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Managing urban citizens' panic levels and preventive behaviours during COVID-19 with pandemic information released by social media

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ABSTRACT

Reducing citizens’ panic and promoting their preventive behaviours are critical parts of pandemic management for the government. However, the effects of pandemic information types (daily statistical vs. detailed case information) and sources (official vs. unofficial social media accounts) on the psychological states and behaviours of urban citizens need to be explored further. Furthermore, the heterogeneity of these effects for citizens from areas with different epidemic levels also needs further investigation. Therefore, we conducted a survey during the COVID-19 outbreak in mainland China in March 2020, and 1298 urban citizens (592 from Wuhan) offered reliable data. Results of linear regression analysis indicated that non-Wuhan urban citizens who were more concerned about detailed case information (e.g., patients’ movement paths) exhibited more preventive behaviours. Additionally, regarding social media information sources, unofficial social media caused both Wuhan and non-Wuhan urban citizens to have higher levels of panic than official media but had no significant impacts on their preventive behaviours. These findings contribute to urban management through the discovery of the effects of different information types and social media information sources on urban citizens during pandemics.

1. Introduction

In December 2019, a group of people infected with the coronavirus disease 2019 (COVID-19) was reported in Wuhan, Hubei Province, China (Wu & McGoogan, 2020); since then, COVID-19 has become an international public health emergency of concern (Wang et al., 2020). The high infectivity of COVID-19 not only threatens citizens’ health but also causes them to feel panic (Bao, Sun, Meng, Shi, & Li, 2020). Panic is a serious negative psychological state that can lead to abnormal behaviours (Liu, Lin, Wang, Chen, & Zhang, 2021). In addition, citizens’ preventive behaviours directly determine the effectiveness of pandemic control (Dai et al., 2020). Therefore, it is crucial to manage citizens’ panic level and preventive behaviours during pandemics.

In the new digital era, social media platforms have become indispensable to people’s daily lives. In particular, during the COVID-19 pandemic, social media has become the main source of epidemic-related information for citizens (Tang & Zou, 2021). Compared with traditional media, such as newspapers, TV, radio, and magazines, social media has the ability to build online communities and provide timely information and updates (Demuyakor, 2020). Furthermore, owing to their characteristics of interactivity, including geographic location functions and population penetration (Stoove & Pedrana, 2014), social media can facilitate interactions between citizens and government officials, which can provide opportunities for citizens to seek or receive information that they need to know (Siyam, Alqaryouti, & Abdallah, 2020). Social media platforms have even replaced official webpages and serve as the main source of epidemic information (Ahmad & Murad, 2020).

Recognizing the importance of social media, both central and local governments in China relied on their official social media, such as the “Weibo Government official account” and “WeChat Public Services” (Mourad, Srou, Harmanai, Jenainati, & Arafeh, 2020; Tang & Zou, 2021), to release pandemic information to the public. Taking official Weibo accounts from People’s Daily (owned by the Central Committee of the Communist Party of China) and Beijing Daily (owned by Beijing Municipal Committee of the Communist Party of China) as examples, we counted the number of posts related to COVID-19 through 17 March 2020 using the keywords “新冠”(coronavirus) OR “肺炎”(pneumonia) AND "新冠"(coronavirus) OR "肺炎"(pneumonia)
Residents will pay more attention to personal hygiene and social distance
whereabouts prior to their positive diagnosis (Zastrow, 2020). In addition, the WHO and other experts believe that case informa
tion can help reduce the spread of the pandemic (Zastrow, 2020). For example, Demuyakor (2020) found that the utilization of social media dramatically caused panic among the Ghanaian migrant community during the COVID-19 outbreak. Besides, in the face of a pandemic, social media is considered as important information channels, which may have a positive impact on people’s preventive behaviours. For example, Liu (2021) found that citizens' COVID-19 information consumption on social media can predict their preventive behaviours.

In sum, both administrators and researchers recognize that information released through social media has a significant impact on citizens’ panic level and preventive behaviours (Ahmad & Murad, 2020). However, the relative effects of different pandemic information types (i.e., daily statistical and detailed case information) and social media information sources (i.e., official and unofficial) on citizens’ panic and preventive behaviours remain unclear. This research gap is problematic because it will affect information management for both administrators and researchers as well as our understanding of the roles that information types and social media information sources play in a pandemic. Furthermore, citizens from areas with different epidemic levels are likely to show different psychological and behavioural responses (Li et al., 2010). Thus, it is necessary to further explore the heterogeneity of these effects of social media information on urban citizens from core area (i.e., Wuhan, Hubei province) and non-core area (i.e., non-Wuhan cities) of the COVID-19 pandemic. Consequently, this study aims to answer the following research questions, focusing on urban citizens:

RQ1: Do pandemic information types (daily statistical vs. detailed case) influence citizens’ panic levels or preventive behaviours?
RQ2: Do social media information sources (official vs. unofficial) influence citizens’ panic levels or preventive behaviours?
RQ3: Are the effects of information types and sources heterogeneous for citizens from areas with different epidemic levels (Wuhan vs. Non-Wuhan)?

To address these questions, we designed a cross-sectional questionnaire to reveal the effects of different pandemic information types and different social media information sources on urban citizens’ panic levels.
and preventative behaviours. This research aims to contribute to the literature in two primary ways. First, this research contributes to the information management literature by deepening our understanding of the roles of social media as information sources during the pandemic to discover the relative effects of different social media information sources (official vs. unofficial), as well as the relative effects of their different released information types (daily statistical vs. detailed case). Second, this research also contributes to the urban management literature by examining how to manage urban citizens' panic and preventative behaviours during pandemics and how to create a healthy environment for cities across the world through the example of Chinese urban citizens. From a practical perspective, we expect that this research can provide guidance on pandemic management for city governments around the world on releasing proper information through official social media.

2. Literature review

2.1. Panic and preventive behaviours during pandemics

Reducing citizens' panic emotion and improving preventative behaviours are critical parts of pandemic management for the government. First, as a negative psychological state, panic damages people's mental health (Wang et al., 2020) and can lead to abnormal social behaviours, such as panic buying (Keane & Neal, 2021; Yoshizaki, de Brito Junior, Hino, Aguiar, & Pinheiro, 2020) and overuse of other emergency health resources (Basch et al., 2020b). To reduce citizens' panic, therefore, many studies have made efforts to reveal its influencing factors. Existing research has demonstrated that age, education, family background (Islam, Ferdous, & Potenza, 2020), and risk perceptions (Liu, Lin, Wang, Chen, & Zhang, 2021) are associated with panic. Additionally, information disclosure can provoke panic, especially misinformation and complicated information (Basch et al., 2020b). Based on these findings, researchers tried to determine ways to manage citizens' panic effectively. For example, Jones, Waters, Holland, Bevins, and Iverson (2010) developed communication strategies to cope with citizens’ panic.

Second, preventative behaviours directly determine the effectiveness of pandemic control. Identifying the factors associated with preventative behaviours might improve citizens' adherence to them. Specifically, individuals' vulnerability, perceived risk, fear (Yildirim, Gecer, & Akgul, 2021), subjective norms (Liu, Xie, Li, & Ji, 2020), perceived efficacy, positive emotions (Dai et al., 2020) and trust in government (Min, Shen, & Hino, 2020) can significantly predict their preventative behaviours during COVID-19. From the perspective of the government, positive risk communication, rumour refutation and protective equipment distribution can influence citizens' preventative behaviours (Dai et al., 2020). Notably, social media are deemed to be an effective tool to promote citizens' preventative behaviours during the COVID-19 outbreak (Li & Liu, 2020) by offering correct, scientific preventive measures and releasing pandemic information to citizens (Dai et al., 2020).

2.2. Social media during pandemics

In the new digital era, social media platforms have become indispensable to people's daily lives. However, during pandemics, social media can be a double-edged sword. On the one hand, social media play a significant positive role during pandemics from several perspectives. First, social media allows better information exchange between the public and government than other platforms (Siyam et al., 2020). The public can use social media to share their health and activity information and search for self-protective measures during pandemics (Yusof, Al-Kabsi, & Potenza, 2020). In addition, public administrators provide information about pandemics and protective actions to the public through social media (Nisar & Shafig, 2019; Smith, 2010) because social media platforms are faster than traditional websites (Gao & Lee, 2017). For example, during the H1N1 virus pandemic, the Twitter accounts of the UK government were the predominant source of information for the public (McNeill, Harris, & Briggs, 2016). The Chinese government aimed to promote the public's awareness of prevention by providing daily updates about surveillance and active cases on websites and social media (e.g., Weibo, WeChat, etc.) during the COVID-19 pandemic (Bao et al., 2020).

Second, social media can serve as tools to track and predict a pandemic due to their capability for real-time surveillance of disease outbreaks (Al-Garadi, Khan, Varathan, Mujtaba, & Al-Kabsi, 2016). Compared with traditional disease surveillance systems, monitoring pandemics using social media data can be faster (Signorini, Segre, & Polgreen, 2011) and less expensive (Al-Garadi et al., 2016). For example, in China, Sina Weibo data provide an opportunity to detect the transmission of contagion, and the results from analysing these data are in accordance with those of the Chinese Center for Disease Control and Prevention (CDC) (Huang, Zhao, & Zhang, 2013). Additionally, data from social media can be used to predict infection cases during pandemics. Most studies demonstrated that social media data could predict official data up to one week in advance of its release by health agencies and centres (e.g., US CDC and UK HPA) (Al-Garadi et al., 2016). For example, Shen et al. (2020) revealed that reports of symptoms and diagnoses of COVID-19 obtained by analysing posts related to COVID-19 on Weibo significantly predicted daily case counts up to 14 days ahead of official statistics. Thus, social media can help government and health organizations facilitate timely actions to decrease unnecessary mortality (Li & Cardie, 2013).

In contrast, social media can also have negative effects during pandemics. First, social media offers individual platforms to spread misinformation, unsceintific news, rumours, and pseudoscience, which undermine public health efforts to control pandemics (Chou, Gaysynsky, & Vanderpool, 2021). Specifically, misinformation was associated with younger age, male gender, lower education level, and, particularly, greater rejection of official social media accounts (Pickles et al., 2021). In addition, Lobato, Powell, Padilla, and Holbrook (2020) identified that individuals who are less supportive of liberal policy positions and who have a high social dominance orientation were substantially more willing to spread conspiracy-themed misinformation on social media. Therefore, fact-checking and censorship of social media and improving the authority of official accounts on social media platforms are necessary actions (Chou et al., 2021; Niemiec, 2020).

Second, social media can stimulate negative emotions, such as panic, stress, anxiety and fear. For example, in Iraqi Kurdistan, Ahmad and Murad (2020) found that social media had a significant impact on spreading fear and panic, which is harmful to individuals' mental health and psychological well-being. Furthermore, First, Shin, Ranjit, and Houston (2021) demonstrated that the use of social media had higher positive relationships with depression and stress than traditional media use during the COVID-19 outbreak. The possible reason might be the overabundance of information and the difficulty for people to find trustworthy sources (Yu, Chen, Liu, & Lee, 2020). However, some authors also found that social media use among Cypriots did not cause panic or anxiety because they are aware of fake news and follow official sources (Kaya, 2020). Therefore, official sources play an important role in weakening the negative effects of social media.

2.3. Information disclosure during pandemics

Information disclosure is one of the most significant factors in public health crisis management (Shangguan, Wang, & Sun, 2020). Both scholars and practitioners agreed that information disclosure during pandemics has many benefits. For example, information may aid professionals and the public in understanding the risks of the pandemic (Heymann, 2020), sharing knowledge held by various specialists (Komenda et al., 2020), helping the public understand the pandemic (Komenda et al., 2020), and estimating epidemiological indicators (Backhaus, 2020).

The establishment of information disclosure channels and platforms
is another important factor in public health crisis management (Shangguan et al., 2020). Countries and organizations throughout the world have made efforts to promptly report epidemic information. The WHO released worldwide situation reports daily (Dong, Du, & Gardner, 2020). Additionally, the governments of various countries have taken corresponding measures to disclose pandemic information on a national level, such as the Icelandic COVID-19 in Iceland – Statistics (Sen-Crowe, McKenney, & Elkbuli, 2020); the Korean Coronavirus Disease-19, Republic of Korea; the Singaporean Dashboard of the COVID-19 Virus Outbreak in Singapore; and a web-based app from the Czech Republic (Komenda et al., 2020).

The information disclosed by the government during pandemics can be divided into two types: daily statistical information and detailed case information (Dai et al., 2020). Daily statistical information includes the overall numbers of performed tests, confirmed cases of COVID-19, COVID-19-related deaths, and daily and cumulative overviews of people positive for COVID-19 (Komenda et al., 2020). Detailed case information includes the movement of each infected patient prior to being quarantined (Moon, 2020), including travel history and trains or flights taken (Dai et al., 2020). These types of information have been shown to significantly influence citizens’ perceived risk and perceived efficacy of protective behaviours (Dai et al., 2020); however, the different effects of these two types of information remain unclear.

In sum, many researchers have realized that social media plays an important role in influencing citizens’ panic levels and preventive behaviours by offering relevant information. However, their effects are two-sided (Peyravi & Ahmadi Marzaleh, 2020), and few studies have focused on urban citizens. Compared with unofficial social media, official social media is recognized as responsible for reporting correct pandemic information to citizens. However, whether official social media plays a more positive role in influencing urban citizens and how different types of pandemic information affect citizens have not been addressed. These knowledge gaps can hinder our understanding of the role of social media, especially official social media, during pandemics and confuse both researchers and officials about which types of pandemic information should be released.

3. Methods

3.1. Research design

The current study explored the effects of urban citizens’ pandemic information type and their dominant social media information source on their panic level and preventive behaviours during the COVID-19 pandemic. We designed a questionnaire (please see Appendix A) to obtain urban citizens’ information type, dominant social media information source, psychological states (such as panic), preventive behaviours (such as wearing a mask), and other sociodemographic information.

3.2. Data collection and sample

Because the Chinese government advised the public to minimise face-to-face interaction and adopt self-isolation, the surveys in this study were distributed to potential respondents through an online survey platform (“SurveyStar”, Changsha Ranxing Science and Technology, Shanghai, China). Besides, given the time-sensitivity of the COVID-19 outbreak, we adopted the snowball sampling method as previous
In total, 2543 Chinese individuals completed the questionnaire from 9 to 17 March 2020. We obtained 1298 valid urban citizen responses from 188 cities in China. The sampling frame consisted of 592 urban citizens living in the core area of the COVID-19 pandemic (Wuhan city in Hubei Province, China) and 706 citizens living in other areas in China. A map of the final sample source and distribution is shown in Fig. 2, and Table 1 provides the specific sociodemographic characteristics of the participants.

3.3. Measurements

Information type was self-reported by asking which type of information the participant preferred to obtain from social media during the pandemic. Specific examples include the following: 1) daily statistical information, for example: ‘On 7 February, there were 3 newly confirmed cases in your city, including 2 cases in A District and 1 case in B District; to date, there are 113 confirmed cases in total; there were no new severe cases, and 3/5 original severe cases have been converted to mild; there were 2 new discharges, for a total of 6 discharges’; 2) detailed case information: ‘On 7 February, the new confirmed patient No. 113 in your city is a male patient, 21 years old, from Cheng'an County. On 26 and 30 January, he went to Daguozhuang Village twice. He went to the outpatient clinic of Bencun Village in the early morning of 4 February and was isolated in the south wing of Linzhang Traditional Chinese Medicine Hospital on the afternoon of 4 February.’

The dominant social media information source was self-reported by asking the participant: ‘Which of the following social media are your dominant sources of pandemic information during the COVID-19 pandemic? 1) Official social media including “Weibo Government official account” (e.g., People’s Daily) and “WeChat Public Services” (e.g., Xinhua News), or 2) unofficial social media, such as WeChat Groups, unofficial Weibo Accounts, and We Media (zi meiti) run by individuals (similar to influencers in the West).’

Panic was measured with 5 items from the short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI), which was developed by Marteau and Bekker (1992). We asked participants to rate the extent to which these emotions matched their feelings during the pandemic on a 7-point Likert scale ranging from 1 (strongly unfit) to 7 (strongly fit).

Preventive behaviours were measured by three items developed by our group. We have provided a list of the three main types of citizens’ preventive behaviours (i.e., wearing a mask, washing hands, and disinfecting themselves) to participants and asked them to report their frequency of adopting these measures when they left or returned home during the pandemic. Participants rated the items on a 7-point Likert scale ranging from 1 (never) to 7 (every time). A high score on the scale indicated that the participants had a high level of engagement in preventive behaviours.

To rule out potential influences of other factors, we included several controls in this research. For example, individuals’ attention to threatening information (Farooq et al., 2020) and collectivism (Cho & Lee, 2015) can lead to individuals’ panic and improve preventive behaviours. Therefore, we controlled for attention to pandemic information (measured by three items developed by our group—i.e., I wish I could read every piece of information about the epidemic) and collectivism, which was measured using a scale developed by Triandis and Gelfand (1998) (a sample item is “It is my duty to take care of my family, even when I have to sacrifice what I want.”). Additionally, we controlled for the sociodemographic information of participants, including age, gender, education, location and location type, according to suggestions from Wang et al. (2020). We also controlled for relational distance (we asked the respondents to indicate whether they or their relatives had been infected by COVID-19), physical distance from the nearest confirmed or suspected case, perceived disclosure of pandemic information, confidence in overcoming this pandemic and the controllability of this pandemic (Wu, Deng, & Liu, 2021).

4. Results

4.1. Preliminary analysis

Table 2 provides the means, standard deviations, and intercorrelations for the sociodemographic characteristics, psychological states and preventive behaviours of the respondents.

Based on the survey data, the reliability and validity of the scales of three latent variables were calculated using SPSS Statistics 20 (IBM SPSS Statistics, New York, United States), and the results are shown in Table 3. On the one hand, Table 3 shows that the Cronbach’s alpha coefficients of all latent variables were higher than 0.7, proving that the scale passed the internal consistency test (Robinson, Shaver, & Wrightsman, 1991). On the other hand, the Kaiser-Meyer-Olkin (KMO) values of all the variables were greater than 0.6 (Table 3). The Bartlett sphericity test of each variable was significant, and all the factor loads were greater than 0.50. The composite reliability (CR) estimates ranged from 0.86 to 0.90 (ideally acceptable between 0.70 and 0.90). These results confirmed that these scales have good reliability. Convergent validity was tested by average variance extracted (AVE) values, which were all higher than 0.5. Discriminant validity was assessed by comparing the square of construct correlations with the AVE values, which exceeded the square of the correlation among these three variables. Overall, the measures of the three latent variables have acceptable

Table 1
Sociodemographic information of the participants.

| Variables | Characteristics | N  | Percentage | Variables | Characteristics | N  | Percentage |
|-----------|----------------|----|------------|-----------|----------------|----|------------|
| Gender    | Male           | 568| 43.8%      | Education | Intermediate school and below | 41 | 3.2%       |
|           | Female         | 730| 56.2%      | Secondary school | 99 | 7.6%       |
| Age       | < 18           | 61 | 4.7%       | Bachelor's or college | 729 | 56.2%     |
|           | 18-25          | 434| 33.4%      | Master's and above | 429 | 33.1%     |
|           | ≥ 26-30        | 285| 22.0%      | Wuhan | 592 | 45.6%     |
|           | ≥ 31           | 346| 26.7%      | Non-Wuhan | 706 | 54.4%     |
|           | 41-50          | 127| 9.8%       | Medical professionals | 19 | 1.5%      |
|           | 51-60          | 41 | 3.2%       | Service staff | 33 | 2.5%      |
|           | > 60           | 4  | 0.3%       | Freelancers | 49 | 3.8%      |
|           | ≤ 5            | 492| 37.9%      | Workers | 18 | 1.4%      |
| Income (10 thousand RMB/Year) | ≤ 10          | 138| 10.6%      | Company employees | 434 | 33.4%     |
|           | 11-15          | 292| 22.5%      | Civil servants | 196 | 15.1%     |
|           | 16-20          | 218| 16.8%      | Students | 468 | 36.1%     |
|           | 21-25          | 89 | 6.9%       | Self-employed individuals | 22 | 1.7%      |
|           | ≥ 26-30        | 50 | 3.9%       | Unemployed individuals | 16 | 1.2%      |
|           | ≥ 31           | 19 | 1.5%       | Others | 43 | 3.3%      |

| Variable                  | N  | Percentage |
|---------------------------|----|------------|
| Total sample size         | 1298| 100%      |

| Variable                  | N  | Percentage |
|---------------------------|----|------------|
| Total sample size         | 1298| 100%      |
validity and reliability.

4.2. Effects of information type and source on urban citizens

We applied linear regression analysis using SPSS Statistics 20 to test the effects of the concerned information type (i.e., daily statistical vs. detailed case) and dominant social media information sources (i.e., official vs. unofficial) on urban citizens’ panic and preventive behaviours during the COVID-19 pandemic, and check the differences of these effects for citizens in different areas (i.e., non-Wuhan vs. Wuhan). There were two steps: 1) examining the effects of independent variables on the outcome variables for the whole, and 2) exploring the differences in these effects between different groups (Cohen, Cohen, West, & Aiken, 2013). However, when the effects of independent variables are significant for one group but not for another group, we can conclude that there are differences in these effects between groups. On the one hand, when the effects of independent variables are both significant for these two groups, it is necessary to further test the difference of regression coefficients (Cohen et al., 2013). Following the above procedures, as shown in Table 4, we first examined the effects of information type and source on the whole sample, and we, subsequently, tested these effects on non-Wuhan and Wuhan (i.e., the core area of the pandemic) citizens respectively. Finally, we compared the differences in these effects between the two groups.

First, most of the controlled predictors affected urban citizens’ panic levels (Table 4). Age \((b = 0.10, p < .01\) for the whole), physical distance \((b = -0.08, p < .01\) for the whole), attention paid to pandemic information \((b = 0.27, p < .01\) for the whole), perceived controllability of the pandemic \((b = -0.13, p < .01\) for the whole) and collectivism \((b = 0.16, p < .01\) for the whole) had significant effects on citizens, and these effects have no significant differences for citizens in non-Wuhan or Wuhan areas. However, for citizens in non-Wuhan and Wuhan areas, effects of gender \((b = 0.48, p < .01\) for non-Wuhan citizens, and \(b = 0.13, p > .05\) for Wuhan citizens), educational background \((b = 0.04, p > .05\) for non-Wuhan, and \(b = 0.25, p < .01\) for Wuhan), and confidence in overcoming this pandemic \((b = 0.07, p < .05\) for non-Wuhan, and \(b = -0.04, p < .05\) for Wuhan) were significantly different. That is, elder citizens in non-Wuhan areas showed higher levels of panic, and the higher the level of confidence that non-Wuhan citizens perceived during this pandemic, the lower their levels of panic were. Wuhan citizens having a higher educational background reported higher levels of panic. Furthermore, after controlling the above potential factors, results in Table 4 indicate that the effects of pandemic information type and source are not different between citizens in non-Wuhan and Wuhan areas. Specifically, detailed case information did not cause higher levels of panic \((b = 0.04, p > .05\) for the whole) than did statistical information. However, urban citizens whose dominant social media information sources were unofficial \((b = 0.69, p < .01\) for the whole) showed higher panic levels than those who preferred official social media.

Second, most controlled predictors had different impacts on preventive behaviours of urban citizens in non-Wuhan and Wuhan areas. Specifically, age \((b = -0.07, p < .05\) for non-Wuhan, and \(b = 0.06, p < .05\) for Wuhan), gender \((b = 0.25, p < .01\) for non-Wuhan, and \(b = 0.07, p > .05\) for Wuhan), education \((b = 0.05, p > .05\) for non-Wuhan, and \(b = -0.13, p < .05\) for Wuhan), physical distance \((b = -0.02, p < .05\) for non-Wuhan, and \(b = -0.04, p < .05\) for Wuhan), attention to information concerning COVID-19 \((b = 0.19, p < .01\) for non-Wuhan, and \(b = 0.10, p < .01\) for Wuhan), perceived controllability of this pandemic \((b = 0.11, p < .01\) for non-Wuhan, and \(b = 0.06, p > .05\) for Wuhan), and collectivism \((b = 0.11, p < .01\) for non-Wuhan, and \(b = 0.20, p < .01\) for Wuhan) could heterogeneously predict urban citizens’ preventive behaviours. Ruling out these potential factors, results in Table 4 imply that the effect of information type on urban citizens was different between citizens in non-Wuhan areas \((b = 0.25, p < .01\) and those in Wuhan areas \((b = 0.05, p > .05\). That is, non-Wuhan urban citizens who were concerned more about detailed case information tended to adopt more
5. Discussion

Our findings answered the three questions raised in the Introduction section. First, information type (detailed case vs. daily statistical) did not influence urban citizens’ panic levels but did influence preventive behaviours. However, its effects on preventive behaviours of non-Wuhan and Wuhan urban citizens are different. Specifically, detailed case information promoted non-Wuhan urban citizens’ preventive behaviours without increasing their levels of panic over those induced by daily statistical information. Second, social media information sources (official vs. unofficial) affected urban citizens’ panic levels but not their preventive behaviours. Specifically, use of official social media information sources was associated with decreased panic levels but not with stricter preventive behaviours during the COVID-19 pandemic, and these effects were not different between urban citizens in non-Wuhan and Wuhan areas. Furthermore, other factors that influenced panic levels and preventive behaviours were also confirmed, such as age, gender, education and physical distance to the nearest confirmed patients. These findings have significant theoretical and practical implications.

5.1. Theoretical implications

In this study, the findings offer significant theoretical implications for information management and urban management during pandemics. First, social media has provided various pandemic information to help the public understand the epidemiology of COVID-19 (Adhikari et al., 2020), the spread and development of the pandemic (Bento et al., 2020), the location of the cases nearest to their own living area, and the identification of close contacts (Cho, Ippolito, & Yu, 2020). However, the
relative effects of different information types (daily statistical vs. detailed case information) on citizens’ psychological states and behaviours are largely neglected. Our results suggest that detailed case information about confirmed patients can increase urban citizens’ preventive behaviours without increasing the level of panic compared to that caused by daily statistical information. This is especially true for citizens in non-core areas of the pandemic. These findings offer researchers new perspectives to understand the effects of pandemic information. In addition, our research provides empirical evidence on a hot topic – how detailed pandemic information should be disclosed (Zastrow, 2020) – that has been debated fiercely by scholars in the academic community.

Second, this research contributes to information management during pandemics by deepening researchers’ understanding of the impacts of social media when releasing pandemic information through a comparison of the relative effects of official and unofficial media. Although the effects of social media on information release during crises have been widely explored by researchers and administrators (Hayes & Kelly, 2018), whether official social media information sources play a more positive role in pandemic management is unclear. This research confirmed that official social media played a more positive role in the COVID-19 pandemic because information released through these official accounts was associated with less panic than unofficial accounts.

Third, this research also contributes to pandemic management by comparing the different psychological and behavioural reactions of citizens in different areas (core vs. non-core pandemic areas). Previous researchers well explored the general populations’ psychological and behavioural responses during the initial stage of the COVID-19 (Wang et al., 2020). However, citizens from areas with different epidemic levels are likely to have different perceptions and protective behaviours on the associated factors. In this research, our findings confirmed the above argument by highlighting that urban citizens living in the epicentre of this pandemic (i.e., Wuhan) could report different panic and preventive behaviours reactions with those in non-core areas to associated factors. Especially, detailed case information had higher impacts than daily statistical information on preventive behaviours for urban citizens in non-core pandemic areas but not for citizens in the centre of the devastated area. This finding is in line with a typical phenomenon called “Psychological Typhoon Eye”, which refers to that the psychological or behavioural reactions of residents in the central area where disasters occur are calmer than those outside the central area (Li et al., 2010).

Fourth, this research also contributes to urban management during pandemics. Many studies have explored the factors that can influence individuals’ panic and preventive behaviours during the COVID-19 pandemic, focusing on university students (Tang, Hu, Yang, & Xu, 2020) and general citizens (Kamenidou, Stavrianea, & Liava, 2020). However, few studies focused on urban citizens. In the new digital era, the use of social media, such as Weibo and WeChat, is a new practice in urban management in China (Wang & Medaglia, 2017; Yang, 2017). Our findings confirmed that official social media and their released information types can be used to manage urban citizens’ panic and preventive behaviours during pandemics and offer guidance for cities across the world to create healthy environments.

5.2. Takeaway for practices

To achieve better urban management during pandemics, the following takeaway for practices is suggested to city-level governments across the world based on the research findings.

1) The government needs to establish its own official accounts on mainstream media platforms and increase its influence.

Owing to the positive role of official social media in reducing urban citizens’ panic, the government that has no official social media needs to initiate collaborative projects on open information using external social media platforms (such as WeChat and Weibo in China or Twitter and Facebook in Western countries), following the suggestions of Wang and Medaglia (2017). Governments that have already established official social media should devote more time and energy to building and developing official social media and expanding the influence of their accounts. Furthermore, urban administrators should make efforts to manage unofficial social media accounts, especially those that post misinformation, and to identify and correct false information on social media platforms (Chou et al., 2021).

2) The government can release various types of pandemic information to urban citizens but should pay attention to the frequency.

Given the different impacts of different pandemic information types, the government, especially in non-core pandemic areas, should promptly disclose detailed case information to improve urban citizens’ preventive behaviours. Considering that vaccines for COVID-19 have not yet been applied widely, preventive measures might be the best way for the general public to protect against COVID-19 (Adhikari et al., 2020). Therefore, our findings provide implications for urban governments to report real-time case information during pandemics to increase preventive behaviours (Huang, 2004).

However, the results of this study also provide guidance to the government and urban citizens concerning the frequency with which they report or search for information. Our findings confirmed that excessive attention to information concerning disasters could cause greater panic (MacLeod, Mathews, & Tata, 1986) and increase the public’s preventive behaviours in response to disaster (Hirano, Kishi, Narupiti, Chooccharukul, & Nakatsuji, 2014). Therefore, in unnecessary cases, the government should avoid releasing epidemic information excessively or repeatedly.

3) When the government manages the panic and preventive behaviours of urban citizens, the local epidemic level and the local citizens’ individual differences need to be considered.

Our findings revealed other factors that influence people’s panic levels and preventive behaviours during the COVID-19 pandemic and discovered their heterogeneous or homogeneous effects. Regarding heterogeneous factors, such as gender, Wuhan and non-Wuhan urban citizens responded to them differently. For example, female urban citizens in non-Wuhan areas had higher levels of panic and preventive behaviours than male citizens. However, there were no significant differences among male and female urban citizens in the core area of the pandemic (i.e., Wuhan). With regard to homogeneous factors, such as collectivism, both Wuhan and non-Wuhan urban citizens showed similar reactions to them. For example, urban citizens who have a higher level of collectivism showed a lower degree of panic and a higher level of preventive behaviours. These findings suggest that the government should consider differences in mentality and demographic characteristics among individuals in different areas with different epidemic levels to avoid panic and improve preventive behaviours. For example, the local governments of non-core areas of the pandemic can provide necessary psychological counselling to their female residents (Zhu, Wu, Miao, & Li, 2008) living in communities with confirmed patients. Additionally, male urban citizens in non-core areas showed lower levels of preventive behaviours than female citizens in these areas. The government can further rely on other technologies, such as big data analysis (Fung, Tse, & Fu, 2015), to track male urban citizens and provide timely reminders of self-protection when they leave or return home, such as sending an SMS, which has proven to be helpful in public health management (Revere, Calhoun, Baseman, & Oberle, 2015).

5.3. Limitations and future research

Some limitations that should be addressed by future research should
be discussed. First, cross-sectional data cannot reflect the dynamic nature of citizens’ psychological states and preventive behaviours during the pandemic and might fail to reflect the causal relationship between variables. Therefore, future research should use longitudinal studies and pay attention to the dynamic changes of public psychological states and behaviours to further test the causal relationship between variables. Second, because snowball sampling strategy is not a random sample selection method, the current study sample has possible limitations in the representativeness of the general population. Although we ruled out the potential influences of sociodemographic factors in the data analysis process, more rigorous sampling methods (e.g., stratified random sampling) are encouraged to be used in future studies to improve the representativeness of the sample.

Moreover, the small R-squared of regression results implied that some powerful predictors of urban citizens’ panic and preventive behaviours could have been omitted in this research. We suggest that future researchers explore more potential influential factors in citizens’ panic and preventive behaviours to build a more comprehensive model and compare the findings with ours. Last, this study focused on different types of information released by social media. However, during the COVID-19 pandemic, the public has been surrounded by information published by various sources, for example, mass media, scientists, and rumours. Future research can reveal the different effects of information from various sources on the public’s psychological states and behaviours. In this way, the relative competitiveness of official social media can be revealed.

6. Conclusion

Concerning the COVID-19 pandemic, major issues that need to be addressed are whether different pandemic information types and social media information sources have different effects on panic levels and preventive behaviours of urban citizens living in areas with different epidemic levels. This study, by investigating the relationships among pandemic information type and sources, urban citizens’ panic, and their preventive behaviours, revealed that detailed case information, such as activity tracks, does not cause higher levels of panic among citizens but could increase preventive behaviours of citizens in non-Wuhan areas. Additionally, this study confirmed that official social media as information sources for urban citizens in the COVID-19 pandemic can reduce panic levels. These findings provide significant evidence-based support for governments to disclose real-time case information through official social media during this pandemic. This study also offered measures that the government or urban citizens can apply to reduce panic levels and increase preventive behaviours.

CRediT authorship contribution statement

Guobin Wu: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. Xiaopeng Deng: Conceptualization, Investigation. Bingsheng Liu: Conceptualization, Investigation, Supervision, Funding acquisition.

Declaration of competing interest

None.

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Appendix A. Questionnaire

Questionnaire of this article can be found online at https://doi.org/10.1016/j.cities.2021.103490.

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