



Trust in government buffers the negative effect of rumor exposure on people's emotions

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Abstract

Although we are surrounded by various kinds of rumors during the coronavirus disease pandemic, little is known about their primary content, what effect they might have on our emotions, and the potential factors that may buffer their effect. Combining qualitative (study 1 extracted 1907 rumors from top rumor-refuting websites using the Python Web Crawler and conducted content analysis) and quantitative (study 2 conducted an online survey adopting a three-wave design, $N=444$) research methods, the current study revealed that government-related rumors accounted for the largest proportion of rumors during the outbreak stage of the pandemic and were positively associated with the public's negative emotions. We also found that trust in government negatively moderated the relationship between government-related rumors and negative emotions. Specifically, when people had low trust in government, exposure to government-related rumors was positively associated with negative emotions. However, when people had high trust in government, the association was non-significant. For positive emotions, we found no significant effects of government-related rumors. The findings highlight the importance of rumor control during public emergencies and cultivating public trust in government in the long run.

Keywords Rumors · Trust in government · Negative emotions · Positive emotions

Introduction

The pandemic broke out in December 2019 and was declared a public health emergency of international concern (WHO, 2020a). The virus officially infected over 546 million people in 205 countries and territories and claimed more than 6.39 million lives (as of Jun 24th, 2022; Outbreak. MY., 2022). The pandemic has also created the largest global recession since the Great Depression, with approximately 100 million people falling into extreme poverty, further accelerating the rise of social inequities (Bacher-Hicks et al., 2021; Blundell et al., 2020). During the pandemic, rumors, i.e., unverified information, have propagated quickly and widely (Cheng et al., 2021; Pennycook et al., 2020).

Pandemic-related rumors are believed to be as dangerous as the virus itself (Sibley et al., 2020). The spread of pandemic-related rumors may mislead individual's healthy behaviors and lead to wrong practices that increase the spread of the virus and impact physical and mental health among the public (Pian et al., 2021; Tasnim et al., 2020). Rumors can further intensify vicious conflicts among individuals and groups, which could result in exacerbation of xenophobia and induce racial discrimination (DiFonzo et al., 1994; Sibley et al., 2020). In addition, rumors even have been found to be detrimental to the national economy, national security, and overall public health (Rosnow, 1991; Suls & Goodkin, 1994). As the WHO Director-General said at the 2020 Munich Security Conference on 15 February 2020, "We're not just fighting an epidemic; we're fighting an infodemic."

Most studies on rumors during COVID-19 focused on the precedents (Luo et al., 2021; Pennycook et al., 2020) and the negative consequences of rumor generating and spreading (Tasnim et al., 2020; Pian et al., 2021). In addition, extant literature generally treats rumors about the COVID-19 as a whole without categorizing rumors into different types. Recognizing the dominant types of rumors and detecting potential factors that could buffer the negative effects of

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different type of rumors might be a rather plausible avenue to fight against the numerous rumors during the pandemic.

The current research aims to explore the content of rumors during the pandemic and explore whether the majority are government-related. Then, we focus on government-related rumors and aim to explore the negativity induced by government-related rumors on emotions and the potential ameliorating effect of trust in government. Rumors are usually about issues that are personally relevant and important (DiFonzo & Bordia, 2000; Nekmat & Kong, 2019). Governments' responses and actions taken during crises generally have a far-reaching influence on the public. For example, are they going to shut down the city? If yes, what will they do to ensure the supply of commodities in the city? Answers to these questions are important and relevant to all city dwellers. This is why the public often raises concerns about what governments are going to do when a major crisis occurs. However, information about governments' action normally reaches the public at a speed far slower than expected. As a result, government-related rumors tend to be widely disseminated among the public and may account for the main share among rumors during the pandemic. Rumors were generally found to negatively affect emotions (DiFonzo & Bordia, 2007; Jones et al., 2017). Accordingly, we assumed that exposure to government-related rumors should have a negative impact on the public's emotions during the pandemic. However, since trust affects individuals' interpretation of others' unclear actions (Dirks & Ferrin, 2001), we assumed that the relationship between exposure to government-related rumors and the public's emotions might be moderated by the degree of public trust in the government.

In summary, the current study has two main purposes. First, we are interested in exploring what rumors during the pandemic are about and determining whether rumors targeting the government account for the main share. Second, we aim to explore how exposure to government-related rumors is associated with the public's negative emotions and positive emotions and whether trust in government moderates these associations. We analyzed rumors from top rumor-refuting websites and tested the hypotheses using a general population sample.

Literature review

Rumors and government-related rumors

Rumors are defined as widespread but unverified statements regarding information of current concern (DiFonzo & Bordia, 2007; Knapp, 1944). To theorize the generation of rumors, Allport and Postman (1947) proposed the basic law of rumor: R (rumor intensity) = I (importance) \times A (ambiguity), which means that the amount of rumors depends on the

importance of the subject to the individuals and the ambiguity of the evidence pertaining to the topic. When important issues are ambiguous, people feel out of control and are motivated to reduce ambiguity for the purpose of restoring the sense of control over the situation. However, when there is a lack of information from credible channels, people will turn to informal channels, where rumors are frequently generated (DiFonzo & Bordia, 2007). In general, the more important the more ambiguous issues are, related rumors are more likely to be generated and spread (Allport & Postman, 1947).

According to the basic law of rumor (Allport & Postman, 1947), among all pandemic-related rumors, we expected that a large number of rumors should be related to governments. On the one hand, government's actions are important to the public during the COVID-19 pandemic. The COVID-19 pandemic is an acute public health event, which immediately threatens public health (WHO, 2020b). In addition to being a health problem, the pandemic also hampers economic development through limiting peoples' economic activities and damages social stability by provoking social conflicts. During the acute public health events, governments have the responsibility to safeguard the public's life and health, maintain economic development and restore social stability, all of which could not be done by any other organizations (Rosenthal & Kouzmin, 1997). During some pandemics in human history, such as African swine fever (ASF) and severe acute respiratory syndrome (SARS) in China, governments played a key role handling these emergencies (Ding & Wang, 2020). Given the irreplaceable role of government during public crisis, people are particularly concerned about what governments will do to overcome the COVID-19 pandemic.

On the other hand, prompt action is sometimes difficult for governments to take during the pandemic due to its inherent complexity and ambiguity. For example, the sources of the virus were hard to trace and the potential course of the disease were hard to predict. Under such complex situations, it takes time for governments to obtain information from multiple sources, negotiate the interests of different groups, and weigh the pros and cons of different measures before they make a final decision and take actions. Moreover, in some cases, even if decisions have already been made, governments still have to wait until the last minute to announce them for security reasons (Knapp, 1944). Therefore, in a crisis, reliable real-time information about government's action is generally unavailable to the public.

Combining the above two aspects together, when a situation is of high importance to the public while there is a shortage of authoritative information, rumors are likely to be generated and spread, which can be seen as a collective effort to explain the situation (Fine, 2007). Given the crucial role governments are expected to play during public crises and the difficulty for governments to make immediate

decisions and provide instant solutions, government-related rumors are likely to emerge and to be widely circulated among the public. Thus, we come up with the proposition that government-related rumors may constitute one of the largest shares of rumors during the pandemic.

Negative and positive emotions

Emotions are the central part of people's lives (Nezlek & Kuppens, 2008). Theories of emotional appraisal suggest that our evaluation of events determines whether we generate emotions and what specific emotions we generate (Parrott, 2002). Negative emotions (e.g., fear, sadness, anxiety, etc.) usually result from negative appraisal (Parrott, 2002). It may be that one's happiness is threatened, one has to give up his goal, one's future is hopeless and so on. In contrast, positive emotions (e.g., happiness, relief, hope, etc.) usually result from positive appraisals (Parrott, 2002). It may be that one's goal is completed, one's problem is solved, one's future is hopeful and so on. The danger and uncertainty of the disease may cause people to make negative appraisals in the face of this crisis, which in turn generate negative emotions and decrease positive emotions. Researchers have found that since the onset of the pandemic, people have indeed shown more negative emotions and less positive emotions (Li et al., 2020; Shi et al., 2020).

Emotions can not only reflect an individual's appraisal of the current states but also may affect people's decision about how to allocate his or her mental and physical resources (Oatley & Jenkins, 1992). Negative emotions may reduce people's immune function (Kiecolt-Glaser et al., 2002) and disrupt the balance of their normal physiological mechanisms, such as increasing people's autonomic nervous systems, producing increases in heart rate, vasoconstriction, and blood pressure (Fredrickson et al., 2000b, 2003; Gross et al., 1994; Levenson et al., 1990). In contrast, experiments have shown that positive emotions can quell or undo the lingering cardiovascular effects of negative emotions. That is, positive emotions produce faster returns to baseline levels of cardiovascular activation following the arousal of negative emotions (Fredrickson et al., 2000a; Fredrickson et al., 2003; Fredrickson & Levenson, 1998). A study conducted during the H1N1 influenza outbreak showed that positive emotions could improve disease management behaviors (Kim & Niederdeppe, 2013). Therefore, it is essential to understand what may influence people's emotions and possible mitigating factors during the pandemic.

In a crisis situation, although rumors were generated to express collective concerns, exposure to oceans of unverified information tended to make people crazy and have a negative impact on people's emotions (Jones et al., 2016). During the epidemic period, rumors may affect people's emotions in many ways. First, the widely disseminated rumors,

regardless of truthfulness, repeatedly exposed people to information about the epidemic. This information usually makes it easy for people to think about the pain and threats that the epidemic brings to people around them and to society as a whole. Repeated exposure to event-related pain can lead to more negative emotions (Holman et al., 2014; Jones et al., 2016).

Second, although the content of rumors is not always negative, the number of negative rumors is far greater than the number of positive rumors (Bordia et al., 2006; DiFonzo et al., 2012; Al-Zaman et al., 2020), and people generally pay more attention to negative rumors due to the tendency of negative bias (Baumeister et al., 2001). In addition, studies have suggested that negative rumors are more likely to be spread to more people (Guadagno et al., 2013; MacLeod & Mathews, 2012; Zhang & Qu, 2020) and usually arouse fear, anxiety and uncertainty among the public.

Third, even if there are some positive rumors, they may also result in negative emotions. Positive rumors could be divided into two groups, i.e., the positive rumors that are latter proven to be false and the positive rumors that are latter proven to be true. In the first situation, false hope can bring up sad emotions when hope is shattered. For example, a rumor claiming that "public schools will come back on March 1st" implies that the epidemic would soon be brought under control. However, when the day came but the schools were still closed, people were disappointed and even depressed. If such kind of dream-breaking happens again and again, it may also damage people's optimism about the future. Later, people will become more and more skeptical. It is difficult to feel happy when people hear a positive rumor because of their constant concern about the authenticity of the rumors, even if those rumors are suggesting something good will happen. In addition, since these positive rumors are not true, contradictory information might exist, which might increase people's doubts and decrease the possibility that they feel happy about the rumors.

In the second situation, when positive rumors turn out to be true, people could experience positive emotions from them. However, as mentioned earlier, people gradually tend to refrain from believing these positive rumors before they were officially confirmed. Since positive rumors only account for a small percentage (Bordia et al., 2006; DiFonzo et al., 2012; Al-Zaman et al., 2020) and even fewer of them are true, the limited positive effects of these true positive rumors on people's emotions may be overshadowed by the negative effect of many negative rumors and the possibility that the positive rumors are not true. Therefore, the influence of rumors on people's emotions is still dominated by negative effects.

In addition, in large-scale crisis events, since government actions are the focus of public concern (Sibley et al., 2020), people will pay more attention to and give more weight to

government-related information. It is reasonable to expect that the above mentioned negative effect of rumors on emotions will be amplified in the case of government-related rumors. Based on the above argumentation, the current study proposed the following hypothesis:

Hypothesis 1a: Exposure to government-related rumors is positively related to people's negative emotions.

Hypothesis 1b: Exposure to government-related rumors is negatively related to people's positive emotions.

Trust in government

Trust is defined as “an individual's belief in and willingness to act on the basis of the words, actions, and decisions of another” (Lewicki & Wiethoff, 2006). It is an expectation of the benign nature of others' actions (Kramer, 1999). Two types of trust are usually distinguished: interpersonal trust and institutional trust (Jovanović, 2016). Institutional trust is concerned with trust in the formal system, and trust in government is a typical kind of institutional trust.

Trust is determined by one's life experience (Lewicki & Wiethoff, 2006). The public's trust in the government is largely developed based on their interactions with government agencies (Newton et al., 2018). People will be more motivated to trust these institutions if they feel that these institutions have cared about their interests and well-being in their past experiences (Bradford et al., 2016). For example, people may find a certain section of road in their community is in disrepair and often accumulates water after raining. After reporting the issue to the transportation department, people found that the government agency responded timely and reconstructed the road quickly. Such a positive interaction and experience will encourage individuals believe that the government cares about them. With the accumulation of such positive experiences, people will gradually develop trust in the government.

Trust built based on past experience within a given relationship guides one's interpretation of the trustee's actions (Dirks & Ferrin, 2001). When the trustees' behavioral intention is hard to discern, a high level of trust helps people interpret the behaviors as benign, while a low level of trust may make people interpret those behaviors as malicious. Since rumors are unverified information, people with low trust in the government may tend to interpret this ambiguous information from an anti-government perspective based on their previous experience with the government. As a result, exposure to government-related rumors is likely to dampen their spirits, that is, increase their negative emotions and decrease their positive emotions. Low trust in government may strengthen the negative influence of government-related rumors on people's emotions. However, things might be different for those who hold a high level of trust in the

government. People with strong trust in the government may choose to ignore anti-government information because this information is not in line with their previous experiences of interacting with the government. They also tend to interpret ambiguous information from a pro-government perspective. Thus, it is reasonable to expect that trust in the government will offset the negative influence of government-related rumors on people's emotions to some extent. Based on the above argumentation, the current study proposed the following hypothesis:

Hypothesis 2a: Trust in government plays a moderating role in the relationship between exposure to government-related rumors and people's negative emotions. Specifically, when trust in government is low, exposure to government-related rumors is positively associated with people's negative emotions, while when trust in government is high, the positive association between exposure to government-related rumors and people's negative emotions is weakened.

Hypothesis 2b: Trust in government plays a moderating role in the relationship between exposure to government-related rumors and people's positive emotions. Specifically, when trust in government is low, exposure to government-related rumors is negatively associated with people's positive emotions, while when trust in government is high, the negative association between exposure to government-related rumors and people's positive emotions is weakened.

The present research

To explore our proposition about government-related rumors, in study 1 we constructed a highly representative rumor pool during the pandemic and conducted content analysis by coding rumors based on their targets. To assess hypotheses 1a, 1b, 2a and 2b, study 2 adopted a three-wave design and collected data on trust in government, people's frequency of exposure to government-related rumors, and negative and positive emotions three times. The study was reviewed and approved by the Academic Ethics Committee at the first author's institution before being conducted.

Study 1

The purpose of study 1 is to investigate the main target of rumors circulating during the pandemic. We gathered rumors extracted from top rumor-refuting websites using the Python Web Crawler. In this way, the representativeness of rumors we collected was guaranteed. This is also important for the external validity of the study (Malterud, 2001). A content analysis was conducted on the pool of rumors, and

the frequency of each coded category was obtained. Two coders coded the rumors independently. Coding categories were not specified in advance but were developed during the analysis process because of the explorative nature of the study.

Method

Data collection

Study 1 used Python Web Crawler to extract rumors from China's popular rumor-refuting websites, including DXY (<https://search.dxy.cn/?words=谣言>), one of the largest online physician communities; the "fact checking" platform (<https://vp.fact.qq.com/home>) operated by Tencent, one of the largest internet service providers with the largest number of registered users; the "Weibo Refutes Rumors" site (<https://weibo.com/weibopiyao>) operated by Sina Weibo, one of the largest social media platforms; and the Chinese Internet United Platform for Rumor-refuting (CIUPR) (www.piyao.org.cn) operated by Xinhua net, one of the most influential official internet media platforms of the national government. These four websites stand at the frontlines during the pandemic. They collected unconfirmed information that was widely spread among the public and provided rumor-refuting services for the public by verifying information from official channels (experts or authorities). These websites updated the pandemic-related rumors almost in real time during the crisis, so they can meet the purpose of the current study to collect as many representative pandemic-related rumors as possible.

Rumors collected from these websites were screened based on the following criteria: (1) the rumor dated from December 8, 2019 (the date of the discovery of the first known Chinese patient), to March 3, 2020 (the date the current study began collected data), mainly covering the most important period of the pandemic in the country; (2) the rumor involved something related to the pandemic. Initially, 2350 rumors were collected. Then, the dataset was manually organized and cleaned. After deleting duplicate cases, the final dataset consisted of 1907 rumors with 46,682 characters in total, among which 194 cases (10.17%) were from DXY, 421 cases (22.08%) were from the "fact checking" platform, 1197 cases (62.77%) were from the "Weibo Refutes Rumors" site, and 418 cases (21.92%) were from the CIUPR.¹ Further analysis was conducted on these 1907 rumors.

¹ The reason why the sum of the proportions is larger than 100% is because some rumors appeared on more than one website. Specifically, 17 rumors appeared on all four rumor-refuting websites, 51 appeared on three of them, 170 appeared on two of them, and 1669 appeared on only one of them.

Manual content analysis

We categorized these rumors based on their targets. The information provided by most rumors is always about some particular people, agency or other target (Knapp, 1944). For example, the rumor "the customs office of the local government detains face masks in the mail" was categorized as a government-related rumor because it is talking about the action of a government agency. When a rumor had multiple targets, it was classified into more than one category accordingly.

We coded the rumors following the procedures of qualitative content analysis (Mayring, 2000). First, two trained coders who are native speakers independently coded 10% of the cases in the dataset using NVivo 12.0. After that, the coders came together to resolve discrepancies. Based on intensive discussion, coding rules, including category definitions and coding instructions, were established. Based on the coding rules, the same two coders coded all rumors in the dataset independently to establish intercoder reliability. Any coding discrepancies found were discussed and resolved in the end.

Results

As shown in Table 1, the results of the content analysis suggested that rumors could be classified into 13 categories: domestic government, infected/suspected patient, coronavirus, service industry, general public, epidemic prevention equipment, hospital, social organization, celebrity, education, foreign government/institution, epidemic in general and other related diseases during the outbreak in the country. The category, an example, the intercoder reliability, and the number of rumors in each category are shown in Table 1. The intercoder reliability values were generally satisfactory.

The results suggested that the most dominant category is rumors targeting domestic government (553 cases, 29.00%), among which 515 cases (93.13%) target local governments, 27 cases (4.88%) target the central government, and 11 cases (1.99%) target the domestic government in general (unspecified). Thus, the result supported our proposition. In addition, rumors targeting infected/suspected patients ranked second and accounted for 27.27% of rumors. These results supported the argument that rumors reflect current concerns. Facing one of the most fatal and highly contagious viruses in human history, people are keen to learn what the government will do to prevent its further spread and protect the interests of the public. Because the actions of local governments are most relevant to one's personal interests, rumors about local government are the most popular category. The results highlighted the importance of focusing on government-related rumors and exploring their potential outcomes.

Table 1 Name, example, intercoder reliability, and quantity of each rumor category

Category	Example	Intercoder reliability	Number (Percentage)
Domestic Government	The customs office of the local government detains face masks in mail.	0.95	553(29.00%)
Infected/suspected Patient	A suspected coronavirus case was found in Huangshan.	0.94	520(27.27%)
Coronavirus	The disease can be spread via feces.	0.98	296(15.52%)
Service Industry	Gas supply is limited in some districts of Chongqing.	0.79	223(11.69%)
General Public	A resident in Pudong district sprayed everything in their house with alcohol and a naked gas flame ignited the house.	0.83	139(7.29%)
Epidemic Prevention Equipment	N95 face masks are effective for about four hours.	0.82	119(6.24%)
Hospital	People can get free masks in 49 hospitals in Shenzhen.	0.96	116(6.08%)
Social Organization	Wuhan Red Cross charges service fees.	0.86	72(3.78%)
Celebrity	The Cambodian prime minister Hun Sen has contracted the coronavirus.	0.87	55(2.88%)
Education	Mianyang middle school in Sichuan province will be open on February 19.	1.00	41(2.15%)
Foreign Government/Institution	Japan has dispatched a team with 1000 care staff to Wuhan.	0.83	29(1.52%)
Epidemic in General	The pandemic outbreaks in Shanghai.	0.86	21(1.10%)
Other Related Disease	SARS-Cov has not vanished and has been parasitizing in bats.	0.82	19(1.00%)

Study 2

Based on the results of study 1, study 2 focused on government-related rumors and explored the relationship between exposure to government-related rumors and people's negative and positive emotions (hypotheses 1a and 1b) and the possible moderating role of trust in government (hypotheses 2a and 2b) during the pandemic. To examine hypotheses 1a, 1b, 2a and 2b, we adopted a three-wave design in study 2. Trust in government, the frequency of exposure to government-related rumors, and participants' negative and positive emotions were measured in each wave.

Method

Participants and procedure

We tested our hypothesis in a Chinese sample that was heterogeneous in terms of gender, age, education, and income level. Participants were recruited via a paid research participation system (www.credamo.com), a reliable data collection platform similar to Amazon Mechanical Turk. Respondents participated in the three-wave online survey. We started recruitment in March 2020 during the pandemic. Ten days after completion of the first wave of questionnaires, the same group of participants was automatically invited by the system to complete the second wave of questionnaires, and the third wave was completed ten days later. In all sessions, the questionnaires were presented online in a password-protected environment. All participants confirmed their consent to participate and were debriefed and paid 8 RMB online each time.

Among the 500 participants who completed the first wave of questionnaires, 453 completed all three waves (response rate = 90.60%). In addition, 4 participants were excluded because they did not pass the attention check. Prior to analyses, all variables were screened for outliers to prevent possible statistical assumption violations (Meyers et al., 2016). Using R-4.0.3, the boxplot identified 42 major outliers (3 interquartile ranges outside the central box) on the variable scores among 1347 observations (3.12%). After deleting those outliers, the final data comprised 1305 observations within 444 participants (250 males), which included a wide range of age groups ($M = 28.75$ years, $SD = 5.63$ years, range = 16–51 years). During the pandemic, 285 participants lived in urban areas (64.19%), 90 lived in towns (20.27%), and 69 lived in rural areas (15.54%). Among all participants, 181 indicated that they were unmarried (40.77%), and 263 were married (59.23%); 29 attended high school or below (6.53%), 79 attended junior college (17.79%), 301 attended college or university (67.79%), and 35 attended postgraduate education or above (7.89%). Self-reported monthly income ranged between no monthly income ($n = 4$) and 150,000 RMB ($M = 7292.16$ RMB, $SD = 9858.09$ RMB).

Measures

Participants' scores on each scale were computed by averaging across items, with higher scores representing higher levels of the construct being assessed.

Trust in government Participants were asked, "To what extent do you trust the local government?" and "To what extent do you trust the central government?" ($r = 0.80$ for wave 1, $r = 0.83$ for wave 2, $r = 0.83$ for wave 3). The items

were rated using a 7-point scale ranging from 1 (not at all) to 7 (very much).

Frequency of exposure to government-related rumors Two items ($r=0.79$ for wave 1, $r=0.86$ for wave 2, $r=0.90$ for wave 3) were used to measure the perceived frequency of exposure to government-related rumors. Participants were instructed, “Please recall the unverified information you have heard about during the pandemic (wave 1).” In waves 2 and 3, the instruction changed to “Please recall the unverified information you have heard about since last survey you took approximately 10 days ago”. Then, they were asked, “How often did you hear such information about the local government of your residence?” and “How often did you hear such information about the central government?” The items were rated using a 7-point scale ranging from 1 (seldom) to 7 (very often).

Negative and positive emotions The two kinds of emotions were measured using the Chinese positive and negative affect scale (Chen & Zhang, 2004), which was adapted from Bradburn (1969). The scale consists of 14 items with two dimensions: negative emotions (6 items, e.g., “feel restless”, $\alpha=0.87$ for wave 1, $\alpha=0.91$ for wave 2, and $\alpha=0.90$ for wave 3) and positive emotions (8 items, e.g., “feel happy”, $\alpha=0.91$ for wave 1, $\alpha=0.92$ for wave 2, and $\alpha=0.92$ for wave 3). Participants were instructed, “Please rate your feelings in general since the outbreak of the COVID-19 (wave 1).” In waves 2 and 3, the instruction changed to “Please rate your feelings in general since your participation in the study 10 days ago”. The items were rated using a 7-point scale from 1 (strongly disagree) to 7 (strongly agree).

Control variables Following previous studies on emotions (for a comprehensive review, see Diener, 2009), we included the following demographic variables that could influence emotions as control variables: gender (female = 0; male = 1), age, marital status (unmarried = 0, married = 1), education level (high school or below = 1, junior college = 2, college or university = 3, postgraduate education or above = 4), monthly income, and residence area during the pandemic (urban area = 1, town = 2, rural area = 3).

Results

Analytic strategy

As the present study focused on a multilevel main and moderation effect, hierarchical linear modeling (HLM) was applied to test our hypotheses. We conceptualized our data as a hierarchical data structure with measurements (level 1) being nested in individuals (level 2). Before assessing the main and moderation effects, predictor variables at Level 1

(trust in government and exposure to government-related rumors) were group-mean centered (Enders & Tofighi, 2007). In addition, to assess whether there was a need to account for random intercepts or slopes in our data, we compared the fit of random intercept and random slopes models by the log-likelihood ratio test (LRT) to examine if the difference between the models’ fit was significant (Vuong, 1989). The non-significant result of the LRT suggests that the simpler random intercept model is sufficient. Otherwise, the random slope model is necessary.

Descriptive statistics

Table 2 presents the means, standard deviations, and correlations among the variables. There was a stable positive relationship between exposure to government-related rumors and negative emotions within each of the three waves. However, exposure to government-related rumors was significantly and positively related to positive emotions in Wave 3, and the relations between these two variables were all non-significant in other waves.

Hypothesis testing

The results of a series of hierarchical linear models are shown in Table 3. The ICC for the model when the outcome variable is negative emotions is 0.67, while the ICC for the model when the outcome is positive emotions is 0.72. These results indicated that HLM is an appropriate method to explore our hypotheses (Nezlek, 2011).

We used the random intercept in Model 2 in Table 3 due to the non-significant result of the LRT ($\chi^2(2)=5.73$, $p=0.057$). The results for Model 2 in Table 3 indicated that exposure to government-related rumors was positively related to negative emotions ($b=0.08$, $SE=0.02$, $p<.001$) after controlling for gender, age, marital status, education level, monthly income and residence during the pandemic. Hypothesis 1a was supported. We used the random intercept in Model 3 in Table 3 due to the non-significant result of the LRT ($\chi^2(2)=5.19$, $p=0.075$). The results for Model 3 in Table 3 suggested that after controlling for gender, age, marital status, education level, monthly income, residence during the pandemic, exposure to government-related rumors and trust in government, the interaction term “exposure to government-related rumors \times trust in government” was significantly related to negative emotions ($b=-0.19$, $SE=0.09$, $p=.041$). Hypothesis 2a was supported. To further examine this interaction, we plotted the simple slopes for participants who were ± 1 SD away from the mean of trust in government (see Fig. 1). As predicted, for people with low trust in government, the relationship between exposure to government-related rumors and negative emotions was positively significant ($b=0.14$, $SE=0.04$, $p<.001$). However, for people with

Table 2 Descriptive Statistics and Correlations among the Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1. Gender	-																		
2. Age	.04	-																	
3. Marital Status	-.04	-.65***	-																
4. Education Level	.01	.02	.01	-															
5. Monthly Income	-.01	.12*	-.18***	.13**	-														
6. Residence during the Pandemic	-.09	-.25***	.25***	-.24***	-.09	-													
7. Wave1 Trust in Government	-.05	.08	-.20***	-.07	.02	.06	-												
8. Wave2 Trust in Government	-.09	.11*	-.24***	-.00	.03	-.01	.74***	-											
9. Wave3 Trust in Government	-.06	.15**	-.23***	.03	.01	-.02	.72***	.79***	-										
10. Wave1 Rumor Exposure	-.10*	-.05	-.06	.05	-.10*	.05	.05	.05	.11*	-									
11. Wave2 Rumor Exposure	-.09	-.11*	.05	.03	-.10*	.10*	.01	.08	.09*	.62***	-								
12. Wave3 Rumor Exposure	-.05	-.09	.04	.02	-.11*	.09	.04	.10*	.13**	.59***	.80***	-							
13. Wave1 Negative Emotions	-.11*	-.17**	.25***	-.04	-.10*	.03	-.32***	-.30***	-.27***	.14**	.13*	.18**	-						
14. Wave2 Negative Emotions	-.11*	-.16**	.21***	.02	-.07	.05	-.28***	-.24***	-.27***	.07	.12*	.15**	.70***	-					
15. Wave3 Negative Emotions	-.05	-.15**	.20***	-.08	-.10*	.08	-.26***	-.28***	-.25***	.04	.10*	.12**	.63***	.72***	-				
16. Wave1 Positive Emotions	-.07	.03	-.17***	.04	.07	-.07	.44***	.43***	.42***	.07	.04	.05	-.56***	-.41***	-.40***	-			
17. Wave2 Positive Emotions	.01	.10*	-.19***	-.00	.06	-.01	.44***	.46***	.47***	.02	.05	.04	-.50***	-.54***	-.42***	.73***	-		
18. Wave3 Positive Emotions	-.02	.13**	-.25***	.05	.09	-.04	.49***	.50***	.56***	.07	.08	.10*	-.48***	-.53***	-.56***	.68***	.74***	-	
M	-	28.75	-	2.77	7292.16	1.51	6.20	6.20	6.16	4.77	4.49	4.33	3.03	2.73	2.67	5.29	5.41	5.43	-
SD	-	5.63	-	0.68	9858.09	0.75	0.80	0.81	0.81	1.61	1.74	1.84	1.16	1.17	1.15	0.91	0.88	0.84	-

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

Table 3 Hierarchical Linear Model Predicting the Negative Emotions

Variable	Model 1	Model 2	Model 3
Intercept	4.49*** (0.51)	4.49*** (0.51)	4.53*** (0.51)
Gender (control variable)	-0.21* (0.10)	-0.21* (0.10)	-0.21* (0.10)
Age (control variable)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Marital Status (control variable)	-0.47*** (0.13)	-0.47*** (0.13)	-0.47** (0.13)
Education Level (control variable)	-0.07 (0.07)	-0.07 (0.07)	-0.08 (0.07)
Monthly Income (control variable)	-0.06 (0.05)	-0.06 (0.05)	-0.06 (0.05)
Residence during the Pandemic (control variable)	-0.04 (0.07)	-0.04 (0.07)	-0.05 (0.07)
Exposure to Government-related Rumors (GR)	-	0.08*** (0.02)	0.08** (0.02)
Trust in Government (TG)	-	-	0.06 (0.06)
GR × TG	-	-	-0.19* (0.09)
R ²	0.062	0.065	0.067
ΔR ²	-	0.003	0.002

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

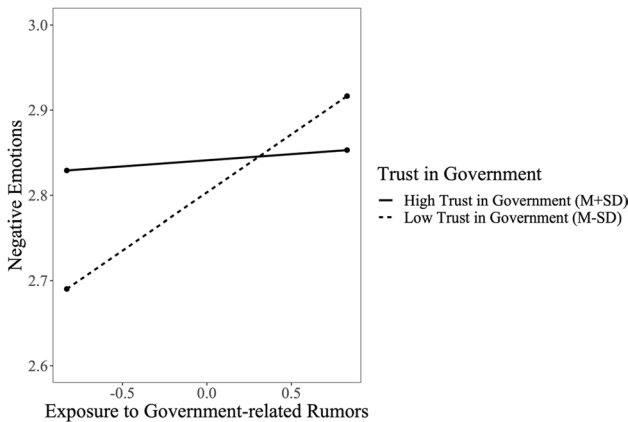


Fig. 1 Interaction effect of exposure to government-related rumors and trust in government on negative emotions

high trust in government, the relationship between exposure to government-related rumors and negative emotions was non-significant ($b = 0.02$, $SE = 0.04$, $p = .681$).

We used the random slope in Model 2 in Table 4 due to the significant result of the LRT ($\chi^2(2) = 21.46$, $p < 0.001$). The results for Model 2 in Table 4 indicated that the relationship between exposure to government-related rumors and positive emotions was non-significant ($b = 0.02$, $SE = 0.02$, $p = .291$) after controlling for gender, age, marital status, education level, monthly income and residence during the pandemic. Hypothesis 1b was not supported. We used the

random slope in Model 3 in Table 4 due to the significant result of the LRT ($\chi^2(2) = 21.00$, $p < 0.001$). The results for Model 3 in Table 4 suggested that after controlling for gender, age, marital status, education level, monthly income, residence during the pandemic, exposure to government-related rumors and trust in government, the relationship between the interaction term “exposure to government-related rumors × trust in government” and positive emotions was non-significant ($b = -0.04$, $SE = 0.07$, $p = .503$). Hypothesis 2b was not supported.

Discussion

Findings

The pandemic is a perfect storm for the spread of rumors because of its inherent uncertainty. Given the dearth of credible information, rumors spread quickly and widely. Although we are surrounded by various kinds of rumors every day, little is known about their main content, what effect they might have on our emotions, and the potential factors that would buffer their effect. Combining qualitative and quantitative research methods, study 1 discovered that nearly 30 % of rumors are about domestic government, which is the most dominant rumor category. Our proposition regarding the role of government-related rumors was supported. Study 2 focused on government-related rumors

Table 4 Hierarchical Linear Model Predicting the Positive Emotions

Variable	Model 1	Model 2	Model 3
Intercept	4.73 ^{***} (0.39)	4.73 ^{***} (0.39)	4.73 ^{***} (0.39)
Gender (control variable)	−0.04 (0.08)	−0.04 (0.08)	−0.04 (0.08)
Age (control variable)	−0.01 (0.01)	−0.01 (0.01)	−0.01 (0.01)
Marital Status (control variable)	0.46 ^{***} (0.10)	0.46 ^{***} (0.10)	0.46 ^{***} (0.10)
Education Level (control variable)	0.05 (0.06)	0.05 (0.06)	0.05 (0.06)
Monthly Income (control variable)	0.03 (0.04)	0.03 (0.04)	0.03 (0.04)
Residence during the Pandemic (control variable)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)
Exposure to Government-related Rumors (GR)	–	0.02 (0.02)	0.02 (0.02)
Trust in Government (TG)	–	–	0.11 ^{**} (0.04)
GR × TG	–	–	−0.04 (0.07)
R^2	0.049	0.049	0.051
ΔR^2	–	0.000	0.002

** $p < .01$, *** $p < .001$

during the pandemic and explored their effect on the public's negative and positive emotions. The results suggested that, generally, exposure to government-related rumors had a positive effect on people's negative emotions. Hypothesis 1a was supported. In addition, trust in government can negatively moderate the effects of exposure to government-related rumors on negative emotions. Specifically, for people with low trust in government, exposure to government-related rumors will bring higher negative emotions, while when people have high trust in government, such rumors are unharmed. Hypothesis 2a was supported. For positive emotions, the main effect of government-related rumor exposure and the moderation effect of trust in government were all non-significant. Hypotheses 1b and 2b were not supported.

Rumors reflect people's current concerns. Based on the results of the current study, rumors on domestic government ranked number one among all 13 categories, followed by rumors on infected/suspected patients and rumors on the coronavirus itself. Rumors falling into these three categories accounted for more than 70 % of the total number of rumors. These findings are consistent with the extant literature. For example, Sun et al. (2009) analyzed rumors collected after the Wenchuan Earthquake and revealed the two most popular types of rumors: rumors about domestic government and rumors about the earthquake itself. During a public crisis, the government has main responsibility to develop effective measures to fight the crisis, provide timely public services, coordinate limited resources, maintain the threatened social

order, and regulate unhealthy or unsafe individual behavior. Thus, people are concerned about what the government is going to do. Information about the government is helpful for the public to manage threats under uncertainty. However, such information is not always available quickly due to the complexity of dealing with pandemic and releasing authoritative information for the government. Fine (2007) argued that when specific issues incite high involvement from the public but authoritative information is insufficient, rumors corresponding to those issues become dominant.

Although exposure to government-related rumors has a harmful effect as far as the public's negative emotions are concerned, the moderating effect of trust in government suggests that people may interpret the same government-related rumor differently. As a result, exposure to these rumors has differential effects on their negative emotions. Specifically, when trust in government is low level, government-related rumors are positively associated with negative emotions, while when trust is high, the positive association becomes non-significant. That is, trust in government could buffer the negative effect of government-related rumors during the pandemic. Similarly, research has suggested that trust could alleviate the negative effect of the economic crisis on the public's mental health (Helliwell et al., 2013). Rumors are unverified information disseminated without confirmation or certainty. Trust could serve as a filter to screen the information around us. We believe only the information we want to believe and disregard all else. The results of the current

study suggested that trust is another important weapon to defend against rumors' erosion of our emotional health.

The results show that exposure to government-related rumors and interaction items of exposure to government-related rumors and trust in government can significantly affect negative emotions, but they have no significant effect on positive emotions. This may be because negative emotions and positive emotions are relatively independent. In fact, researchers have argued for a bivariate model of negative emotions and positive emotions (Cacioppo & Berntson, 1994; Watson & Tellegen, 1985). Consistent with the model, Viinikainen et al. (2010) found anatomical differences in mechanisms for processing positive and negative pictorial stimuli, which suggested that positive emotions and negative emotions can be activated independently. In addition, Goldstein and Strube (1994) found that students who received success feedback showed improvement in positive emotions but no change in negative emotions, while students who received failure feedback showed an increase in negative emotions but no change in positive emotions. It is possible that events with different valences were associated with the uncoupled activation of negative and positive emotions. Thus, it is natural to find that government-related rumors in general, as a negative stimulus, have a more pronounced effect on people's negative emotions rather than their positive emotions.

Implications of the current study

The findings of the current study have many important theoretical and practical implications. First, the present study is one of the first to categorize rumors during a pandemic based on rumors' targets, and we found that government is the key target of rumors during the public health crisis. Exploring rumors from this perspective is important because it shows the focus of rumor control policy. There might be a general misimpression that rumors during an epidemic are generally about the disease itself. Thus, rumor refutation generally focuses on the scientific aspect of the pandemic, including denying ineffective approaches to virus prevention or incorrect understandings of the origin of the virus and the principle of its spread (e.g., WHO, 2020b). The results of the current study suggest that rumors about the government are another important issue. Using multiple channels and deploying more resources to inform and communicate with the public about what the government is actually doing and why. These actions could decrease people's anxiety and give them some sense of control. In addition, based on the possible detrimental effect of government-related rumors on people's mental health, the government should make efforts to facilitate real-time monitoring of public opinion, which will allow rumors to be refuted in a timely manner.

In addition, the moderating role of trust in government suggested that those who have strong trust in the government seem to be immune to the detrimental effect of such rumors. Trust is built over time. The results of the current study emphasize the importance of building trust between the government and the public in the long run. Rumors seem inevitable during crises because there is always a gap between the strong desire to acquire related information and the dearth of credible information. The current study suggested that trust in the government is an important remedy to fight against rumors.

Limitations and future directions

The current study was conducted in China, a country with a unique cultural background and a government structure that is quite different from that of most Western countries (Seifert & Chung, 2008). During the process of COVID-19 prevention, the central government and the local governments played important roles by implementing many effective measures. However, the situation might be different in those countries where governments have relatively weak influence. Thus, additional studies conducted in countries with different cultural and political characteristics would be helpful to provide evidence of the generalizability of our findings.

Trust in government was measured by two items in the current study. One item for local government and another for central government. Using fewer items reduces the participants' response loadings, which may help researchers avoid the likelihood of missing data in a multi-wave design. Previous research has suggested that a single item is valid and reliable in regard to reflecting trust, such as the single trust question in the World Values Survey (Minkov, 2012). Future studies can further explore the different facets of trust. Researchers have proposed that trust contains three components: predictability, dependability and faith (Rempel et al., 1985). Future researchers can further analyze whether different components of trust in government will play different roles. More in-depth exploration will help governments design more targeted measures to cultivate public trust. In addition, other variables may also affect people's response to government-related rumors, such as whether people are sympathetic to the government or whether they share the same ideology with the government. If people voted for the governing party, they may view government action in a more positive way (Barros et al., 2020), and the significant association between exposure to government-related rumors and negative emotions may be weaker. Thus, the results of the current study could be affected by other variables such as ideology or sympathy with the government. Unfortunately, we did not measure these variables, which makes it impossible for us to control these variables in our analyses. Further

studies are encouraged to measure and control them to test the robustness of findings of the current study.

Conclusion

The current study revealed that government-related rumors accounted for the largest proportion of rumors during the pandemic and were positively associated with people's negative emotions during the crisis. In addition, the results supported the moderating role of trust in the government on the relationship between government-related rumors and the public's negative emotions. Specifically, when trust in the government is low, government-related rumors are positively associated with negative emotions, while when trust is high, the associations become non-significant. For positive emotions, we found no significant effects of either rumor exposure or the interaction terms of rumor exposure and trust in government. The findings highlight the importance of controlling government-related rumors during public health emergencies and the cultivation of public trust in the government in the long run.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s12144-022-03508-x>.

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Data availability Our data can be found in the Mendeley Data. DOI: <https://doi.org/10.17632/6tyd3g9cxn.2>

Declarations

Ethical approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards, and were approved by the Institutional Review Board of the Faculty of Psychology at the first author's institute.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflicts of interest.

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