeking consequences from an organization" (Grunig & Dozier, 2002, p. 144). To identify key publics, public relations managers need to use public segmentation theories (e.g., situational theory of problem solving, Kim & Ni, 2010). Since poorly handled issues can evolve into crises, it is imperative for public relations managers to discuss and negotiate with publics (Grunig et al., 2002). In this regard,

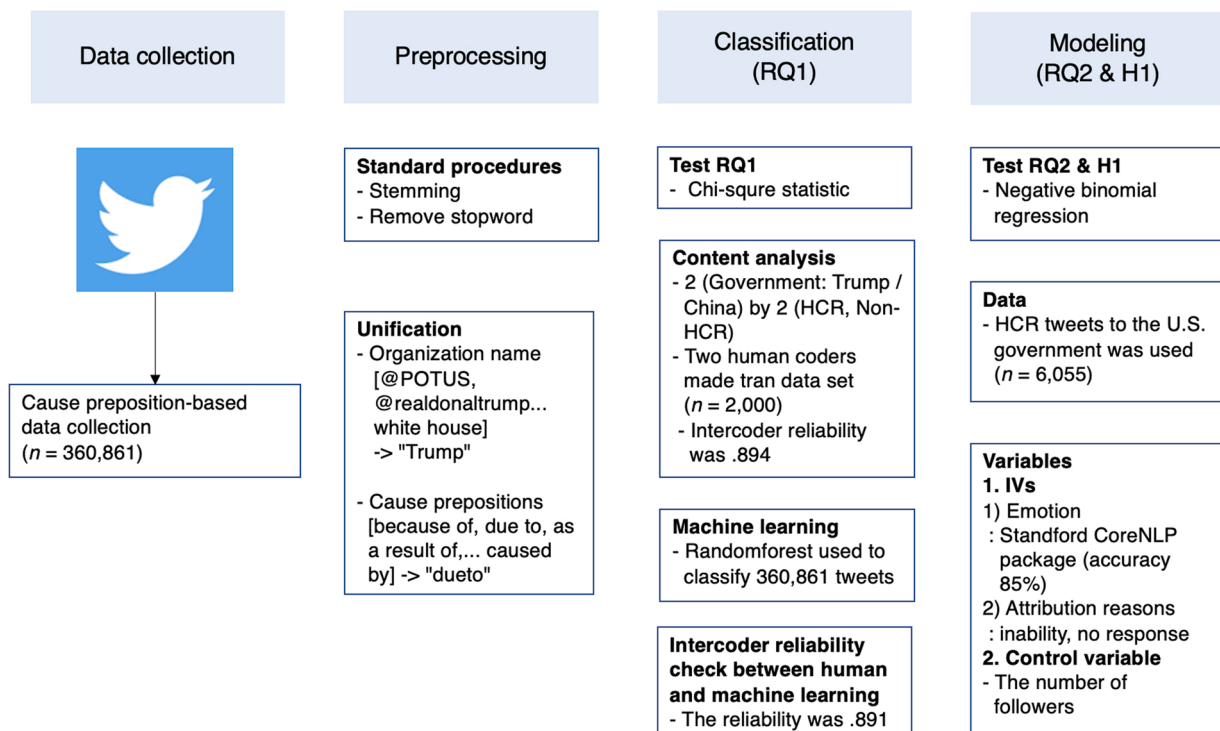
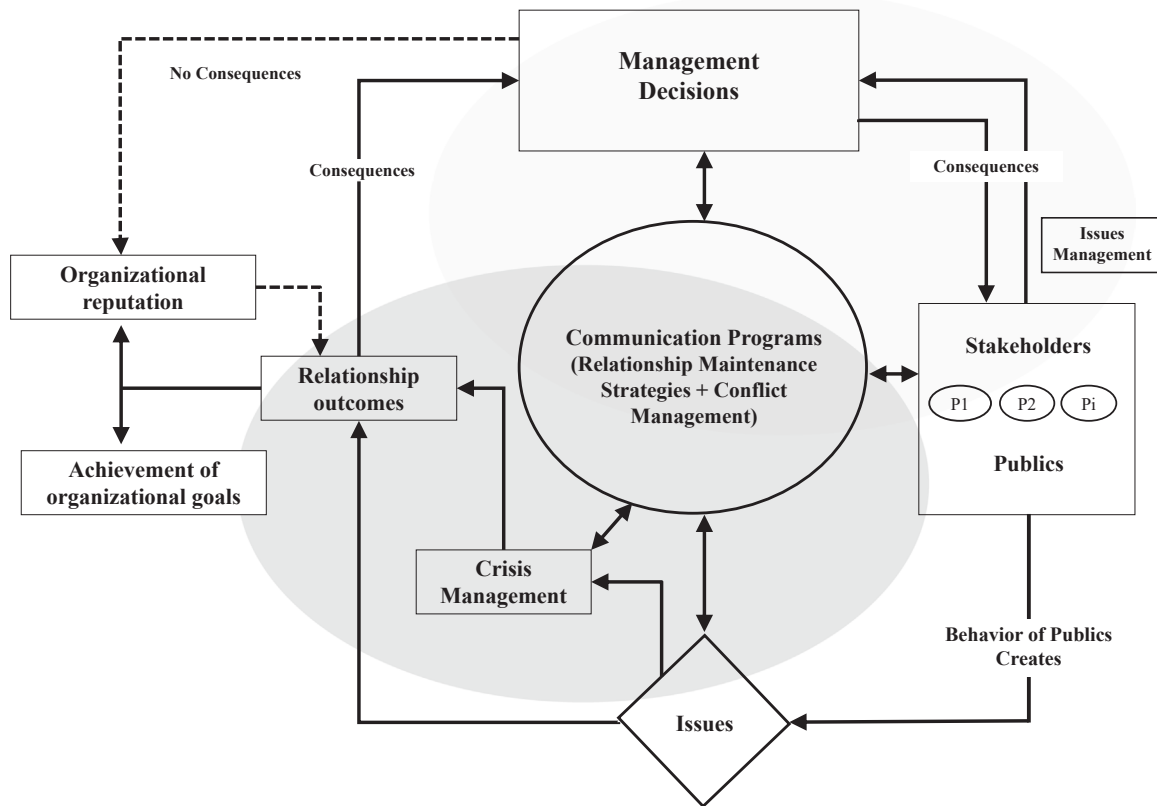


Fig. 1. The study overview.



**Fig. 2.** Model of strategic management of public relations, Model of strategic management of public relations. This is a model of emphasizing the role of issues management in the digital age and based on model of strategic management of public relations (Grunig et al., 2002). 145. The original model is adapted from “Excellence public relations and effective organizations: A study of communication management in three countries,” by Grunig et al. 2002, p.

issues management provides public relations managers with a framework to take the initiative with issues and activist publics (Renfro, 1993). In a complex environment, issues management attempts to decrease conflict and build on shared interests between an organization and its publics (Heath, 2005). To proactively cope with a turbulent and complex digital media environment, public relations managers should be vigilant to monitor issues related to their organizations.

The emergence of social media has had an impact on the agenda-building process related to organizational problems by transforming citizens into information producers (Yang & Sun, 2021). While news producers based on professional journalism practices cultivate public agendas from the view of traditional agenda-setting theory, the organizations can be dependent variables influenced by information sources such as publics in the digital age (Guo & McCombs, 2016; Kim & Lee, 2006). Thus, public relations managers in the digitally networked society should monitor issues from publics and news media together.

### 3.2. Social media analytics for proactive issues and crisis management

Social media have become major platforms organizations can use to deal with crisis and communicate with key publics (Jin et al., 2014). Unlike traditional media, such as television and newspapers, social media allow organizations to interact with their publics via two-way communication (Fearn-Banks, 2016). The two-way communication function of social media has attracted many scholars to study how these platforms are used to manage crises efficiently (Austin et al., 2012; Coombs, 2019) and how crisis communication strategies are used to employ social media effectively (Cheng, 2018). With the increasing use of social media, these platforms have become the “driving force in the bleeding edge of crisis communication” (Coombs, 2014, p. 2). In this

sense, monitoring a crisis on social media becomes the foundation of issue and crisis management.

When it comes to issue management in the pre-crisis stage, social media can be used to detect potential threats and interact with key publics who can influence others on a given issue. During an ongoing crisis, before making any decisions about crisis responses, practitioners can use social media to analyze and understand publics’ attitudes and reactions toward an organization (Freberg, 2012; Taylor & Kent, 2007). Social media monitoring in crises is defined as “a process of ongoing, systematic searches of social media websites for up-to-the-minute information on news or a live event” (Hadi & Fleshler, 2016, p. 775). As a more active type of communication, social media listening refers to organizational communication to engage and interact with publics through conversation (Avery, 2017).

Recently, it has become critical for organizations to utilize and listen to social media as they deal with crises in terms of prior, ongoing, and post-crisis stages. Avery (2017) found the value of monitoring social media during public health crises from the practitioner’s standpoint: practitioners who monitored social media were highly satisfied with their past crisis management. Avery proposes the importance of educating practitioners who never use social media to listen to the voice of the public. Despite the importance of monitoring and listening via social media in crises, however, many practitioners in the real world use social media in the same ways they used one-way communication tools rather than taking advantage of the dialogic potential of social media (Grunig, 2009; Macnamara, 2016). In addition, PR scholars have paid little attention to listening or monitoring via social media in issue management and crisis communication (Macnamara, 2016, 2018).

Although previous research has emphasized the importance of issues management and crisis communication, there has been little study of

how social media can be utilized to monitor and listen to the voices of publics in the pre-crisis and ongoing crisis stages. We will explore proactive crisis management strategies using social media by applying the concept of attribution of crisis responsibility and testing negative information transmission in social media.

### 3.3. Theoretical frameworks for applying social media analytics

This study reviews the social-mediated crisis communication (SMCC) model and attribution theory to suggest a theoretical framework of social media analytics from the view of issues and crisis management.

#### 3.3.1. Social-mediated crisis communication model and active-digital publics

Although crisis communication research on social media has increased, not many studies have focused on theory building to better understand dynamic crisis communication in social media (Cheng & Cameron, 2017). The SMCC model depicts how influential social media creators and followers interact with an organizational crisis (Jin et al., 2014) and is useful to understand communicative behaviors of digital publics in social media environments and interactions with an organization in the context of an organizational crisis. In particular, we focus on social media users' communicative behaviors (e.g., posting and retweeting on an organizational crisis) and conceptualize active-digital publics based on their communicative behaviors in social media.

Austin and her colleagues (2012) proposed the SMCC model to understand how individuals and organizations use social media during organizational crises. The model explains dynamic communication between an organization and digital publics before, during, and after an organizational crisis using three types of digital publics during an organizational crisis: *influential social media creators* who create crisis information, *social media followers* who consume crisis information by the creators, and *social media inactives*. The present study pays attention to influential social media creators and social media followers as active-digital publics. Social media allows active-digital publics to be engaged in the process of crisis information creation and diffusion (Wei et al., 2012). Active-digital publics perceive an organizational crisis and respond to it with posting or retweet behaviors in social media. Importantly, communicative behaviors have been used to explain active publics in public relations. For instance, active publics in public relations research refer to a group of people who discuss and do something to solve a problem (Kim & Grunig, 2011). A recently developed social media activism model suggests that posting or retweeting behaviors are essential to predict collective actions of publics (Chon & Park, 2020).

#### 3.3.2. Attributions of crisis responsibility in the early stage of the COVID-19 pandemic

Along with the SMCC model, attribution theory is essential in developing a theoretical framework of social media analytics from the view of issues and crisis management. The revised SMCC model encourages organizations to analyze how different types of crisis affect acceptance of crisis responses (Jin et al., 2014). When it comes to the various communication behaviors of active-digital publics, attribution theory is useful to explain how digital publics attribute crisis responsibility for the COVID-19 pandemic in the U.S. and predict their crisis communication behaviors in the social media environment.

Attribution theory deals with "how the social perceiver uses information to arrive at causal explanations for events. It examines what information is gathered and how it is combined to form a causal judgment" (Fiske & Shelley, 1991, p. 23). This theory assumes that people search for information to make an attribution during a negative and unexpected event (Weiner, 1986). Responsibility attribution can be influenced by one's self-perception to evaluate locus of control about an organizational crisis (Shaver, 2016).

Given the rationale of attribution theory, situational crisis communication theory (SCCT) has been used for decades to develop crisis

response strategies to protect organizational reputation in crises (Coombs, 2007) and as a theoretical frame to explain and predict public response to an organization in a crisis (Coombs, 2016). According to SCCT, the three elements of crisis history, prior reputation, and crisis type influence organizational reputation (Coombs, 2007). When it comes to evaluating reputational threat, public relations practitioners use a two-step process of first determining the crisis type among victim, accidental, and preventable cluster and then modifying the initial assessment based on crisis history and prior reputation (Coombs, 2015).

Managing a crisis effectively is an important component of deciding the level of crisis responsibility. If an organization fails to meet publics' expectations during a crisis, people tend to attribute more responsibility to the organization. High crisis responsibility can seriously damage reputation and trust, which "may sever ties to the organization and/or spread negative word of mouth about the organization" (Coombs, 2007, p. 164). Punitive word of mouth influences others' perception of crisis responsibility (Yum & Jeong, 2014) and social behaviors such as voting and boycotting (Jeong & Lee, 2019). Even though an organization may have had a favorable reputation before the crisis, the diffusion of negative word of mouth (WOM) shifts it into a negative reputation (Coombs, 2007). A negative reputation toward the government is critical during a national crisis because it causes social instability and citizens' noncooperation, which exacerbates a crisis (Zhu, Liu, Kapucu, & Peng, 2020).

Attribution of crisis responsibility is essential to suggest strategic crisis responses for organizations (Coombs, 2007). Previous research has found that each crisis type is useful to predict attributions of crisis responsibility and evaluate the reputational threat of an organization (Coombs & Holladay, 2012). For example, the level of organizational reputation threat can be high in the case of organizational misdeeds (i.e., preventable cluster) because publics highly attribute responsibility for this type of crisis toward an organization, whereas publics are less likely to attribute crisis responsibility to an organization in the case of natural disasters (i.e., victim cluster).

In the first several months after COVID-19 was identified in the U.S., the situation evolved from an external issue (e.g., a threat in China) to an internal crisis for the U.S. which needed to be managed by the federal government. At the beginning of the initial stage of dealing with the COVID-19 pandemic, some people argued that the spread of COVID-19 could have been managed if the Trump administration had shown ability, will, and preparation to control it in advance (i.e., preventable cluster), while others thought the crisis could not be avoided and the Trump administration was also a victim of China (i.e., victim cluster). While the victim cluster does not lead to a high level of crisis responsibility by the organization, the preventable cluster is likely to do so.

Guided by the SMCC model and attribution theory, we explore how the COVID-19 pandemic became a government crisis by using social media analytics. Social media analytics can be used to perform proactive crisis management by understanding dynamic communication with active-digital publics and identifying the attribution of crisis responsibility (i.e., crisis type). We applied social media analytics to trace how U.S. public opinion during the early stage of COVID-19 shifted the responsibility attribution from China to the federal government (i.e., the Trump White House). We pose the following research question:

**RQ1.** How did the COVID-19 crisis (the U.S. as a victim of China) turn into a government crisis (the U.S. government failed to prevent the spread of COVID-19)?

#### 3.3.3. Predicting negative communication behaviors toward the federal government via inability, no response, and emotions

Digging deeper into reasons why people attribute the crisis responsibility for COVID-19 spread to the federal government, this study investigates two factors that explain the attribution of crisis responsibility: inability and lack of response of the federal government to



deal with the COVID-19 crisis.

Previous crisis communication research has found that human-error accidents and organizational misdeeds (i.e., preventable cluster of SCCT) produce very strong attributions of crisis responsibility because people perceive that the organization could control the crisis (Coombs, 2007). However, the literature is less robust in its exploration of the ability of the organization to control the crisis in detail. In this regard, this study conceptualizes inability and no response of the federal government in regard to the COVID-19 pandemic as internal factors and then tests how the factors are associated with the attribution of crisis responsibility. In this context, *inability* indicates that the organization (in this case, the U.S. government) does not have the ability to solve a crisis, while *no response* means that the organization can handle the crisis but does not respond to it.

Accordingly, this study proposes inability and no response to predict citizens' negative engagement and amplification of negative tweets about the spread of COVID-19. The underlying idea of this proposal is that if other, more competent leaders had managed the crisis, the issue could have been solved. In this sense, both inaction and no response imply that the crisis was preventable. Instead, inappropriate actions resulting from internal factors inside the federal government caused the spread of COVID-19. In an experiment study, Buckwalter and Turri (2015) showed that people blame more when an organization has the ability to help but does not (no response). In the COVID-19 context, people might attribute more blame to the Trump White House if they perceive that it could handle the crisis but did not respond to it.

On social media, individuals engage with an issue through various actions such as viewing, liking, sharing, and posting. These social media activities can amplify an issue in cyberspace. In addition, negative contents tend to quickly and rapidly spread on social media (Tsugawa & Ohsaki, 2015). It is valuable to examine how the two factors of inability and no response are associated with the negative communicative actions of publics in the context of the COVID-19 pandemic.

Given the above background, this study explores how people's perceptions about inability and no response are associated with citizens' engagement and amplification of negative tweets about the federal government's crisis management. Thus, we propose the following research question:

**RQ2.** How were the high level of crisis responsibility (HCR) tweets with (a) inability and (b) no response of the federal government about COVID-19 associated with like and retweet actions on Twitter?

We further propose negative emotions as another factor to predict negative communication behaviors toward the federal government. According to attribution theory, responsibility attribution leads to emotions (Weiner, 1986). As people perceive a high level of attribution of crisis responsibility, they are more likely to experience negative emotions (e.g., anger and fear), leading to negative outcomes such as negative reputation (Choi & Lin, 2009). In the social media environment, both information and emotion can be diffused during a crisis (Jin et al., 2011; Wang et al., 2011). With the attribution of crisis responsibility for the spread of COVID-19, we believe citizens' negative emotions can negatively influence government reputation in relation to managing the national pandemic. Previous research has found that negative emotions drive people to engage with a problematic situation (Chon, 2019; Lazarus, 1991; Shin & Han, 2016; Turner, 2007). Lazarus (1991) proposed that all emotions including anger are related to motivational action tendencies, which lead people to change their attitudes and behaviors.

More importantly, negative emotions can drive people to use collective action for activism (Chon & Park, 2019; Turner, 2007). According to the Anger Activism Model (Turner, 2007), for example, angry feelings about the target issue motivate people to engage with a problematic situation. Anger and efficacy together in the Anger Activism Model can be used to identify four distinct groups to predict activism. Among the four groups, angrier people are more likely to engage in

higher-commitment behaviors (Turner, 2007). For example, when it comes to contentious social issues such as gun ownership and immigration, individuals who experience injustice feel a sense of unfairness, subsequently motivating them to be engaged in social media activism and offline activism (Chon & Park, 2019). In the risk communication research, fear and anxiety are known factors that motivate individuals to increase their efforts to obtain protection-related information and communicative behaviors to take and transmit risk information (Chon & Park, 2019; So, Kuang, & Cho, 2019).

Given the theoretical arguments and empirical evidence, this study proposes that people who feel negative emotions regarding the Trump administration's crisis management during the COVID-19 pandemic are more likely to engage with and amplify negative tweets about the federal government. This study posits the following hypothesis:

**H1.** Negative emotions in HCR tweets of the federal government about the COVID-19 crisis were more likely to receive likes and retweets on Twitter.

## 4. Method

### 4.1. Data collection and analysis

The tweets for this research were obtained from Brandwatch. The data time period is from January 20 to June 30, 2020. We started data collection on January 20 because that is the day the first COVID-19 infection in the U.S. was reported. Only tweets created by people in the U.S. were obtained based on their geo-location information. Search keywords were ("covid" OR "corona") AND ("trump" OR "potus" OR "white house" OR "china" OR "xi" OR "wuhan") AND ("because of" OR "due to" OR "owing to" OR "on account of" OR "attributable to" OR "ascrivable to" OR "caused by" OR "as a result of" OR "as a consequence of" OR "by reason of"). POTUS is an acronym for President of the United States.

The keyword sets were intended to gain tweets related to COVID-19, locus of responsibility, and the reasons of attribution. Prepositions of cause (e.g., because of, due to) in the keywords show a reason for happening or being in a sentence. When people attribute the responsibility for COVID-19 with prepositions of cause in a tweet, locus of responsibility (e.g., Trump, China) and attribution reasons (e.g., inability, no response) can be founded if we look at prepositional phrases. The ten cause prepositions in the keyword search (e.g., because of, due to) were based on synonyms of "because of" from the Merriam-Webster Dictionary (<https://www.merriam-webster.com>) and Dictionary.com (<https://www.dictionary.com>). The topic of interest is who is responsible for the COVID-19 crisis, not what the COVID-19 crisis results in, so we filtered out tweets mentioning COVID-19 itself as a cause for something, such as "I cannot exercise at the gym because of COVID-19." A total of 360,861 tweets were used for this study.

### 4.2. Preprocessing to collect data

Using string and reoperations in Python, we did data cleaning such as stemming, removing such as numbers, special characters, and URLs, as well as stopwords. Because stopwords such as conjunctions (e.g., and, but, which) and articles (e.g., the, a, an) do not have meaningful information, removing them is standard procedure for text-mining (Maier et al., 2018). The stopwords list came from the Natural Language Toolkit (NLTK, v. 3.5) in Python.

Additionally, different words indicating Donald Trump (e.g., @realdonaldtrump, POTUS) were transformed into "Trump." Since a computer cannot distinguish between WHO (organization) and who (wh-pronoun) after low capital transformation, we changed WHO into "W.H.O." before low character transformation. Then, we tokenized the sentence into a word and calculated word frequencies in the tweet corpus.

### 4.3. Analysis

#### 4.3.1. Computer-assisted content analysis for COVID-19 attribution tweets in the U.S

RQ1 asks how the COVID-19 crisis (the U.S. as a victim of China) turn into a government crisis (the U.S. government failed to prevent the spread of COVID-19). To answer this question, we used content-analysis and machine-learning to classify tweets into 2 (Government: The U.S. vs. China) by 2 (HCR vs. non-HCR).

First, we classified tweets based on government mentions. For example, if a tweet includes a U.S. government keyword such as Trump or White House, it was classified as U.S. government. For the classification of responsibility level, two human coders conducted content analysis to develop a training data set. The coding rules were that if a tweet mentions one of the two government keywords and attributes responsibility to one of the two governments, it was coded as HCR. The remaining tweets other than HCR tweets were coded as non-HCR. Non-HCR shows unclear attribution, such as supporting one of those two governments, keeping an ambiguous stance, or blaming both governments. Thus, we exclude MCR tweets from our analysis.

To check the intercoder reliability, the two coders labeled a random sample of 500 tweets (Krippendorff's  $\alpha = 0.894$ ). Then, the coders labeled another 1500 random tweets, resulting in a total of 2000 tweets for the training set. Next, we tokenized words and calculated the TF-IDF score as word vectors. We used a random forest classifier from *Scikit-learn*, a machine learning package in Python. The hyperparameters were tuned several times; ultimately, we used five max depth and 10,000 max features.

We compared the random forest output and human coders' labels to check our random forest model performance. One coder hand-labeled 500 randomly selected tweets from the random forest output. Krippendorff's  $\alpha$  was .891, indicating the model's performance is equivalent to that of human coders.

#### 4.3.2. Extraction of attribution text from tweets

We used regular expressions to extract HCR tweets toward the U.S. or Chinese government (RQ1). Regular expressions are a sequence of characters that recur in patterns in text. We developed a regular expression to detect only ten words after cause prepositions. For example, if an original tweet is "A 'Trump Death Clock' was installed in Times Square to track COVID deaths due to Trump's inaction," the word set *due to Trump's inaction* was extracted from the above tweet. Among our 360,861 tweets, 44,726 tweets (12.4%) matched with our regular expressions. Then, a weekly-basis word frequency was calculated to figure out the responsibility locus.

#### 4.3.3. Model estimation with negative binomial regression model, data, and variables

To answer RQ2 (association of HCR tweets and like/retweet) and H1 (association of negative emotion and like/retweet), we constructed two negative binomial regression models (NB models). When dependent variables - like and retweet - are count variables and overdispersion (i.e., variance is larger than mean), it violates the normal distribution assumption of general linear regression (Hilbe, 2011). In this case, NB regression models are recommended (Agresti, 2019).

We used original tweets without retweet contents. The inclusion of retweets results in redundant data by having the same contents with the same number of likes and retweets. Among 44,723 tweets, 6055 tweets (13.5%) were original tweets. The numbers of retweets and likes were obtained through DMI-TCAT refetch (Borra & Rieder, 2014).

The outcome variables are the numbers of likes and retweets per tweet. The predictors are attribution types (i.e., inability, no response) and sentiment score. Because we collected tweets with Trump-based keywords, most tweets blame President Trump, not the overall US government. We used computer-assisted content analysis to code attribution types. After reviewing the tweet text and calculating the most

frequent words, the researchers made a dictionary for the analysis (see Appendix A). From the total of 6055 tweets for the NB analysis, inability (42.2%,  $n = 2555$ ) and no response (25.7%,  $n = 1558$ ) dominated the tweets. Only 5.3% ( $n = 322$ ) were coded as both inability and no response. As a covariate, the number of followers was included in the model after natural log-transformation. Before the log transformation, we added 1 to the number of followers to prevent a negative infinity value since a few Twitter accounts have no followers, meaning their values are zero.

#### 4.3.4. Emotion analysis

We used the Stanford CoreNLP Python package (Manning et al. 2014) to calculate sentiment scores in tweets. Based on a recursive neural tensor network, this sentiment analysis outperforms other analyses (Socher et al., 2013). Because the package labels sentiment per sentence, we chose the most negative score in a tweet as our variable. Though the original value range is from 0 (strongly negative) to 4 (strongly positive), we recorded the value from 0 (non-negative) to 1 (negative) for easy interpretation of negative valence in Twitter users' engagement. The Stanford NLP analysis result shows that it is highly skewed toward negative valence: 84.7% (5126) are negative valence tweets and 15.3% (929) are neutral or positive valence tweets out of the total 6055 tweets. To check inter-coder reliability with a human, we asked a coder to label 200 randomly selected tweets and compared them with the CoreNLP result. Krippendorff's  $\alpha$  was .670 with 85% accuracy.

## 5. Results

### 5.1. RQ1. Attribution of the crisis responsibility of COVID-19 crisis spread in the U.S

Among a total of 44,723 tweets mentioning the U.S. government, there were 43,172 (96.5%) HCR tweets and 1551 (3.5%) non-HCR tweets. The number of tweets mentioning China was 4353. Among these, there were 3864 (88.8%) HCR tweets and 489 (11.2%) non-HCR tweets. As our study interest is in high crisis attribution, we excluded non-HCR tweets from our analysis. Fig. 3 shows weekly aggregated HCR tweets toward the U.S. government and China.

To examine the monthly frequency difference between the U.S. HCR tweets and the China HCR tweets, we used the Chi-square test. The results showed a significant difference in HCR between the U.S. government and the Chinese government,  $\chi^2(5, n = 47,036) = 5873.32, p < .001$ . Because the number of HCR tweets seems similar from January to March compared to the later period (from April to June), we conducted post-hoc analysis with the Bonferroni method. The results showed that HCR tweets toward the Chinese government were more prevalent than toward the U.S. government in January and February, residuals = 8.23  $p < .001$ ; residuals = 19.81,  $p < .001$ , respectively. However, in March, the number of HCR tweets toward the U.S. government was higher than toward the Chinese government, residuals = 21.89,  $p < .001$ .

### 5.2. RQ2 & H1. Predicting blame for COVID-19 spread and amplification via negative emotions toward the federal government

Table 1 shows the results of the negative binomial regression models on the number of likes and shares of HCR tweets toward the Trump White House. As the link function of the NB regression is log, the coefficient interpretation needs exponential transformation.

RQ2 asked if HCR tweets with internal factors (i.e., inability and no response) of the Trump administration are related to increased numbers of likes and retweets. Inability content was positively associated with likes ( $\beta = .580, p < .001$ ) and retweets ( $\beta = .304, p < .001$ ). That is, when tweets mentioned the incompetence of the Trump administration, other Twitter users were more likely to like and retweet the contents, adjusting for the number of followers. Specifically, inability content

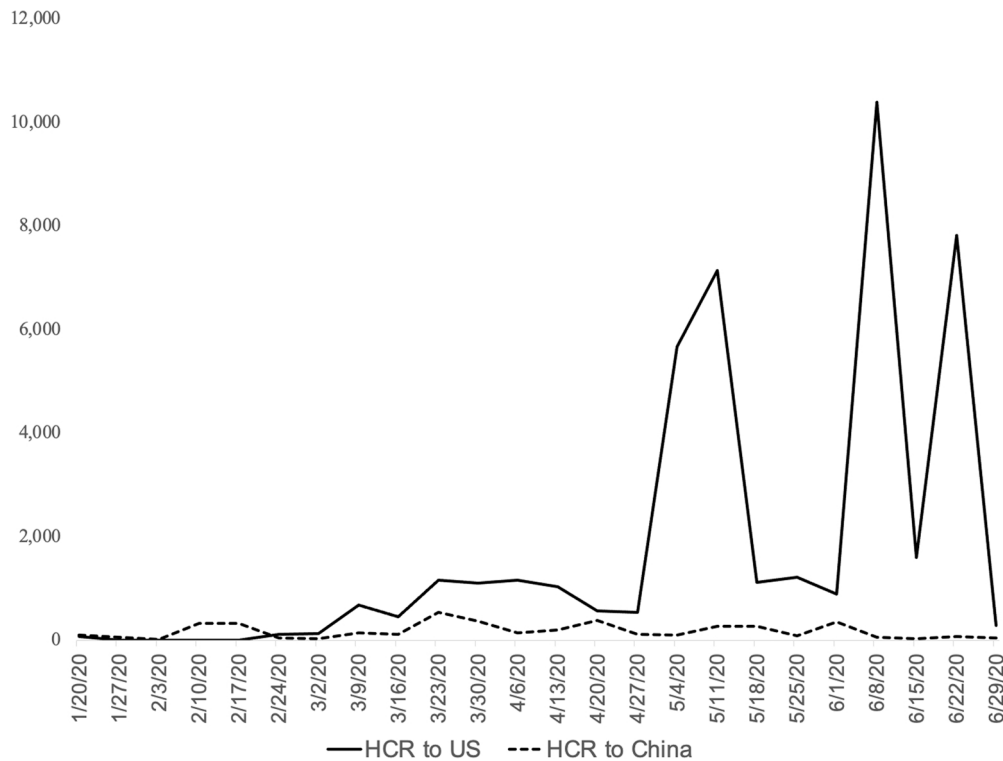


Fig. 3. COVID-19 crisis attribution of high crisis responsibility to U.S. and China.

**Table 1**  
HCR\* tweets to predict engagement and amplification of like and retweet.

	Like		Retweet	
	IRR	SE	IRR	SE
(Intercept)	-3.680***	0.066	-7.215***	0.111
Content				
Inability	0.580***	0.034	0.304***	0.047
No response	-0.058	0.040	0.349***	0.056
Negative sentiment	0.643***	0.047	0.631***	0.065
Followers (Log)	0.639***	0.006	0.882***	0.010
McFadden's Pseudo R <sup>2</sup>	0.451		0.608	

**Note.**  $n = 6055$ , Negative binomial regression was used because engagements (like, retweet) are overspersed. Sentiment analysis was conducted by Stanford CoreNLP package. We changed the sentiment range as 0 (non-negative) and 1 (negative). Originally, the range is from 0 to 4 (2: neutral). \*HCR means the high level of crisis responsibility on the COVID-19 spread. IRR: Incident rate ratio. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (two-tail).

resulted in a 78.6% increase in the number of likes and a 35.5% increase in the number of retweets. No response content had a significant positive association with retweets ( $\beta = .349, p < [TS 0.001$ but it did not have a significant association with likes. If a tweet talked about no response aspects of the Trump government’s handling of the pandemic, it got 41.8% more retweets than otherwise. Consequently, inability was shown to be a significant factor to increase the numbers of both likes and retweets, whereas no response was only significant to increase the number of retweets.

H1 proposed that tweets with negative sentiment about the Trump White House’s crisis management of the pandemic were more likely to obtain likes and retweets than those with positive or neutral sentiment. The results showed that negative valence was positively associated with likes ( $\beta = .643, p < [TS 0.001$ nd retweets ( $\beta = .631, p < [TS 0.001$ Negative tweets led to a 90.2% increase in the number of likes and an 87.9% increase in the number of retweets compared to non-negative tweets. These results support H1.

## 6. Discussion

This study aimed to propose a theoretical framework to show how social media analytics can be used to listen to the voices of citizens and evaluate how issues become crises based on two theoretical frameworks: the SMCC model and attribution theory. In the context of government crisis management to deal with the spread of COVID-19, the results of this study indicate that the COVID-19 situation evolved from an issue to a crisis of the federal government because Americans attributed crisis responsibility for the spread of COVID-19 to poor crisis management by the federal government. The results also show that inability and no response by the federal government contribute to amplifying the diffusion of Twitter content. Finally, negative emotions also caused people to tweet and retweet during the public health crisis.

### 6.1. Theoretical implications

Using representative Twitter data in the U.S., this study applied attribution theory to investigate how social media analytics can be used to monitor and analyze Twitter data about issues and crisis management of the federal government in the context of the COVID-19 pandemic. The theoretically derived analytical framework contributes to crisis communication theories and extends it to social media use in the public sector from the view of issues and crisis management. Although the SMCC model and attribution theory have been widely used in crisis communication, they have not been applied to social media analytics using a computational social science approach.

While the SMCC model has been used to understand dynamic communication between an organization and its publics in social media environment, little research has shown how active-digital publics in social media attribute crisis responsibility and amplify negative opinions. Most studies that have applied theories of attribution theory (i.e., SCCT) in crisis communication have conducted content analysis in social media by human-aided method of ongoing crisis. However, the present study utilized social media analytics to analyze 360,861 tweets in the pre-crisis and during crisis contexts. That is, this study applies a practical

methodology to monitor (potential) crises and suggests data classification using responsibility prepositions (e.g., because of) and sentiment analysis (e.g., emotion) with machine learning, computer-assisted content analysis for crisis texts, and statistical models to predict the diffusion of crisis contents on social media.

Particularly, this study contributes to the literature by predicting how citizens engage with negative tweets and goes one step further to explore how they amplify negative tweets. This process explains why and how active-digital publics attribute crisis responsibility for the COVID-19 pandemic toward the federal government by finding specific leading factors. Given the theoretical framework of attribution theory, we conceptualized inability and no response of the federal government in managing the crisis of the spread of COVID-19 as aspects to predict citizens' engagement and amplification of negative tweets toward the federal government. When citizens perceived the federal government's inability and lack of response in its crisis management, they were more likely to amplify negative tweets about the federal government by retweeting.

More importantly, we used negative emotions to predict citizens' engagement with negative tweets and retweets. We found negative emotions to be highly associated with retweets. According to previous studies, negative emotions lead to social activism of individuals to solve a given problem (Chon & Park, 2019; Turner, 2007). In terms of government public relations, the implication of this study about activism is significant because it is possible that social media activism on contentious issues can result in offline activism (Chon & Park, 2019).

The results show that tweets attributing high crisis responsibility to the federal government dominated Twitter. In this case, the appropriate reputation-repair strategy, according to SCCT, is to use a rebuild strategy (e.g., apology) and provide physically and psychologically helpful information to publics (Coombs, 2017). However, President Trump mainly used a denial strategy. For example, he denied responsibility for the pandemic, such as by saying that "I think we've done a great job" (Collinson, 2020), and engaged in scapegoating by blaming others such as governors, the media, and China (Phillips, 2020). The president also delivered false claims and rumors about the coronavirus (Anti-disinformation unit, 2020).

## 6.2. Practical implications

This study offers a practical methodology for applying academic knowledge to PR practices. The theory-grounded frameworks contribute to decreasing the gap between PR academia and practitioners. Scholarly works have long been criticized for their limited usefulness to professional practice (Kieser, Nicolai, & Seidl, 2015). In in-depth interviews, PR practitioners have pointed out that "most [crisis communication] theories are too abstract and difficult to translate to actual crisis situations with which they are confronted" (Claeys & Opgenhaffen, 2016, p. 242). The current study translates crisis communication scholars' knowledge to practice. Specifically, we show that crisis communication theories (i.e., SMCC model and attribution theory) are useful to build issue and crisis monitoring frameworks in social media.

In addition, we utilized data collection with cause prepositions (e.g., because of) and machine learning to classify contents based on level of attribution of crisis responsibility, emotion analysis with the Python package (i.e., Stanford CoreNLP), and statistical modeling to predict the diffusion of crisis contents on social media.

Our frameworks can help practitioners save time and resources in monitoring and analyzing social texts during a crisis. We found that cause prepositions are an efficient way to filter out HCR attribution contents from a huge amount of user-generated content in social media. The relatively small data will reduce the practitioners' burden from

data-cleaning, analyzing, and summarizing unstructured text data, which would help in the formulation of timely crisis response strategies based on analytical evidence. Efficiency is especially useful when a crisis does not end in the early stages because the amount of content increases exponentially as a crisis spreads nationally.

More importantly, the results of this study suggest a proactive social media strategy for issues and crisis management. Using social media strategies in the theoretical framework proposed by this study, public relations practitioners in government can listen to or monitor the voices of citizens about issues and crisis management. For public relations practitioners, a proactive social media strategy for issues management is efficient in that the focus of attribution theory is to find the link between crisis-triggering actors and the cause. To proactively cope with a turbulent and complex environment, public relations managers should be vigilant about monitoring issues related to their organizations from the viewpoint of strategic management of public relations (Grunig et al., 2002).

Although this study examined social media, its results provide a potential framework for predicting offline opinions through social media for issues and crisis management. In fact, the comparison of our analytical approach and real opinion polling data exhibits statistically significant correlations. To compare the time-series trend of attribution tweets and traditional opinion polls, we collected 104 poll data about disapproval of President Trump's handling of the COVID-19 pandemic from RealClearPolitics and FiveThirtyEight. These two websites collect polls from survey companies and mass media such as Gallup, CNN, and Reuters. Here, we only focused on HCR tweets and disapproval ratings toward the Trump White House response to COVID-19 to compare negative tweets and disapproval ratings. If it is possible to control variables to test the correlation between social media opinions and offline survey results, our analytical strategy would be useful to monitor daily online opinion by helping practitioners perceive crisis risk quickly with less human and computational resources. Quick detection of issues in social media has become more important to prevent real crisis (Coombs & Holladay, 2012). This study does not argue that social media analytics will replace survey polls. Instead, they can be used as complementary methods to figure out the overall opinion trend in real time by listening to the voices of real people. Though we conducted a case study of a public health crisis, we encourage researchers to verify the relation between HCR attribution postings and survey polls in other contexts.

## 7. Limitations and future research

There are several limitations that should be addressed in future research. First, the sample of tweets used in this study do not represent the entire population of tweets about responsibility attribution, and they were not controlled by factors (e.g., partisanship) that can cause potential bias. Second, this study applied its analytical framework to only one issue, the U.S. pandemic crisis. To verify its usefulness, this framework should be applied to other crisis issues. Third, we did not consider the federal government's crisis response strategies to deal with the crisis. Future research on the time-series dynamics between the attribution of crisis responsibility toward an organization and the organization's response strategies will provide additional insights. It would also be advisable to test crisis principles such as Spontaneity, Accessibility, Coherency, and Accountability. Finally, the proposed theoretical framework needs to be applied to other issues or crises in the private sector. As corporations face many issues related to activism (e.g., environmental activism and political activism), the current framework using social media analytics can be effectively used to monitor and analyze social media about ongoing problems related to various issues and crisis management.



## Appendix A. Dictionary of inability and no response for computer-assisted content analysis

	Dictionary words
Inability (42.2%)	attention OR bluster OR bungl OR claim OR competence OR corruption OR decision OR disinfectant OR egomania OR elimina OR fail OR fiasco OR handl OR hyp OR inability OR incompet OR inept OR leadership OR lie OR mismanag OR misuse OR mouth OR noise OR obsession OR pimp OR polic OR rally OR reckless OR response OR science OR sin OR stupid
No	abdication OR bumble OR carelessness OR cut OR danger OR deceit OR delay OR denial OR deny OR derelict OR dismiss OR dither OR fumble OR halt OR ignor OR
Response (25.7%)	inaction OR indiffer OR interest OR irrespons OR kit OR lack of action OR mask OR neglig OR not act OR not taking OR plan OR ppe OR refusal OR seriousness OR slack OR OR test withdraw

**Note.** Some words were truncated to catch words with the same root word. For example, bungl can capture bungle and bungling. The number of contents coded as both inaction and no responsibility were 5.3%.

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