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# Self-protection by fact-checking: How pandemic information seeking and verifying affect preventive behaviours

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## Abstract

The COVID-19 pandemic has witnessed the proliferation of a plethora of (mis)information on various media platforms and inconsistent crisis instructions from different sources. People consume crisis information from multiple channels and sources to better understand the situation and fact-check COVID-19 information. This study elucidates how Americans determine their preventive behaviours based on their information seeking and verifying behaviours during the pandemic. Our results were based on a US nationally representative sample (N = 856), and showed that proactive preventive behaviours (e.g., washing hands frequently) were positively affected by information-seeking through interpersonal channels, news media, and the government, whereas avoidance preventive behaviours (e.g., avoiding social gatherings) were only positively affected by information-seeking through news media. Crisis information verifying had positive effects on all types of preventive behaviours. Crisis managers are recommended to reach out to the public using appropriate channels and sources and facilitate individual's ability and motivation in verifying pandemic information.

**KEYWORDS**
crisis, information seeking, information verifying, perceived risk, preventive behaviours

## 1 | INTRODUCTION

By November 2020, the coronavirus disease 2019 (COVID-19) pandemic has spread to over 200 countries and infected more than 62 million people worldwide (Worldometer, 2020). In this ongoing pandemic, more people are using different kinds of media to monitor the volatile situation and look for crucial information regarding governmental responses and practical guidance from health organizations (Pew Research Center, 2020). A global survey conducted in March showed that 67% of the respondents watched more news, 45% spent longer time on messaging services (e.g., WhatsApp), and 44% spent more time on social media (GlobalWebIndex, 2020). Alongside the surge in the public's informational needs, false information about the pandemic began circulating profusely on digital platforms, such as Reddit and Twitter (Cuan-Baltazar et al., 2020; Rosenberg et al., 2020). According to the World Health Organization

(2020a), the pandemic is also an "infodemic" due to the pervasiveness of misinformation and unverified information. The conflicting information and false claims result in uncertainty, confusion, or even counterproductive preventive actions among the public (Gallup/ Knight Foundation, 2020). Thus, understanding the nuances and implications of crisis information consumption has never been so urgent and important.

The complex and dynamic informational landscape is not unique to the COVID-19 pandemic. The crisis, risk, and health communication literature has recorded how organizations and individuals perceive risks and engage in informational behaviours during crises (e.g., Liu et al., 2016; Seo, 2019; Sutton et al., 2018). One line of studies regarding the social-mediated crisis communication (SMCC) model focuses on the antecedents and outcomes of information seeking and sharing (Austin et al., 2012; Fraustino & Liu, 2017; Liu et al., 2019; Zhao, Zhan, & Liu, 2018). Another line of research in risk and health

communication deals with the change in preventive behaviours during infectious disease outbreaks and how the behavioural shift can be facilitated by media use and socio-psychological factors such as channel-related beliefs (Dunwoody & Griffin, 2013; Oh et al., 2020; Ophir & Jamieson, 2020). There has also been growing interest regarding the cognitive processing of misinformation and its correction in public health crises (Bode & Vraga, 2018; Krause et al., 2020; Lu & Jin, 2020; van der meer & Jin, 2020).

This study contributes to the thriving literature in two important ways. First, the crisis communication scholarship focuses more on information dissemination and its nuances that are conditioned by information sources and forms (e.g., SMCC; Liu et al., 2019). Yet, there has been insufficient knowledge of how people's verification of the sought information (Lu & Jin, 2020) affects their preventive behaviours during crises. Our study considers information seeking and verifying as two important dimensions of information consumption and examines both dimensions' effects on preventive behaviours in a pandemic. This enables us to achieve a more holistic understanding of the nuances and outcomes of crisis information consumption. Second, there has been a paucity of crisis communication research on the socio-psychological mechanisms (e.g., anxiety) underlying the relationships between information consumption and preventive behaviours. Extending the Social Amplification of Risk Framework (SARF; Kasperson & Kasperson, 1996; Pidgeon et al., 2003), our study also tested the mechanisms accounting for the relationships between information seeking and verifying and health behaviours.

To understand how crisis information seeking and verifying are associated with preventive behaviours, we relied on survey data based on a U.S. nationally representative sample (N = 856) during the COVID-19 pandemic. Our results can help crisis managers and public health officers navigate the complex information environment during a pandemic and benefit from a more nuanced understanding of various facets of information consumption and their implications for facilitating preventive behaviours in public health crises.

## 1.1 | COVID-19 pandemic background

After the first case of COVID-19 was identified in Wuhan, China (WHO, 2020b), the outbreak dramatically escalated. On March 11, 2020, COVID-19 was officially declared a pandemic (WHO, 2020c). The United States was one of the countries hit hardest by the pandemic, with over 13 million cases by November 2020.

The US government and health agencies only started to respond to the pandemic in March, which gave rise to a flood of criticisms regarding the delayed and muffed pandemic response of the Trump administration (Lipton et al., 2020; Yamey & Gonsalves, 2020). On various occasions, Trump downplayed the threat of COVID-19 and called the criticisms a "hoax" in February during a rally (Garrett, 2020). There have also been inconsistent or even contradictory health guidelines across different sources, such as Trump and the Centers for Disease Control and Prevention (Kim & Kreps, 2020; Yamey & Gonsalves, 2020). The slow, insufficient and inconsistent communication across various government agencies has resulted in confusion among the people regarding the actual risks (Wise et al., 2020) and uncertainties in relation to the appropriate preventive actions. This study examined how people consumed and reacted to COVID-19 information from different sources and channels in April 2020.

## 2 | CRISIS INFORMATION CONSUMPTION AND HEALTH BEHAVIOURS

A pandemic features enormously high uncertainty and anxiety (Garrett, 2020). This is mainly because of the lack of scientific consensus and accurate information regarding the route of transmission, clinical symptoms and effective treatment at the start of the pandemic (Reynolds & Seeger, 2005). To cope with a novel threat, individuals are urged to learn more about the associated risks and potential preventive measures through a multitude of channels and sources (Anthony et al., 2013; Moreno et al., 2020), particularly on digital platforms (Fraustino et al., 2017). The abundance of health information made possible by ever-changing technologies can help the public stay abreast of the developing situation (Fraustino et al., 2017), keep them informed about the latest medical findings and practical guidance (Oh et al., 2020), and mobilize individuals and groups to coordinate relief efforts (Reuter & Kaufhold, 2018).

However, the health information environment in a pandemic is often populated with biased information, false claims or even conspiracy thinking (Bode & Vraga, 2018), which bias people's pandemic-related beliefs (Kata, 2010; Vraga & Bode, 2017) and impede their adoption of effective actions (Tan et al., 2015). The prevalence of inconsistent or even false messages circulating can prompt individuals to perform fact-checking (Krause et al., 2020), which is required to determine the veracity of the coronavirus-related claims in this case. It is crucial to understand how individuals act upon information verification, as the public may perceive misinformation differently from the consensus among experts and health authorities (e.g., WHO; Vraga & Bode, 2020). Thus, their information processing and verification may have different behavioural implications.

Previous studies suggest that information seeking through different channels and sources is positively associated with preventive behaviours during crises (e.g., Liu, 2020; Liu et al., 2019). Yet, it is still unknown how people's information verifying affects their preventive behaviours. According to Kim et al. (2020), people's exposure to COVID-19 misinformation reduces the perceived information insufficiency and leads to information avoidance. We argue that the individual conduct of fact-checking can play a key role in predicting preventive behaviours, in addition to traditional information-seeking behaviours. To understand how preventive behaviours can be affected by information seeking and verifying, we introduce the SMCC model and extend it based on the misinformation correction literature below.

## 2.1 | Social-mediated crisis communication model

In the public health context, an infectious disease crisis/outbreak occurs when a disease quickly spreads between people in a region. An outbreak, if not well controlled, turns into a pandemic when a new virus spreads all over the world (WHO, 2010). In public health crises, governmental agencies are expected to handle the unpredictable incident that poses significant and widespread risks to the public.

The SMCC model provides theoretical explanations and predictions regarding people's information seeking and sharing and their subsequent preventive behaviours in crises (e.g., Vijaykumar et al., 2015). The SMCC mainly discusses three factors affecting people's information dissemination and preventive behaviours, including the following: (1) information forms/channels (e.g., social media, offline interpersonal communication); (2) information sources (e.g., the organization responsible for handling a crisis, a third party); and (3) types of social media publics (i.e., influential social media creators, social media followers, inactives) (e.g., Austin et al., 2012; Jin et al., 2016; Liu et al., 2016; Zhao, Zhan, & Liu, 2018).

The original SMCC studies emphasize crisis information seeking and sharing as two distinct constructs of information dissemination (e.g., Lee & Jin, 2019). Yet, the relationship between crisis information verifying and preventive behaviours has not been well understood (Lu & Jin, 2020). This study examines both information seeking and sharing as effective information consumption strategies for reducing uncertainty in a complex information environment (Bode & Vraga, 2018; Lu & Jin, 2020). Crisis information seeking through various platforms and sources can mitigate information insufficiency (Griffin et al., 1999) by providing a repertoire of potentially useful information. Crisis information verifying allows individuals to evaluate information quality, increase response efficacy, and perform appropriate preventive actions by comparing the consistency of information from different channels and sources (Anthony et al., 2013). The following sections discuss crisis information seeking and verifying in a pandemic.

## 2.2 | Crisis information seeking through different channels

The two primary information channels during a pandemic are social media and interpersonal communication. Recent crisis communication research has revealed the significance of social media in information seeking (Fraustino et al., 2017). Social media provide timely, unfiltered and personally relevant crisis information (Fraustino et al., 2017) to help people interpret their risks (Chong & Choy, 2018). However, some scholars argue that individuals may delay their protective actions because they engage in prolonged information seeking and evaluation processes to fully understand the terse information they encounter in social media (Liu et al., 2016). Indeed, there has been inconsistent evidence for how social media information seeking affects preventive behaviours in crises (e.g., Liu et al., 2019; Oh et al., 2020). This inconsistency may be explained by the

motivation of social media use and the urgency to decide preventive actions in a certain crisis. During imminent threat crises, such as tornados, people have to make an immediate decision following the initial warning. In this case, information seeking through social media fulfills their immediate information needs and facilitates timely actions (Liu et al., 2019). Nevertheless, people who perceive lower levels of involvement may delay their protective actions (Jin et al., 2016) when they continue seeking information on social media.

During the COVID-19 pandemic, social media information seeking is anticipated to dampen preventive behaviours. This is because there has been widespread misinformation, disinformation and conspiracy theories surrounding the coronavirus (Nguyen & Catalan, 2020). As a result, people's perceived risks and needs for preventive actions can vary to a large extent, particularly considering the political implications of the pandemic. On one hand, the Trump administration and the Republican party kept downplaying the threat of the pandemic (Halon, 2020), driving the conservatives to perform less preventive behaviours. By contrast, the Democratic party took the pandemic and preventive measures seriously, trying to prompt liberals to be more alert and adopt more preventive behaviours, such as mask-wearing (Kessel & Quinn, 2020). Given that social media platforms (e.g., Twitter) were fuelled with President Trump's statements during the pandemic (Jang et al., 2020), we expect voices downplaying the pandemic to have an upper hand and, in turn, lead to a negative relationship between social media information seeking and preventive behaviours during the COVID-19 pandemic.

On the other hand, information seeking through interpersonal channels is foreseen to incite preventive behaviours (Liu et al., 2016, 2019; Stephens et al., 2013). Two rationales can account for such an expectation. One is that the information exchanged through interpersonal channels can be more personalized and convincing (Dutta-Bergman, 2004). When personal contacts share COVID-19-related information, people might take it more seriously and stay away from possible avenues of contracting the virus. Another aspect is that interpersonal communication features a higher level of media richness, including more vividness and attachment, which can assist people in interpreting the urgency and the risks associated with the pandemic more easily. Based on the discussion, we propose the first two hypotheses:

H1: Social media information seeking negatively affects preventive behaviours during the pandemic.

H2: Interpersonal information seeking positively affects preventive behaviours during the pandemic.

## 2.3 | Crisis information seeking through different sources

Two major information sources are news media and government agencies. Numerous studies have revealed the vital role of news media in shaping people's risk perceptions and preventive behaviours in public health crises (Chan et al., 2018; Ophir & Jamieson, 2020;

Seo, 2019; Zhang et al., 2015). During a crisis, news media constitute the primary gateway for people to seek information and knowledge about a hazard (Reynolds & Seeger, 2005; Zhao, Zhan, & Wong, 2018). Many consider news media as the most credible sources of crisis information (Jang & Baek, 2019; Utz et al., 2013), probably because journalists as gatekeepers filter out unverified sources or incredible information in their coverage. During the COVID-19 pandemic, 59% of Americans believed that news media provided them with useful coronavirus information (Pew Research Center, 2020). COVID-19 information seeking through online news media was found to be positively associated with preventive behaviours among the Chinese (Liu, 2020). Therefore, we anticipate COVID-19 information seeking online to positively predict preventive intentions.

Government agencies and organizations, such as the CDC or WHO, have used social media for pandemic preparation, rapid information sharing and public education (Spence et al., 2015). Individuals typically seek information about imminent threats from governmental agencies (Sjöberg, 2018; Sutton et al., 2018). During public health crises, people typically perceive official sources (e.g., the CDC) as more credible than unofficial sources and rely more on official sources for decision-making (Austin et al., 2012). Yet, during the COVID-19 pandemic, local, national and international agencies have provided inconsistent or even inaccurate information (Kim & Kreps, 2020), which could impede individuals' preventive behaviours. For example, in March 2020, the CDC recommended that people "wear a facemask if you are sick" (CDC, 2020b, March 14). In April, the CDC advised individuals to "cover your mouth and nose with a cloth face cover when around others" (CDC, 2020a, April 13). Given the fluidity of the situation and the shift in recommendations, laymen may be confused about whether and when they should use masks. As such, there may be a weak positive association between information seeking through government (i.e., health agencies) and preventive behaviours. Based on the discussion, we propose the following two hypotheses:

H3: News media information seeking positively affects preventive behaviours during the pandemic.

H4: Government information seeking positively affects preventive behaviours during the pandemic.

## 2.4 | Crisis information verification

There has been growing scholarly interest regarding misinformation and its correction (Bode & Vraga, 2018; Krause et al., 2020; Tan et al., 2015), especially in public health crises. Misinformation in a pandemic typically involves health-related false claims on the virus' origin, outbreak development, preventive measures, and treatment options. The COVID-19 pandemic saw a vast amount of misinformation, especially on social media platforms such as Twitter (Cuan-Baltazar et al., 2020; Rosenberg et al., 2020). Brennen et al. (2020) found that the number of English fact-checks rose more than 900% from January to March 2020.

An emerging direction in SMCC is how people process or verify crisis information before information transmission (Lu & Jin, 2020; van der meer & Jin, 2020). In an infectious disease outbreak that is characterized by high risk and uncertainty, people need to verify the sought information to determine its accuracy and believability for guidance on preventive behaviours to be adopted (Bode & Vraga, 2018; Vraga & Bode, 2017). According to Mileti & Sorensen (1990), during disasters, at-risk individuals engage in a sequential cognitive process involving *understanding, believing, and personalizing* before *deciding* on the appropriate action. In this evaluative process, at-risk individuals engage in information seeking, sharing, and verifying to make sense of the situation and decide the protective actions to be carried out. Lu and Jin (2020) defined crisis information vetting as a way to cognitively process information and assess the quality of crisis information. They further discussed two layers of information vetting: information verifying (i.e., fact-check or confirm the accuracy of the information) and attitude formation (i.e., forming an attitude toward a threat by evaluating the content quality). Given that actual confirmation of the accuracy of the information can be difficult, particularly during the coronavirus pandemic, this study only focuses on the individual act of information verifying rather than on whether people were able to debunk false claims on their own successfully. To understand whether and how crisis information verifying affects preventive behaviour, we propose the following research question:

RQ1: How does crisis information verifying affect preventive behaviours during the pandemic?

## 3 | MECHANISMS UNDERLYING BEHAVIOURAL OUTCOMES OF INFORMATION SEEKING AND VERIFYING

A number of crisis communication scholars have called for more research regarding the socio-psychological mechanisms of individuals' behaviours in crises (e.g., Jin et al., 2016; Liu & Viens, 2020). To better understand how information consumption affects preventive behaviours through cognitive and affective aspects of risk, we discuss the different aspects of risk and the SARF below.

## 3.1 | Cognitive and affective aspects of risk

Risk has cognitive and affective aspects (Slovic et al., 2004; Terpstra, 2011). On one hand, risk perceptions include perceived susceptibility and severity. In an infectious disease outbreak, perceived susceptibility refers to the likelihood to be infected by the virus and perceived severity refers to how severe the consequences of the infection are (Turner et al., 2006). On the other hand, the risk-as-feeling hypothesis (Slovic et al., 2004, 2005) suggests that negative effects, such as anxiety, help individuals evaluate and respond to risk information rapidly and automatically. Both cognitive and affective aspects of risk affect individuals' preventive behaviours in crises (e.g., Terpstra, 2011).

## 3.2 | Social amplification of risk framework

According to the SARF (Kasperson & Kasperson, 1996; Kasperson et al., 1988; Pidgeon et al., 2003), a threat can interact with social, psychological, and societal processes to amplify or attenuate people's risk evaluations. Risk information can be filtered through various social (e.g., government agencies) and individual (e.g., risk heuristics or prior attitude) amplification stations during transmission. These amplification stations shape the amount and salient aspects of the risk information and alter individuals' risk perceptions.

## 3.3 | Communication channels and sources as amplification stations

Different communication channels and sources can be understood as social amplification stations (Vijaykumar et al., 2015). Recent studies have revealed the prominent role of social media (Choi et al., 2017; Chong & Choy, 2018) and news media (Pidgeon et al., 2003; Shih et al., 2008) in amplifying the perceived risk. For example, social media use amplifies negative emotions, such as fear (Chong & Choy, 2018) and perceived susceptibility (on a collective level; Choi et al., 2017), which stimulates preventive behaviours during crises (e.g., Oh et al., 2020). However, most studies have only examined the consequences of information consumption without considering the complementary use of different channels or sources (cf. Seo, 2019).

People typically use as many available channels and sources as possible for uncertainty reduction in a crisis (Anthony et al., 2013; Liu et al., 2015). For example, during the MERS crisis, the Korean government withheld key information regarding the list of hospitals affected by MERS, which incited people to turn to social media for information (Seo, 2019). As such, it is crucial to examine the roles of all relevant channels and sources of crisis information in affecting preventive behaviours in a pandemic. In addition, there has been limited evidence regarding the interrelationships between perceived susceptibility, severity, and anxiety as mediators of the association between information seeking and verifying and preventive behaviours. To better understand how crisis information seeking through different channels and sources affects preventive behaviours through susceptibility, severity, and anxiety, we ask the last research question:

RQ2: How do crisis information seeking and verifying affect preventive behaviours through susceptibility, severity, and anxiety?

## 4 | METHOD

An online panel of survey data hosted and distributed by Qualtrics was collected from April 21–26, 2020 amid the exacerbation of the COVID-19 pandemic in the United States. The panel consisted of a nationally representative (in terms of age, gender, and education) sample of the US population above 18 years old based on quota sampling. As the number of recruited females aged 65 or above and hold less than a high school degree was not sufficient, the quota for less than a high school degree was reduced to 6% from 13% and distributed equally across the other education groups. The final sample size was 856, among whom 441 were females (51.5%) aged 18 to 86 years ($M = 46.42$, $SD = 17.29$). Meanwhile, about 37% had high school or lower education levels, 52% had partial or full college education, and the remainder had a graduate degree. The average household income reported by the sample was between $50,001 to $60,000.

### 4.1 | Measurement

We found that most variables assessed by multiple items were unidimensional, except for preventive behaviours. The means and standard deviations of all variables are reported below. For the multidimensional construct, the summary scores of each identified factor are included. Table 1 reports the summary statistics and the correlation matrix of all constructs.

### 4.1.1 | Crisis information seeking by channels and sources

As adapted from the SMCC literature (Jin et al., 2016; Lee & Jin, 2019), four sets of questions were asked to gauge the subjects' tendency to seek COVID-19 information from different channels and sources on a 7-point scale ranging from 1 "strongly disagree" to 7 "strongly agree." That is, the subjects indicated the extent to which they would look for COVID-19 information from (1) social media, namely Facebook, Instagram, Twitter, TikTok, and Snapchat ($M = 2.60$, $SD = 2.09$, Cronbach's $\alpha = .84$); (2) interpersonal channels, namely family, friends, and coworkers ($M = 4.19$, $SD = 1.95$, Cronbach's $\alpha = .84$); (3) news media, including national news media and local news media ($M = 5.14$, $SD = 1.83$, Cronbach's $\alpha = .75$); and (4) government agencies, including the Centers for Disease Control and Prevention (CDC), World Health Organization (WHO), and National Institute of Health (NIH) ($M = 3.89$, $SD = 2.11$, Cronbach's $\alpha = .88$).

### 4.2 | Crisis information verifying

This study asked the respondents to indicate how often they fact-checked COVID-19 information and news by "searching for more details about a topic and evaluating the sources providing the information" (Bartolomeo, 2020), including "searching on search engines," "browsing official websites of governmental/health agencies," "reading the news," and "visiting fact-checking sites" on a 7-point scale ranging from 1 "never" to 7 "frequently." The mean of information verifying was 4.03 ($SD = 2.13$, Cronbach's $\alpha = .87$).

**TABLE 1** Summary statistics and correlation matrix of all constructs

| | M | SD | Pearson correlations | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| (1) Age | 46.42 | 17.29 | 1.00 | | | | | | | | | | | | | | | |
| (2) Gender | 1.52 | 0.50 | 0.61* | 1.00 | | | | | | | | | | | | | | |
| (3) Education | 2.06 | 1.01 | -0.16* | -0.30* | 1.00 | | | | | | | | | | | | | |
| (4) Income Level | 5.73 | 3.33 | -0.11** | -0.18* | 0.51* | 1.00 | | | | | | | | | | | | |
| (5) Involvement | 6.02 | 1.60 | 0.19* | 0.17* | 0.04 | 0.01 | 1.00 | | | | | | | | | | | |
| (6) Political Orientation | 4.02 | 1.73 | 0.12* | 0.09*** | -0.09** | -0.01 | -0.11** | 1.00 | | | | | | | | | | |
| (7) Social Media Info Seek | 2.57 | 1.77 | -0.48* | -0.44* | 0.39* | 0.27* | 0.02 | -0.11** | 1.00 | | | | | | | | | |
| (8) Interpersonal Info Seek | 4.19 | 1.80 | -0.18* | -0.14* | 0.19* | 0.21* | 0.12* | -0.03 | 0.49* | 1.00 | | | | | | | | |
| (9) News Media Info Seek | 5.14 | 1.64 | 0.13* | 0.05 | 0.11** | 0.11** | 0.26* | -0.11** | 0.23* | 0.37* | 1.00 | | | | | | | |
| (10) Government Info Seek | 3.89 | 1.90 | -0.27* | -0.25* | 0.37* | 0.25* | 0.13* | -0.19* | 0.52* | 0.42* | 0.34* | 1.00 | | | | | | |
| (11) Information Verifying | 4.07 | 1.83 | -0.31* | -0.28* | 0.29* | 0.25* | 0.11** | -0.13* | 0.51* | 0.49* | 0.32* | 0.61* | 1.00 | | | | | |
| (12) Proactive Preventive Behv | 6.23 | 1.08 | 0.16* | 0.18* | 0.04 | 0.18* | 0.28* | -0.03 | 0.00 | 0.19* | 0.29* | 0.18* | 0.20* | 1.00 | | | | |
| (13) Avoidance Preventive Behv | 6.44 | 1.02 | 0.24* | 0.21* | 0.01 | 0.12** | 0.28* | 0.01 | -0.15* | 0.05 | 0.22* | 0.02 | 0.08* | 0.64* | 1.00 | | | |
| (14) Anxiety | 5.09 | 1.63 | -0.01 | 0.04 | 0.13* | 0.13* | 0.31* | -0.19* | 0.25* | 0.35* | 0.37* | 0.32* | 0.32* | 0.35* | 0.27* | 1.00 | | |
| (15) Perceived Susceptibility | 3.62 | 1.30 | 0.06 | 0.05 | 0.07* | 0.04 | 0.21* | -0.08* | 0.13* | 0.14* | 0.16* | 0.16* | 0.15* | 0.08*** | 0.04 | 0.35* | 1.00 | |
| (16) Perceived Severity | 6.17 | 1.08 | 0.19* | 0.19* | 0.05 | 0.09** | 0.44* | -0.11* | -0.06 | 0.11** | 0.25* | 0.13* | 0.11** | 0.42* | 0.45* | 0.40* | 0.21* | 1.00 |

*Note*: N = 856. Gender: male = 1, female = 2. Male is the reference group. Education: 1 = high school or below, 2 = some college, 3 = Bachelor's degree, 4 = Master's degree or above. Income level: 1 = less than $10,000, 2 = $10,001–$20,000, 3 = $20,001–$30,000, 4 = $30,001–$40,000, 5 = $40,001–$50,000, 6 = $50,001–$60,000, 7 = $60,001–$70,000, 8 = $70,001–$80,000, 9 = $80,001–$90,000, 10 = $90,001–$100,000, 11 = more than $100,000. Crisis involvement was measured by the extent to which respondents considered the pandemic as important and relevant on a 7-point scale (Cronbach's $\alpha$ = .87). Political orientation: 1 = very liberal, 7 = very conservative.

*p < .001; **p < .01; ***p < .05.

### 4.2.1 | Preventive behaviours

Based on the guidelines by the health authorities, such as CDC (CDC, 2020, March 14), a list of preventive behaviours was generated. The subjects indicated how often they had been engaging in the preventive behaviours on a seven-point scale ranging from 1 "never" to 7 "frequently." These items included: "washing your hands more often," "washing your hands appropriately (about 20 seconds)," "covering coughs and sneezes," "avoiding close contact with people who are sick," "avoiding dining out," "avoiding social gatherings," "avoiding travelling," "wearing a facemask," and "self-quarantine if I was in contact with someone who is sick."

Based on a principal component analysis with varimax rotation, two factors were revealed: first, proactive behaviours ($M = 6.23$, $SD = 1.08$, $\alpha = .82$), including washing hands more often, washing hands appropriately, and covering coughs and sneezes; second, avoidance behaviours ($M = 6.45$, $SD = 1.01$, $\alpha = .88$), such as avoiding close contact with those who were sick, avoiding dining out, or avoiding social gatherings. Facemask wearing was not loaded on the two factors ($M = 5.32$, $SD = 2.08$) and was thus treated as a separate dependent variable in subsequent analyses.

### 4.2.2 | Perceived risk

The risk measures were adapted from Turner et al. (2006). Perceived susceptibility was assessed using three questions. On a seven-point scale ranging from 1 "definitely not" to 7 "definitely likely," the subjects indicated the extent of the likelihood that they would get COVID-19 this year, that they were more likely to get COVID-19 than other people their age, and the amount of risk they felt about getting COVID-19 ($M = 3.62$, $SD = 1.48$, $\alpha = .85$). The subjects also indicated their perceived severity by indicating the extent to which they agreed or disagreed with the following statements: "COVID-19 is serious," "COVID-19 can cause death," and "COVID-19 is more severe than most people realize." ($M = 6.17$, $SD = 1.21$, Cronbach's $\alpha = .87$). For anxiety, the subjects indicated the extent to which COVID-19 made them feel "anxious," "worried," and "concerned" ($M = 5.09$, $SD = 1.79$, $\alpha = .90$).

### 4.2.3 | Covariates

Age, gender, education, and income level were used as demographic covariates based on the literature (Choi et al., 2017; Tan et al., 2015). Issue involvement and political orientation were also covariates (Gadarian et al., 2020). For issue involvement, respondents indicated the extent to which they perceived the COVID-19 pandemic as (1) 1 "unimportant" to 7 "important" and (2) 1 "irrelevant" to 7 "relevant" on a 7-point scale ($M = 6.02$, $SD = 1.60$, Cronbach's $\alpha = .87$). For political orientation, respondents indicated whether they considered themselves to be 1 "liberal," 7 "conservative," or somewhere in between ($M = 4.02$, $SD = 1.73$).

Table 1 reports the summary statistics of these covariates. All covariates were included in subsequent analyses.

### 4.3 | Analytical schemes

To answer H1–H4, as well as RQ1, linear regressions through R were conducted, with different covariates, various information seeking variables, and information verifying used as predictors of two types of preventive behaviours.

To answer RQ2, structural equation modelling (SEM) was conducted through the R "Lavaan" Package (Rosseel, 2012). SEM is a set of multivariate statistical techniques to measure and analyse the relationships between observed and latent variables (Kline, 2015). Figure 1 shows the main structural model hypothesizing *sequential mediators* based on the literature (e.g., Seo, 2019). Due to the hypothesized sequential relationships between different mediators, anxiety was hypothesized to predict perceived susceptibility and severity in the model. Exogenous variables included different covariates, social media information seeking, interpersonal information seeking, news media information seeking, government information seeking, and information verifying. The ultimate endogenous variables were proactive preventive behaviours and avoidance preventive behaviours. Note that all covariates were regressed on all endogenous variables. For the measurement model, when a construct had three or less items, the construct was identified using all indicators. When a construct had more than three items, the parcelling technique (Little et al., 2002) was used to create one or more composite indicators (for details, see the note of Figure 1). Maximum likelihood estimation was used.

We also tested an alternative model of *parallel mediators* to identify the better fitting model. The alternative model is similar to the main model, except that anxiety, perceived susceptibility, and severity simultaneously mediate the effects of different information seeking variables on preventive behaviours. Both models were evaluated based on the standard cut-off values for the model-data fit indices (Hu & Bentler, 1999; MacCallum et al., 1996). The two models were compared based on the Bayesian information criteria (BIC; Raftery, 1995).

## 5 | RESULTS

### 5.1 | Relationships between information consumption and preventive behaviours

H1 hypothesizes that social media information seeking negatively affects preventive behaviours during the pandemic. Results from the linear regressions (Table 2) show that social media information seeking negatively affected proactive ($B = -0.08$, $SE = 0.03$, $p < .001$) and avoidance ($B = -0.12$, $SE = 0.03$, $p < .001$) preventive behaviours. There was no association between social media
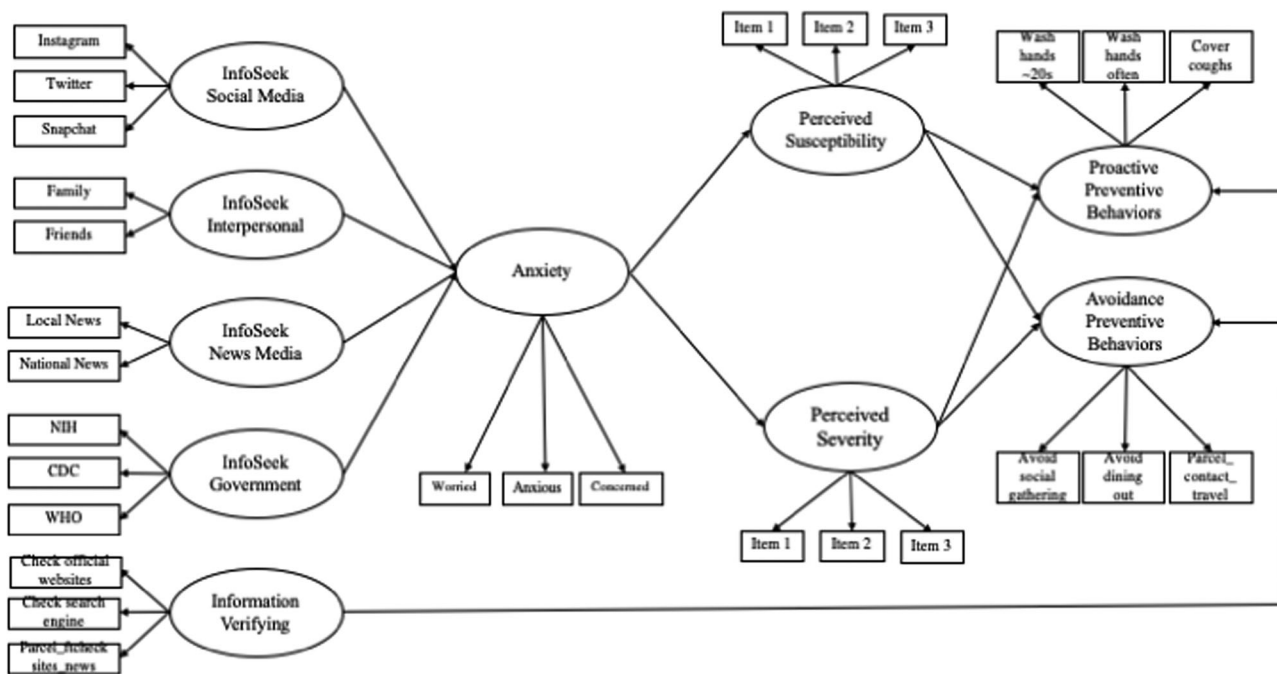
**FIGURE 1** Conceptual structural model of sequential mediators. All covariates were regressed on all endogenous variables. They are not shown in the figure for simplicity. For the construct of social media information seeking, the item of Facebook was dropped due to relatively weaker item loadings than the other indicators (see the discussion section for the difference of information seeking across various social media platforms). The parcelling technique was used when a construct had more than three items (Little et al., 2002). Parcelling was applied for two constructs. First, for information verifying, the third item was created by averaging subjects' responses to "fact-check by visiting fact-check websites" and "fact-check by reading news." Second, for avoidance preventive behaviours, the third item was created by averaging "avoid contact with those who were sick" and "avoid travelling." Refer to the measurement section for the specific items of perceived susceptibility and severity

information seeking and facemask wearing. Therefore, H1 was partially supported.

H2 predicts that interpersonal information seeking positively affects preventive behaviours during the pandemic. H2 was partially supported, as interpersonal information seeking ($B = 0.05$, $SE = 0.02$, $p < .05$) was only positively associated with proactive preventive behaviours but not other types of preventive behaviours.

H3 hypothesizes that news media information seeking positively affects preventive behaviours during the pandemic. We found that news media information seeking was positively associated with proactive ($B = 0.10$, $SE = 0.02$, $p < .001$), avoidance ($B = 0.09$, $SE = 0.02$, $p < .001$), and facemask wearing ($B = 0.11$, $SE = 0.05$, $p < .01$) preventive behaviours. H3 was supported.

H4 predicts that government information seeking affects preventive behaviours during the pandemic. Our results show that government information seeking was positively associated with proactive preventive behaviours ($B = 0.05$, $SE = 0.02$, $p < .05$) and facemask wearing ($B = 0.13$, $SE = 0.05$, $p < .01$). H4 was partially supported.

RQ1 asks whether crisis information verifying affects preventive behaviours during the pandemic. We found that crisis information verifying positively predicted all types of preventive behaviours, including proactive preventive behaviours ($B = 0.08$, $SE = 0.02$, $p < .001$), avoidance preventive behaviours ($B = 0.08$, $SE = 0.02$, $p < .001$), and facemask wearing ($B = 0.20$, $SE = 0.05$, $p < .001$).

## 5.2 | Explaining effects of information seeking and verifying on preventive behaviours

RQ2 asks how crisis information seeking and verifying affects preventive behaviours through susceptibility, severity, and anxiety.

Figure 2 summarizes the results of the main model with sequential mediators. The overall model-data fit was acceptable ($\chi^2 = 1767.98$, relative $\chi^2$ (i.e., $\chi^2/df$) = 3.80, standardized root mean square residual [SRMR] = 0.10, root mean square error of approximation [RMSEA] = 0.058, 90% confidence interval [CI] RMSEA = [0.055, 0.061], $p < .001$, and comparative fit index [CFI] = 0.92). Several mediation tests showed that there were significant indirect effects from interpersonal information seeking to anxiety and then perceived severity and, eventually, proactive ($B = 0.02$, $SE = 0.006$, $p < .001$) and avoidance ($B = 0.03$, $SE = 0.01$, $p < .001$) preventive behaviours. Through the same mediation route, there were significant indirect effects from news media information seeking to proactive ($B = 0.03$, $SE = 0.006$, $p < .001$) and avoidance ($B = 0.03$, $SE = 0.01$, $p < .001$) preventive behaviours, as well as indirect effects from government information seeking to proactive ($B = 0.01$, $SE = 0.006$, $p < .05$) and avoidance ($B = 0.02$, $SE = 0.01$, $p < .05$) preventive behaviours. There was no indirect effect of information verifying on preventive behaviours through anxiety, susceptibility, and severity. Moreover, the main model (BIC = 75,716) had a better fit than the

**TABLE 2** Estimated regression coefficients and standard errors for preventive behaviours

| Variables | Proactive preventive behaviours B (SE) | β | Avoidance preventive behaviours B (SE) | β | Facemask wearing B (SE) | β |
|---|---|---|---|---|---|---|
| Age | 0.01 (0.07) | .03 | 0.01 (0.002)*** | .09 | 0.02 (0.005)** | .12 |
| Gender | 0.29 (0.09)** | .13 | 0.15 (0.08) | .07 | 0.19 (0.17) | .04 |
| Education | −0.05 (0.02)*** | −.08 | −0.02 (0.03) | −.04 | 0.09 (0.05) | .07 |
| Income level | 0.06 (0.01)* | .19 | 0.05 (0.01)* | .16 | 0.03 (0.02) | .04 |
| Crisis Involvement | 0.12 (0.02)* | .18 | 0.13 (0.02)* | .20 | 0.17 (0.04)* | .13 |
| Political Orientation | 0.01 (0.02) | .01 | 0.01 (0.02) | .02 | −0.01 (0.04) | −.01 |
| Social Media Info Seek | −0.08 (0.03)** | −.13 | −0.12 (0.03)* | −.21 | −0.01 (0.05) | −.01 |
| Interpersonal Info Seek | 0.05 (0.02)*** | .07 | 0.01 (0.02) | .02 | 0.06 (0.05) | .05 |
| News Media Info Seek | 0.10 (0.02)* | .15 | 0.09 (0.02)* | .14 | 0.11 (0.05)*** | .09 |
| Government Info Seek | 0.05 (0.02)*** | .09 | −0.01 (0.02) | −.02 | 0.13 (0.05)** | .11 |
| Info Verifying | 0.08 (0.02)** | .14 | 0.08 (0.02)* | .14 | 0.20 (0.05)* | .17 |
| Adjusted $R^2$ | 0.199 | | 0.171 | | 0.165 | |

*Note:* Listwise $N$ = 834. Gender: male = 1, female = 2. Male is the reference group. Education: 1 = high school or below, 2 = some college, 3 = Bachelor's degree, 4 = Master's degree or above. Political orientation: 1 = *very liberal*, 7 = *very conservative*.

*$p$ < .001; **$p$ < .01; ***$p$ < .05.

alternative model (BIC = 75,854). As such, the notion of sequential mediators (with anxiety predicting perceived susceptibility and severity) rather than simultaneous mediators was preferred for explaining the association between information seeking and preventive behaviours.[1]

# 6 | DISCUSSION

This study examined whether and how crisis information seeking and verifying affected preventive behaviours during the COVID-19 pandemic. Our results based on US nationally representative data showed that pandemic information seeking through interpersonal channels, news media, and the government was positively associated with proactive preventive behaviours, whereas only information seeking through news media was positively associated with avoidance preventive behaviours. Information verifying was consistently associated with all types of preventive behaviours. The results are discussed in detail below.

First, news media information seeking was strongly associated with all kinds of preventive behaviours during the COVID-19 pandemic. These results support the pivotal role of news media in crisis communication (e.g., Utz et al., 2013) and show that people rely more on news media (compared with other sources or channels) for self-protection during the pandemic. Information seeking through news media amplified people's "felt" and subsequently "perceived" risks, which, in turn, increased preventive behaviours. These results imply that even in the era of social media and communication technologies, news media are still the most important sources amplifying risk with

regard to a crisis, thus supporting the original SARF (Kasperson & Kasperson, 1996). Our results also demonstrate a process of sequential risk amplification, in which the affective heuristic helps individuals assess the likelihood of infection and how severe the situation is (Slovic et al., 2004). The inclusion of both cognitive and affective components of risk provides stronger explanations and predictions for preventive behaviours (as evidenced by an increase in the explained variance of preventive behaviours).

Second, social media information seeking was negatively associated with proactive and avoidance preventive behaviours. Social media information seeking had no effects on anxiety or facemask wearing. These results do not support the literature on the positive influence of social media on crisis-related perceptions, emotions, and behaviours (e.g., Chong & Choy, 2018; Oh et al., 2020). Additional analyses revealed that our subjects attached different levels of anxiety and severity to information sought through different social media platforms. That is, Instagram and Snapchat information seeking were associated with lower levels of anxiety and severity yet, Facebook and Twitter information seeking was not related to anxiety or severity. Thus, it is likely that people use different platforms for different purposes during the pandemic, with Instagram/Snapchat providing more personal and visual information (e.g., a photo showing a lonely fashion blogger sheltering at home) than Twitter/Facebook.

The null effect of Twitter/Facebook information seeking on facemask wearing might be explained by social media users' awareness of the prevalence of misinformation (Gallup/Knight Foundation, 2020). Further, the negative effect of Instagram/Snapchat information seeking on preventive behaviours might be attributed to the
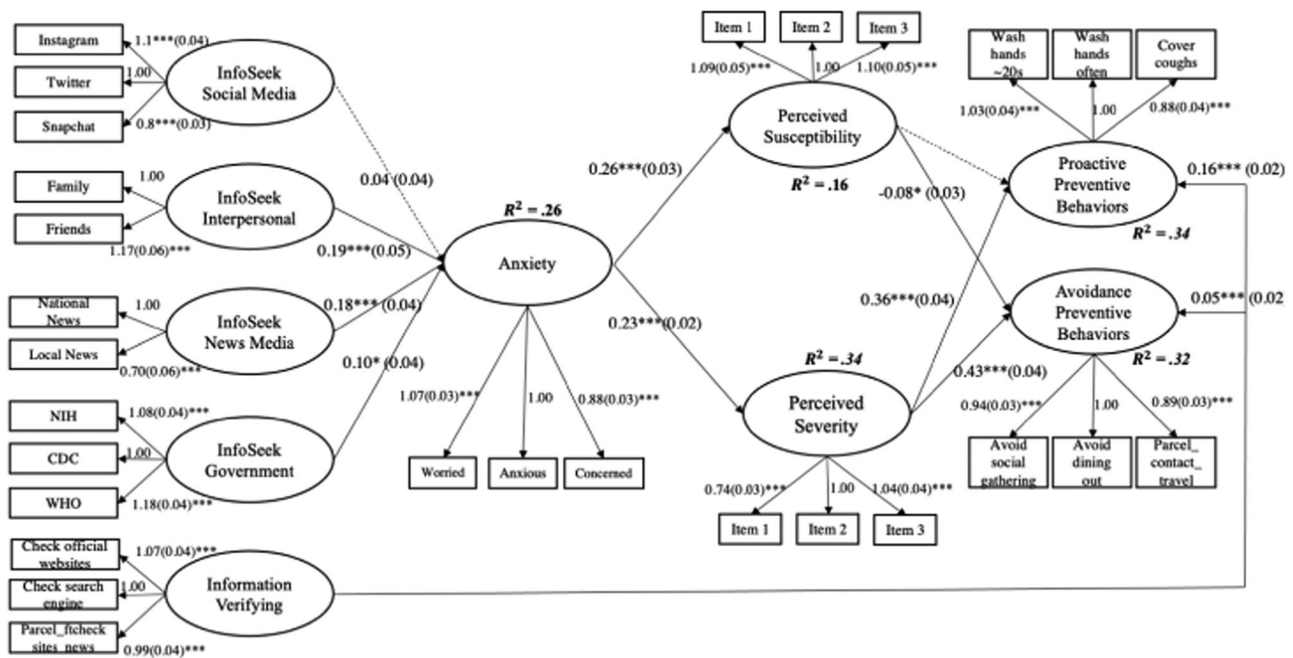
**FIGURE 2** Estimated results for the SEM of sequential mediators. Listwise N = 834. Unstandardized path coefficients (bs) are reported in the figure. Standard errors of the unstandardized coefficients are reported in parentheses. All covariates were regressed on all endogenous variables. The overall model-data fit: $\chi^2$ = 1701.25, relative $\chi^2$ (i.e., $\chi^2/df$) = 3.84, SRMR = 0.10, RMSEA = 0.058, 90% CI RMSEA = [0.05, 0.06], $p$ < .001, and CFI = 0.92. The solid lines represent significant relationships and the dotted lines represent nonsignificant relationships. CFI, comparative fit index; CI, confidence interval; RMSEA, root mean square error of approximation; SEM, structural equation modelling; SRMR, standardized root mean square residual

selective and purposeful use of digital platforms during the pandemic, that is, people might use Instagram/Snapchat for entertainment and relaxation during the pandemic. Altogether, these results suggest the importance of examining individuals' motivation and use of specific social media platforms during the pandemic.

Next, interpersonal information seeking was positively associated with proactive preventive behaviours. These results support the literature regarding the pivotal roles of interpersonal channels (e.g., Liu et al., 2016) in accessing crisis information and shaping preventive behaviours. People rely more on coronavirus information from their personal contacts in deciding whether to adopt proactive behaviours, such as washing hands frequently, probably because this information contains personal implications and increase efficacy beliefs. Government information seeking was also positively associated with proactive preventive behaviours (and facemask wearing). Consistent with the literature, government agencies play a key role (e.g., Sutton et al., 2018) in affecting certain preventive behaviours, such as washing hands and wearing a facemask. Given the lack of scientific consensus on preventive measures and treatment, self-preventive information sought from government agencies, such as the CDC, should be more convincing.

However, it is unclear why people did not change their avoidance preventive behaviours after government and interpersonal information seeking. As the Trump administration kept downplaying the threat of COVID-19, Americans probably did not sense a sufficiently high level of severity from government

information seeking, as evidenced by the weak correlations between government/interpersonal information seeking and severity. They probably believed that proactive preventive behaviours, such as washing hands, should be sufficient for self-protection during the COVID-19 pandemic. Due to the low levels of perceived severity, Americans may believe that it is unnecessary to adopt avoidance behaviours, such as avoiding dining out, which can be inconvenient.

Lastly, information verifying directly affected all kinds of preventive behaviours during the COVID-19 pandemic. These findings underscore the importance of considering both information seeking and verifying in crisis communication (i.e., SMCC; Lu & Jin, 2020) and of extending the health communication literature on misinformation correction (e.g., Bode & Vraga, 2018; Tan et al., 2015). In a complex information environment, individuals can use both information processing strategies to reduce the uncertainty that is related to a threat. To elucidate, information seeking allows people to access a large amount of information, and information verifying enables them to compare and evaluate different contents and form appropriate and efficacious preventive behaviours. Information verifying may occur simultaneously with information seeking in the consumption process because we observed crossloadings of several indicators of seeking and verifying in the structural model. Nonetheless, more studies are warranted to clarify the interrelationships between information seeking, verifying, and behaviours.

## 6.1 | Theoretical implications

Several theoretical implications are worth discussing. First, this study expands the scope of crisis communication, public relations, and health communication literature by examining how different aspects of information consumption affect preventive behaviours during the COVID-19 pandemic. On one hand, our results extend the SMCC model by considering both crisis information seeking and verifying in affecting preventive behaviours for a more comprehensive understanding of people's informational behaviours during a pandemic. Given the consistent and positive relationships between crisis information verifying and various preventive behaviours, it is crucial for researchers to further investigate the antecedents, processes, and perceptual outcomes of crisis information verification. As the relationship between information verifying and preventive behaviours was not explained by any risk-related mediators (e.g., anxiety), future studies should test additional mechanisms, such as response efficacy or uncertainty reduction. For example, verifying crisis information may increase one's perceived effectiveness of the adopted action and thus facilitate preventive behaviours.

Furthermore, answering the call for more public-driven research on the socio-psychological mechanisms of individuals' behaviours during crises (Liu & Viens, 2020), our findings support a sequential process of risk amplification accounting for the associations between information seeking through various sources and channels and preventive behaviours during a pandemic, thereby advancing the literature on crisis communication and information behaviours (e.g., SMCC; Austin et al., 2012). Future studies should also examine the mechanisms underlying the attitudinal and behavioural outcomes of information sharing and verifying by examining other important socio-psychological factors, such as construal level or cognitive elaboration. Given the heterogeneity of the crisis information environment on different social media platforms (e.g., Lee & Jin, 2019), future research should systematically examine platform characteristics (e.g., affordances) and their impacts on preventive behaviours for a more refined understanding of information consumption on social media.

## 6.2 | Practical implications

The COVID-19 pandemic is an ongoing public health crisis worldwide. During this pandemic, people are not passive receivers of crisis information. Instead, they fact-check coronavirus information through various means and determine their preventive behaviours for staying safe during the pandemic. Therefore, crisis managers, particularly those who work with government agencies or health authorities that are responsible for the crisis response, should not only provide accurate, timely and targeted health information during the pandemic but also educate people in navigating the complex information environment. Furthermore, they should supply them with evidence-based methods for identifying false claims and combat the negative effects of unverified biased information. For example, government agencies, such as the CDC, can partner with influencers to share tips on COVID-19 fact-checking and direct users to credible sites of fact-checks on social media platforms. Public health officers can also collaborate with social media companies to develop various algorithmic solutions to address the infodemic, such as adding misinformation identification and verification functions or providing a built-in real-time fact-check service that is highly accessible.

Furthermore, as news media information seeking (but not government information seeking) was associated with all kinds of preventive behaviours, public health information officers should still reach out and build relationships with local and national news media, and constantly provide media outlets with accurate, timely, and evidence-based crisis information. Using social media to raise people's perceived risk and preventive behaviours may be futile during the pandemic, perhaps due to the complex social media information environment, where people struggle to sift facts from misinformation.

## 6.3 | Limitations and future directions

This study has several limitations. First, survey data do not enable the test of causal relationships among variables, although they provide more ecologically valid results compared to experimental data. Future studies should perform experiments to formally assess the causal influence of information verification on preventive behaviours and its underlying mechanisms. Second, numerous studies have shown that cultural background strongly affects perceived risk and preventive behaviours (e.g., Kim et al., 2020). Future studies should examine the behavioural outcomes of information seeking and verifying in another cultural context or conduct cross-cultural comparisons. Third, our study is based on cross-sectional self-report data. Digital traces over time that track the changes in pandemic information consumption will be valuable to understand the dynamics of individuals' information processing goals (e.g., verification or confirming prior beliefs) and their effects on preventive behaviours during an epidemic.

Despite the limitations above, our study highlights the importance of information verifying in driving preventive behaviours during the COVID-19 pandemic and clarifies the mechanism underlying the effect of information seeking on preventive behaviours, thereby opening new opportunities for crisis communication and management theory building.

### DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available upon request from the corresponding author.

### ENDNOTE

[1]As the model-data fit was not ideal, we also conducted theory-informed model modification based on the modification indices. Mainly by allowing cross-loading among information consumption constructs and their indicators (e.g., CDC information seeking cross-loaded on both social media and government information seeking), the model-data fit demonstrated a minor increase ($\chi^2$ = 1596.51, relative $\chi^2$ (i.e., $\chi^2/df$) = 3.56, SRMR = 0.09, RMSEA = 0.055, 90% CI RMSEA = [0.052, 0.058], $p < .01$, and CFI = 0.93). The modified model provided similar results.

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