Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Computers in Human Behavior 138 (2023) 107486

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Who spread COVID-19 (mis)information online? Differential informedness, psychological mechanisms, and intervention strategies☆,☆☆

Rui Wang *, Hongzhong Zhang

School of Journalism and Communication, Beijing Normal University, Beijing, China

ARTICLE INFO

Keywords:
Spread of information online
Misinformation
Informedness
Risk perception
Emotion
Motivation
Intervention
COVID-19

ABSTRACT

Based on a regional survey conducted in five cities of China (Beijing, Shanghai, Guangzhou, Chengdu, and Wuhan) in January 2020 and a national survey experiment conducted in 31 provinces of China in December 2020 during the COVID-19 pandemic, we investigated the intentions for the misinformed, uninformed, and informed individuals to spread COVID-19 related (mis)information online and the psychological factors affecting their distinct sharing behaviors. We found that (1) both misinformed and uninformed individuals were more likely to spread misinformation and less likely to share fact as compared with the informed ones; (2) the reasons for the misinformed individuals to spread misinformation resembled those for the informed ones to share truth, but the uninformed ones shared misinformation based on different motivations; and (3) information that arouses positive emotions were more likely to go viral than that arouses negative feelings in the context of COVID-19, regardless of facticity. The implications of these findings were discussed in terms of how people react to misinformation when coping with risk, and intervention strategies were proposed to combat COVID-19 or other types of misinformation in risk scenarios.

A well-functioning democracy demands its citizens to be well informed, yet the pessimistic reality reveals that the public is largely uninformed, or worse, misinformed, about almost every aspect of public affairs, from politics (e.g., Delli Carpini & Keeter, 1996; Grabe & Myrick, 2016) to science (e.g., Scheufele & Krause, 2019). In 2013, the World Economic Forum ranked the spread of misinformation online as one of the 10 most significant issues facing the world (WEF, 2013). The over-abundance of misinformation on the Internet and social media platforms contributes significantly to an individual becoming increasingly misinformed (see Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012). The outbreak of COVID-19 has aggravated the problem of online misinformation (e.g., Apuke & Omar, 2021; Hou et al., 2020). A comprehensive analysis of over 38 million English-language articles published in both traditional and online media around the world between January and May 2020 found that only 16.4% of the misinformation conversations were "fact-checking" in nature, implying that most COVID-19 misinformation was spread without question or correction (Evanega, Lynas, Adams, & Smolenyak, 2020).

The negative impacts of COVID-19 misinformation are two-fold. On the one hand, misinformed or uninformed individuals may have low risk perceptions about COVID-19 and turn to inadequate preventative measures, such as not wearing masks or not getting vaccinated. On the other hand, people may over-estimate COVID-19 risks, resulting in emotional distress and mental ill-beings (Han et al., 2021). WHO has called attention for a global "infodemic" which may undermine public health responses and jeopardize measures to control the pandemic.[1] Therefore, it is of great significance to understand who spread COVID-19 misinformation online and the psychological mechanisms behind it in order to effectively combat it.

The growing abundance of misinformation has drawn attentions of scholars from different fields to the study of misinformation dissemination (e.g., Kuklinski, Quirk, Jerit, Schweider, & Rich, 2000; Lewandowsky et al., 2012; Pennycook, McPhetres, Zhang, Lu, & Rand, 2020; Scheufele & Krause, 2019). A highly-cited study of more than 12,000

☆ Rui Wang is an Associate Professor at the School of Journalism and Communication of Beijing Normal University in China. Her research focuses on misinformation, public deliberation, and survey methodology.☆☆ Hongzhong Zhang is a Professor at the School of Journalism and Communication of Beijing Normal University in China. His research focuses on media credibility, misinformation, and social bots.

* Corresponding author. School of Journalism and Communication, Beijing Normal University, 19 Xinjiekou Outer Street, Haidian District, Beijing, 100875, China.
E-mail address: wrui@bnu.edu.cn (R. Wang).

[1] Joint statement by WHO, UN, UNICEF, UNDP, UNESCO, UNAIDS, ITU, UN Global Pulse, and IFRC, September 23, 2020, retrieved from: https://www.who.int/news/item/23-09-2020-managing-the-covid-19-infodemic-promoting-healthy-behaviours-and-mitigating-the-harm-from-misinformation-and-disinformation

https://doi.org/10.1016/j.chb.2022.107486
Received 24 February 2022; Received in revised form 4 July 2022; Accepted 10 September 2022
Available online 13 September 2022

news stories distributed on Twitter revealed that falsehood diffused significantly farther, faster, deeper, and more broadly than truth in all categories of information, and that it is because humans, not robots, are more likely to spread it (Vosoughi, Roy, & Aral, 2018). Why do laypeople spread misinformation and what drives them to do so? The existing scholarship of misinformation research has been predominated by the motivated reasoning approach in contexts of highly politicized information environment (e.g., Druckman & Bolsen, 2011; Kraft, Lodge, & Taber, 2015; Kunda, 1990; Schaffner & Roche, 2017). What are the intrinsic psychological mechanisms for people to spread misinformation in apolitical scenarios, and more, in a context of global health crisis? These are the fundamental questions calling for more investigation.

Pennycook et al. (2020) proposed an inattention-based account of misinformation sharing on social media and applied this explanation to the context of COVID-19 misinformation, an apolitical situation in which people are unlikely to be distracted by partisanship. They found that people shared COVID-19 misinformation partly because they failed to think sufficiently about the accuracy of the content before deciding what to share, and a simple accuracy reminder significantly improved the level of truth discernment in participants' subsequent sharing intentions. Their study had significant practical implications on combating COVID-19 misinformation; however, it failed to address some other important psychological factors that are also relevant to people's sharing intentions, such as the role of emotion, which has been highlighted by Lewandowsky et al. (2012) for deserving further research attention.

In addition, the line between being misinformed and uninformed has long been blurry in different literatures (see Scheufele & Krause, 2019). A few studies have noticed their differences (e.g., Kuklinski et al., 2000; Li & Wagner, 2020; van Kessel, Sajuria, & van Hauwaert, 2020), but none has paid attention to the differences in people's intentions and motivations to spread (mis)information in terms of their levels of informedness. In the current research, we differentiated the uninformed from the misinformed. Do uninformed individuals share misinformation the same likely as those misinformed? Do they share for similar or distinct motivations? These are questions yet to be answered.

Based on a regional survey (Study 1) conducted in January 2020 in five cities of China (Beijing, Shanghai, Guangzhou, Chengdu, and Wuhan) and a national survey experiment (Study 2) conducted in December 2020 in 31 provinces of China, the current research investigated people's intentions and psychological mechanisms to share (mis) information during the ongoing COVID-19 pandemic in the context of China. Inspired by the Differential Informedness Model (Li & Wagner, 2020), we examined whether misinformed, uninformed, and informed individuals were different in terms of their intentions to share (mis)information, and how psychological factors, such as risk perceptions, emotions, and motivations, affected sharing intentions of people with different levels of informedness. Both Study 1 and 2 investigated whether people with different levels of informedness would have different intentions to share (mis)information. Study 2 also explored the psychological factors affecting sharing intentions of people with different levels of informedness, as well as intervention strategies that can be implemented to combat online (mis)information. Theoretically, the current research provided new insights into our understanding of online (mis)information sharing, especially in risk scenarios. In terms of practical implications, it proposed effective preventative strategies to combat misinformation in the ongoing pandemic.

1. Theoretical background and hypotheses

1.1. Differential informedness and the intention to spread (mis) information

When considering levels of knowledge, people can be categorized into three types: (1) fully informed; (2) uninformed or ignorant, and (3) misinformed (e.g., Delli Carpini & Keeter, 1996; Kuklinski et al., 2000). The common method to measure levels of knowledge, such as political or science knowledge, is to ask survey respondents a brief battery of factual questions about either politics (e.g., Delli Carpini & Keeter, 1996) or science (e.g., National Science Board National Science Foundation, 2022).

The fully informed ones are those holding accurate beliefs about factual matters, identified by giving correct responses to factual questions in the survey. Being misinformed is often conceptualized as believing in incorrect or counterfactual claims that are not supported by clear evidence or expert opinions (e.g., Nyhan & Reifler, 2010; Scheufele & Krause, 2019), identified by giving incorrect survey responses to factual items. Despite of the debates about using "don't know" as an indicator of being "uninformed," research has shown that for closed-ended factual questions, those who answer "don't know" are truly ignorant of facts, rather than being informed but reluctant to reveal their knowledge (Luskin & Bullock, 2011). There have also been some conceptual debates about what it means to be "misinformed" as compared with "uninformed," but the line between the two has long been blurry. Being misinformed about science has sometimes been understood as both holding inaccurate beliefs and being uninformed about scientific facts and processes (see Scheufele & Krause, 2019 for a discussion).

Recent research began to pay attention to individuals with different levels of informedness and a few attempts have been made to distinguish the uninformed from the misinformed. For example, based on two national representative surveys, Pasek, Sood, and Krosnick (2015) found that Americans were often more uninformed than misinformed about Affordable Care Act. They suggested that researchers should distinguish between ignorance (lacking a correct belief on an issue) and misperception (holding an incorrect belief with confidence). Inspired by their work, Li and Wagner (2020) proposed a Model of Differential Informedness that distinguished three types of individuals, the uninformed, the misinformed, and the ambiguous. They also noted that the U.S. public was largely uninformed rather than misinformed about a wide range of factual claims; in addition, the uninformed individuals were more likely to update their beliefs than the misinformed after exposure to corrective information.

But in terms of spreading (mis)information, there is little empirical evidence suggesting that the uninformed individuals would act the same as the misinformed ones. Research has suggested that people more likely to spread misinformation were those who believed it likely to be true (Buchanan, 2020). In that sense, the misinformed ones would be the main force of spreading misinformation. But do we need to also worry about those uninformed? Intuitively, they would be less likely to spread (mis)information than the misinformed ones because they are ignorant or not interested. Based on these speculations, we hypothesize that:

H1. Misinformation is to be shared most likely by the misinformed individuals, then by the uninformed ones, and least likely by the informed ones.

1.2. Psychological mechanisms of (mis)information sharing

What are the intrinsic psychological mechanisms for people to spread misinformation, especially in risk scenarios like the COVID-19 pandemic? In the current research, we examined how risk perceptions, emotions, and motivations affected people's intentions to spread (mis) information online and how these psychological factors showed different effects on people with different levels of informedness.

1.2.1. Risk perceptions and (mis)information sharing as a coping strategy

Research following a psychometric paradigm suggests that people's risk perception can be characterized along two psychological dimensions: the "dread" risk, as defined by the extent of perceived lack of control, feelings of dread, and perceived catastrophic potential, and the "unknown" risk, the extent to which a hazard is judged to be

unobservable, unknown, new, and delayed in producing impacts (Peters & Slovic, 1996, p. 1428). The outbreak of COVID-19, a novel infectious disease that has caused over 0.5 billion infections and millions of deaths worldwide, can be perceived as extremely serious and high in risk along these two dimensions.

Missing information during disasters or life-threatening events may cause great uncertainty and anxiety. There is a natural and intrinsic driving force for human beings to seek for and share information in risk situations to relieve the state of uncertainty and anxiety. The behavioral immune system (BIS) theory (e.g., Ackerman, Hill, & Murry, 2018; Murry & Schaller, 2016) suggests that human beings are evolutionarily equipped with a set of adaptive psychological mechanisms. When faced with potential threats (e.g., COVID-19), the BIS initiates negative emotions and enhances risk perceptions to help people navigate their environment in ways that reduce the potential risk (Makhanova & Shepherd, 2020). For example, Alqahtani, Arnout, Fadhel, and Sufyan (2021) conducted in-depth interviews between May and June 2020 with people in areas with severe outbreaks of COVID-19 and found that the precautionary behavior of the community was related to individuals' risk perception. As a psychological coping strategy triggered by the coronavirus, people clung to a shred of hope about unreliable information to feel safe, even if the information was false. In this way, information sharing can be seen as a protective strategy, both personally and collectively, to cope with risk and uncertainty during hazardous situations. Therefore, we hypothesize that:

H2. People with a higher perceived risk are more likely to share COVID-19 related (mis)information.

1.2.2. The role of emotion in (mis)information sharing

People suffered from negative emotions during the pandemic, such as fear, anger, anxiety, stress, sadness, and other mental ill-beings (Garfin, Silver, & Holman, 2020; Lwin et al., 2020; Min, Shen, Yu, & Chu, 2020). Emotional arousal increases people's likelihood to spread information. Research has suggested that people are likely to disseminate information that will evoke an emotional response in their recipients, regardless of its truth value (Berger, 2011; Lewandowsky et al., 2012; Peters, Kashima, & Clark, 2009). More specifically, information containing content that is more likely to evoke disgust, fear, surprise, or happiness are spread more readily from person to person and more widely through social media than are neutral stories (Cotter, 2008; Heath, Bell, & Sternberg, 2001; Peters et al., 2009; Vosoughi et al., 2018). Based on this evidence, we hypothesize that:

H3. People experiencing emotional arousals, either positive or negative, are more likely to share COVID-19 related (mis)information than those with neutral feelings.

Positive and negative emotions may play quite different roles in influencing people's information sharing behaviors under risk. From a functional evolutionary perspective (Cosmides & Tooby, 2000; Keltner, Haidt, & Shiota, 2006; Plutchik, 1980), avoiding threats (the functional domain of negative emotions) is of zero evolutionary consequence to survival if people fail to take advantage of opportunities presented by the environment (the functional domain of positive emotions) (Griskevicius, Shiota, & Neufeld, 2010), highlighting the importance of positive feelings in coping with crises and disasters. Research on the role of hope in fear-based persuasive messages also suggested that feelings of hope in response to fear appeals contributed to their persuasive success (Nabi & Myrick, 2019). Therefore, we expect that when experiencing extremely high risk, such as the COVID-19, people may be more willing to share (mis)information that arouses positive feelings, such as hope. Based on these speculations, we hypothesize that:

H4. Misinformation arousing positive emotions is more likely to be shared than that arousing negative emotions in the context of COVID-19 pandemic.

1.2.3. Motivations to spread (mis)information

People share information for both informational and social utilities, and for both self-centered and altruistic reasons. They prefer to share information with high informational utilities – news they can use (Berger & Milkman, 2012; Kim, 2015). Bobkowski (2015) suggested that sharing information can help people gain social approval by appearing well-informed and intelligent, and the shared information may also prove useful for those receiving it, both contributing to improving social standing. These motivations are referred to as the "status-led" sharing (Bright, 2016).

People may also share information for its social utility. When information flows in society from a few influential, trustworthy opinion leaders who are perceived as being well-informed to less active opinion followers (Katz & Lazarsfeld, 1955), the act of sharing is transformed from being "informational" to being "social," as both groups share to build and maintain relationships (Gantz & Trenholm, 1979; Lee & Ma, 2012). Based on 12 focus groups, Duffy, Tandoc, and Ling (2020) examined fake news sharing in terms of interpersonal and small-group dynamics and found that people share news stories in order to keep up with friends and enhance social cohesion. As noted by Liu (2017), what is shared is more than information; it is a reciprocity of '*guanxi*' (personal connections or social networks), especially in Chinese societies where relational interdependence and reciprocity are highly valued.

Altruistic motivations are also relevant to information sharing (Munar & Jacobsen, 2014). During disasters, people's information sharing behaviors can be motivated by their intrinsic satisfaction achieved from helping others (Constant, Kiesler, & Sproull, 1994). Misinformation of bad news may be circulated to close friends in order to alert them to dangers or protect them from harm (Duffy et al., 2020; Weening, Groenenboom, & Wilke, 2001). In online environment, especially that of health communities, altruism and reciprocity can significantly influence users' intentions to share health information (Zhang, Liu, Deng, & Cheng, 2017). In the context of COVID-19 fake news in Nigeria, Apuke and Omar (2021) also identified altruism as the strongest predictor of fake news sharing. Accordingly, the following question is proposed:

R1. How do different motivations affect people's intentions to share COVID-19 related (mis)information?

Pennycook et al. (2020, 2021) proposed an inattention-based account of misinformation sharing, suggesting that people generally wish to avoid spreading misinformation, but they get distracted from considering accuracy when deciding what to share online. If misinformation is false information that people believe is true or fail to think about accuracy, do factors affecting the misinformed to spread misinformation resemble the factors for the informed to share factually correct information? In addition, if the uninformed individuals also spread (mis)information, will they share based on same or different reasons as compared with those misinformed? To address these inquiries, we raise the following research question:

R2. Is there a difference in the effects of psychological factors, such as risk perceptions, emotions, and motivations, on the intentions to share COVID-19 related (mis)information for people with different levels of informedness?

1.3. Interventions: the accuracy nudge versus the emotion priming

Pennycook et al. (2020, 2021) implemented an accuracy-nudge intervention in a few experiments where people were primed to think about accuracy before deciding which headlines they would share on social media. This simple and subtle reminder about accuracy was found sufficient to improve people's sharing decisions regarding information about COVID-19 and therefore improve the accuracy of the information about COVID-19 on social media. One way to think about this priming technique is in terms of salience or accessibility (e.g., Converse & Presser, 1986). Earlier reminders may make accuracy more salient or

available to the participants than they otherwise would be. In the current research, we implemented priming manipulations either (1) to nudge people to think about accuracy by asking them to make judgments on factual statements about COVID-19 (like in Pennycook et al., 2020), or (2) to arouse people's emotions by asking them how they feel about the factual statements before asking them their intentions to share them on social media. The following questions are raised accordingly:

R3. How do accuracy-nudge and emotion-priming interventions affect people's intentions to share COVID-19 related (mis)information?

R4. Do these interventions show different effects in terms of people's levels of informedness?

2. Study 1

2.1. Study 1: design

Study 1 was a regional online survey conducted in five cities of China (Beijing, Shanghai, Guangzhou, Chengdu, and Wuhan) between January 23 and January 24, 2020, shortly after the Wuhan Lockdown on January 23. Study 1 was considered as a high-risk scenario, as the number of daily infections increasing rapidly and rumors spreading virally online at the time of the study. The survey was administrated by Jishuyun, a professional academic data collection platform based in Beijing, China. A total of 1361 participants recruited from an online panel completed the survey, answering questions regarding their perceived risks of the epidemic, their evaluations of the effectiveness of various preventative measures, their sharing intentions of COVID-19 related information, and so forth. The sample descriptions in terms of gender, age, education, income, and city are presented in Table 1. In Study 1, we examined how levels of informedness (H1) and risk perceptions (H2) affected people's sharing behaviors.

2.2. Study 1: measures

2.2.1. Levels of informedness

Participants were asked to evaluate the effectiveness of 12 preventative measures propagated online since the outbreak of COVID-19, including 5 effective measures and 7 ineffective ones, on 5-point scales from 1 "completely ineffective" to 5 "very effective," with 6 indicating "Don't know." For effective measures, participants choosing 1 "completely ineffective" were coded as "being misinformed," so were those choosing 2 "somewhat effective" to 5 "very effective" for ineffective measures. Participants who chose "Don't know" were coded as "being uninformed." The percentages of misinformed, uninformed, and informed responses to the 12 items are presented in Table 2. Dummy variables were created to indicate whether participants were misinformed or uninformed (with informed as the reference group) for each measure. In terms of an effective measure such as "wearing a mask," for instance, those who thought it was "completely ineffective" were given a score of 1 for the "misinformed" dummy, while those who answered "Don't know" were given a score of 1 for the "uninformed" dummy. A total of 24 dummy variables were generated for the 12 measures, including 12 "misinformed" dummies and 12 "uninformed" dummies. Summing up the scores across these dummies generated two variables, the number of misinformed responses ($M = 3.43$, $SD = 1.85$, ranging from 0 to 8) and the number of uninformed responses ($M = 0.87$, $SD = 1.42$, ranging from 0 to 10).

Table 1
Sample distributions in terms of gender, age, highest level of education, income, and city, Study 1.

		N	%
Gender	Male	601	44.2
	Female	759	55.8
Highest level of education	Elementary School or Middle School	205	15.1
	High School or Junior College	366	26.9
	College	703	51.7
	Graduate School	87	6.4
Age	15–20	388	28.5
	21–35	534	39.2
	36–50	345	25.3
	50 and above	93	6.8
Monthly income	1000 RMB	252	18.5
	1001–2000	95	7.0
	2001–5000	214	15.7
	5001–8000	373	27.4
	8001–15000	316	23.2
	15,001 and above	111	8.2
City	Beijing	285	20.9
	Shanghai	257	18.9
	Guangzhou	289	21.2
	Wuhan	275	20.2
	Chengdu	255	18.7
Total		1361	100

2.2.2. Sharing behavior

A multiple-choice question asks participants to indicate whether they have posted or shared any COVID-19 related information on WeChat, Weibo, News Websites, and other social networking platforms. A dummy variable was created to indicate whether participants had such online information sharing behavior ($M = 0.695$).

2.2.3. Risk perception

Dummy variable was generated measuring participants' perceived severity of COVID-19, with 1 indicating their belief in that "COVID-19 pneumonia is a serious health threat" and 0 representing "moderate threat" or "not a threat" ($M = 0.777$).

2.3. Study 1: analysis

Logistic regressions were performed to examine how levels of informedness and risk perceptions affected individuals' sharing behaviors controlling for demographic variables.

Table 2
Percentage of informed, misinformed, and uninformed responses to COVID-19 preventative measures, Study 1.

Item	Effectiveness	Informed	Misinformed	Uninformed
1. Do not go to crowded places.	Effective	98.9% (1346)	0.3% (4)	0.8 (11)
2. Take Vitamin C.	Ineffective	14.8% (201)	72.7% (990)	12.5% (170)
3. Wash your hands often.	Effective	97.6% (1329)	1.0% (14)	1.3% (18)
4. Drink plenty of water.	Ineffective	8.2% (112)	87.2% (1187)	4.6% (62)
5. Open the window and ventilate.	Effective	94.5% (1286)	2.6% (35)	2.9% (40)
6. Wear a mask.	Effective	99.3% (1352)	0.1% (1)	0.6% (8)
7. Steam vinegar indoors.	Ineffective	20.8% (283)	61.6% (838)	17.6% (240)
8. Avoid contact with livestock and wildlife.	Effective	94.3% (1284)	3.2% (43)	2.5% (34)
9. Lit up fireworks and firecrackers to disperse virus.	Ineffective	73.6% (1002)	17.3% (235)	9.1% (124)
10. Smoke to disinfect.	Ineffective	75.0% (1021)	17.9% (243)	7.1% (97)
11. Drink alcohol to disinfect.	Ineffective	66.6% (906)	22.9% (311)	10.6% (144)
12. Eat a lot of Chinese onion, ginger, and garlic.	Ineffective	26.4% (359)	55.9% (761)	17.7% (241)

Note: N in parenthesis.

2.4. Study 1: results

Table 2 shows that uninformed responses constituted a considerable proportion of all the evaluations of COVID-19 preventative measures in Study 1, especially for the ineffective measures.[2] Table 3 shows that more misinformed participants were significantly more likely to share COVID-19 related (mis)information online ($\beta = 0.191$, $p < .001$), while more uninformed participants were marginal-significantly more likely to share (mis)information ($\beta = 0.081$, $p = .083$). Therefore, H1 is supported.

Risk perceptions were found significantly positively associated with people's intention to share COVID-19 related (mis)information ($\beta = 0.312$, $p = .030$), supporting H2. Moreover, higher-incomed ($\beta_{income} = 0.193$, $p = .001$) individuals were found more likely to spread COVID-19 (mis)information.

3. Study 2

3.1. Study 2: design

Study 2 was an online survey experiment conducted between December 29 and December 31, 2020, about a year after Wuhan officially reported the first case of COVID-19 infection. Study 2 was also considered as a high-risk scenario, but less risky than Study 1, since the pandemic was effectively under control in Mainland China with only a few cases of infection reported occasionally at the time of Study 2. The survey experiment was also administrated by the same platform as in Study 1. A national stratified quota sample of 2060 participants in 31 provinces of Mainland China recruited from an online panel completed the questionnaire. The sample represents the Chinese Internet population in terms of gender, age, and education (Table 4).[3] Participants were asked to report their perceived risks of COVID-19, their discernment of factual matters concerning COVID-19, their emotions, and their intentions and motivations to share COVID-19 related (mis)information online.

Since sharing intention was measured for each factual statement in Study 2, we were able to link information attributes with individual factors to predict people's intentions to share a piece of (mis)information. In Study 2, we examined how levels of informedness (H1) and psychological factors, including risk perceptions (H2), emotions (H3 & H4), and motivations (R1), affected people's intentions to share true or false information, as well as how misinformed, uninformed, and informed individuals were affected differently by psychological factors to share (mis)information (R2). In addition, by implementing priming manipulations, we also tested in the experiment the effectiveness of different interventions in terms of combating online misinformation sharing (R3 & R4).

Table 3
Binary logistic regression models on sharing COVID-19 related information online, Study 1.

Predictor	*B*	*se*
Demographic		
Male	.032	.123
Age	−.134	.090
Education	−.111	.085
Income	.193**	.059
Risk perception		
Perceived severity	.312*	.144
Informedness		
Misinformed	.191***	.037
Uninformed	.081†	.047
Intercept	−.253	
Pseudo R^2	.027	
N	1358	

Note: Table entries are logistic regression coefficients and standard errors; †$p <$ .1, *$p < .05$, **$p < .01$, ***$p < .001$.

Table 4
Sample distributions in terms of gender, education, age, and income as compared with the Internet population according to the 46th CNNIC report, Study 2.

		Sample		Population
		N	%	%
Gender	Male	1044	50.7	51
	Female	1016	49.3	49
Highest level of education	Elementary School and below	391	19.0	19.2
	Middle School	846	41.1	40.5
	High School	437	21.2	21.5
	Junior College	202	9.8	10.0
	College and above	184	8.9	8.8
Age	10–19	316	15.3	15.3
	20–29	416	20.2	20.6
	30–39	433	21.0	21.1
	40–49	410	19.9	19.4
	50–59	265	12.9	12.9
	60 and above	220	10.7	10.7
Monthly income	1000 and below	227	11.0	NA
	1001–2000	158	7.7	
	2001–3000	368	17.9	
	3001–5000	652	31.7	
	5001–8000	475	23.1	
	8001–15000	141	6.8	
	15,001 and above	39	1.9	
Total		2060	100	100

3.2. Study 2: measures

3.2.1. Levels of informedness

Participants were asked to evaluate the truthfulness of 10 factual statements (4 true and 6 false) selected from major fact-checking websites regarding the prevention, transmission, and treatment of COVID-19.[4] A categorical variable was generated to indicate whether participants were misinformed (holding incorrect beliefs), uninformed (indicating "Don't know"), or informed (holding correct beliefs, as the reference group) for each statement. The percentages of misinformed, uninformed, and informed responses to 10 statements are presented in Table 5.

3.2.2. Emotion

For each of the 10 statements, participants were asked to indicate whether their emotions were leaning toward positive (i.e., happy, or hopeful), toward negative (i.e., afraid, anxious, or disappointed), or being neutral (as the reference group) when looking at the specific information.

3.2.3. Sharing intention

For each statement, participants were asked to indicate "how likely they are to share this information on social media platforms such as WeChat, Weibo, or QQ" on 5-point scales from 1 "completely unlikely" to 5 "completely likely."

[2] Due to the coding scheme of informedness in Study 1, percentages of informed, misinformed, and uninformed responses in Table 2 are not comparable with the results in Table 5 of Study 2 or Table C1 of Study 3 in the online appendix.

[3] According to the 46th China Statistical Report on Internet Development released by CNNIC in September 2020, retrieved from: http://www.cnnic.net.cn/hlwfzyj/hlwxzbg/hlwtjbg/202009/P020210205509651950014.pdf

[4] Such as http://www.piyao.org.cn/ and https://vp.fact.qq.com/

Table 5
Percentage of informed, misinformed, and uninformed responses to COVID-19 related information, Study 2.

Item	Facticity	Valence	Informed	Misinformed	Uninformed
1. Masks with valves do not protect against COVID-19.	False	Negative	60.7% (1251)	20.6% (425)	18.6% (384)
2. Keeping the mucous membranes in your throat moist can prevent COVID-19.	False	Positive	48.7% (1004)	21.2% (437)	30.0% (619)
3. Asymptomatic infections of COVID-19 can also be a source of infection.	True	Negative	80.0% (1649)	7.8% (161)	12.1% (250)
4. It is not easy for those getting the flu vaccine to get infected with COVID-19.	False	Positive	30.9% (636)	43.7% (901)	25.4% (523)
5. The drier the air, the higher the risk of contracting COVID-19.	True	Negative	23.5% (485)	39.0% (804)	37.4% (770)
6. Oxytetracycline is effective in the treatment of COVID-19 pneumonia.	False	Positive	46.4% (956)	12.2% (251)	41.4% (853)
7. The COVID-19 virus can survive for 20 years at minus 20 °C.	False	Negative	23.9% (493)	36.7% (755)	39.4% (811)
8. Indoor disinfection with UV light can inactivate COVID-19 virus.	True	Positive	36.2% (745)	30.7% (633)	33.1% (682)
9. Patients who have been cured and recovered from COVID-19 pneumonia are still contagious.	False	Negative	36.0% (742)	38.7% (798)	25.2% (520)
10. Convalescent plasma is effective in the treatment of patients with severe and critical COVID-19 pneumonia.	True	Positive	46.2% (951)	20.6% (425)	33.2% (684)

Note: N in parenthesis.

3.2.4. Risk perception

Participants were asked to indicate their perceived severity and susceptibility to COVID-19 on 5-point scales. Perceived severity was measured by two items "COVID-19 pneumonia is a serious health threat" and "If I were to get COVID-19 pneumonia, it would be devastating to my life" from 1 "completely disagree" to 5 "completely agree" (r = 0.385, $p < .001$; $M = 4.19$, $SD = 0.77$). Perceived susceptibility was measured by two items "How likely are you to be infected with COVID-19?" and "Compared with others, how likely are you to be infected with COVID-19" from 1 "completely unlikely" to 5 "highly likely" ($r = 0.708$, $p < .001$; $M = 2.37$, $SD = 0.83$).

3.2.5. Motivations to share information

Participants were asked to indicate their motivations to share COVID-19 related information on 5-point scales from 1 "completely disagree" to 5 "completely agree," including (1) to relieve anxiety (M = 3.39, $SD = 1.17$), (2) to seek for help from others ($M = 3.50$, $SD = 1.10$), (3) to share valuable information ($M = 4.13$, $SD = 0.76$), (4) to appear well-informed ($M = 3.15$, $SD = 1.20$), (5) to gain others' approval (M = 3.21, $SD = 1.22$), (6) to connect with friends and relatives ($M = 3.74$, SD = 1.02), (7) to conform to others ($M = 2.95$, $SD = 1.29$), and (8) to warn or help others ($M = 4.10$, $SD = 0.86$).

3.2.6. Information attributes

Two dummy variables were created to indicate the facticity and valence of each statement (1 "true", 0 "false" for facticity; 1 "positive", 0 "negative" for valence). Facticity of each statement was judged by expert consensus contemporaneous with the time period of Study 2. Information delivering "good news" was considered "positive" in valence, while that delivering "bad news" was considered "negative" in valence, regardless of its facticity. Facticity and valence of each statement are also presented in Table 5.

3.2.7. Experimental manipulation

Participants were randomly assigned to one of the two experimental conditions and a control condition (see the online appendix for more details). In the "cognition-behavior" condition ($N = 503$), participants were asked to evaluate the truthfulness of each statement before indicating their sharing intentions. In the "emotion-behavior" condition (N = 507), they were asked to express their emotions aroused by each statement before indicating their sharing intentions. In the control condition ($N = 1050$), participants were asked directly about their sharing intentions without being cognitively or emotionally primed.

3.3. Study 2: analysis

We compiled the data to the level of each statement (N = # of participants * # of statements = 20,600 cases). Since level of informedness and sharing intentions were nested within participants and items, we analyzed the data using mixed effects linear regressions, accounting for random effects at both the individual level and the item level.

3.4. Study 2: results

Again, there were considerable uninformed responses to the COVID-19 statements: for 6 out of 10 items, uninformed responses outweighed misinformed ones (Table 5). Compared with those informed (Table 6), both misinformed and uninformed participants were significantly more likely to share COVID-19 related false information ($\beta_{misinformed} = 1.438$, $p < .001$; $\beta_{uninformed} = 0.631$, $p < .001$) and less likely to share true

Table 6
Mixed effects linear regressions on sharing COVID-19 related (mis)information online, main effects, Study 2.

Predictor	Full Sample	Fact	Misinfo
Information attributes			
Facticity	.386 (.246)		
Valence	−.364 (.242)	−.185 (.215)	−.189 (.122)
Demographics			
Male	−.011 (.022)	.014 (.025)	−.025 (.023)
Age	.003 (.007)	.012 (.009)	−.007 (.008)
Education	−.013 (.011)	−.005 (.013)	−.016 (.012)
Income	.017† (.009)	.013 (.011)	.018† (.010)
Informedness			
Misinformed	.354*** (.018)	−1.419*** (.027)	1.438*** (.021)
Uninformed	.122*** (.019)	−.836*** (.026)	.631*** (.021)
Risk perception			
Perceived severity	.026† (.015)	.015 (.017)	−.004 (.016)
Perceived susceptibility	.051*** (.013)	.038* (.015)	.056*** (.014)
Emotion			
Positive	.730*** (.019)	.339*** (.025)	.304*** (.023)
Negative	−.206*** (.018)	−.067** (.026)	−.171*** (.020)
Motivation			
Relieve anxiety	.028* (.012)	.027† (.014)	.039** (.013)
Seek for help from others	.008 (.012)	.006 (.014)	−.014 (.013)
Share valuable info	.044** (.017)	.037† (.019)	.011 (.017)
Appear well-informed	.046*** (.013)	.044** (.014)	.055*** (.013)
Gain others' approval	.029* (.013)	.035* (.015)	.029* (.013)
Connect with friends/ relatives	−.013 (.013)	−.012 (.015)	−.016 (.013)
Conform to others	.054*** (.011)	.025* (.013)	.057*** (.012)
Warn or help others	.091*** (.015)	.105*** (.017)	.075*** (.015)
Intercept	1.490	2.672	1.403
Pseudo R^2	.184	.391	.370
N	20,597	8237	12,360

Note: Table entries are mixed effects linear regression coefficients, and standard errors appear in parentheses; the pseudo R^2 representing variances explained by the fixed effects was calculated based on formula developed by Nakagawa, Johnson, and Schielzeth (2017); †$p < .1$, *$p < .05$, **$p < .01$, ***$p < .001$.

information ($\beta_{misinformed} = -1.419$, $p < .001$; $\beta_{uninformed} = -0.836$, $p < .001$). In addition, misinformed participants were more likely to share misinformation and less likely to share fact than uninformed ones. Therefore, H1 is supported.

In terms of risk perceptions, perceived severity of COVID-19 was marginally significantly associated with people's sharing intentions ($\beta = 0.026$, $p = .076$), but perceived susceptibility to COVID-19 was significantly positively associated with their sharing intentions ($\beta = 0.051$, $p < .001$). The positive impact of perceived susceptibility was more salient for sharing misinformation ($\beta = 0.056$, $p < .001$) than for sharing fact ($\beta = 0.038$, $p = .014$). Therefore, H2 is mostly supported.

Compared with neutral emotions, participants with positive emotions were significantly more likely to share COVID-19 (mis)information ($\beta = 0.730$, $p < .001$), but those with negative emotions were significantly less likely to share ($\beta = -0.206$, $p < .001$). Same relationships were observed for the intentions to share both misinformation and fact.

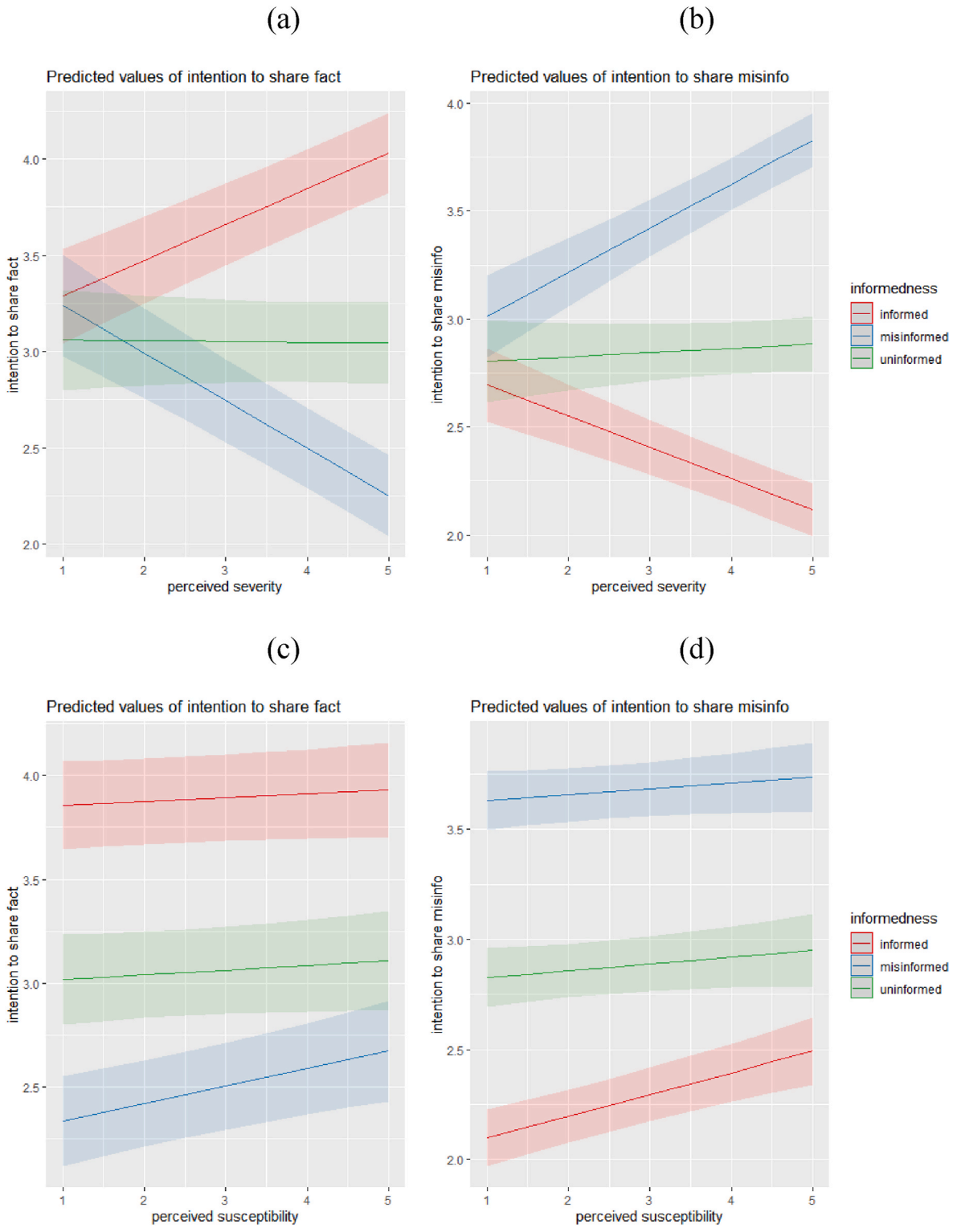

Fig. 1. The effects of perceived risks on the intentions to share fact or misinformation by levels of informedness.

H3 is only partially supported but H4 is supported.

In answering R1, we identified six significant motivations for people to share COVID-19 related (mis)information during the pandemic. Participants were more likely to spread COVID-19 (mis)information because they wanted (1) to relieve anxiety ($\beta = 0.028$, $p = .021$), (2) to share valuable information ($\beta = 0.044$, $p = .007$), (3) to appear well-informed ($\beta = 0.046$, $p < .001$), (4) to gain others' approval ($\beta = 0.029$, $p = .022$), (5) to conform to others ($\beta = 0.054$, $p < .001$), and (6) to warn or help others ($\beta = 0.091$, $p < .001$), but not because they wanted to seek for help nor to connect with friends and relatives.

In answering R2, we observed significant interactions between levels of informedness and risk perceptions, emotions, and motivations to share COVID-19 information (see Table A1 in the online appendix). The patterns for the misinformed to share misinformation were generally in line with that for the informed to share fact. First, as their perceived severity increased, misinformed participants were more likely to share misinformation and less likely to share fact, while the informed were more likely to share fact and less likely to share misinformation (Fig. 1). As their perceived susceptibility increased, misinformed participants were more likely to share fact while the informed were more likely to spread misinformation.

Second, the impacts of emotions on sharing intentions were highly dependent on individuals' levels of informedness (Fig. 2). The misinformed were more likely to share misinformation when positive or negative emotions were aroused, than when neutral emotions were aroused, so were the informed ones to share fact. Meanwhile, negative emotions always induced the least sharing intentions when participants believed the information was false, regardless of its veracity, implying that negative emotions were associated with unbelieving. In addition, positive emotions always induced the most sharing intentions regardless of whether the individuals were misinformed, uninformed, or informed, and regardless of the facticity of the information, also supporting H4.

In terms of motivations (Fig. 3), the misinformed were more likely to share misinformation because they were more motivated by sharing valuable information, warning/helping others, and connecting with friends/relatives ($p < .001$ vs. informed for all), the same motivations as for the informed to share true information ($p < .001$ vs. misinformed for all). The misinformed were more likely than the informed to share true information (though they believed it was wrong) as they became more motivated by relieving anxiety ($p < .001$), seeking for help ($p < .01$), appearing well-informed ($p < .05$), or conforming to others ($p < .001$), the same reasons ($p < .05, p < .05, p < .01, p < .001$, respectively) for the informed to share misinformation (even though they knew it was incorrect). The uninformed were generally not motivated to share either fact or misinformation. When comparing with the informed, they were more motivated by relieving anxiety ($p < .001$) and conforming to others ($p < .01$) to share fact, and sharing valuable information ($p < .001$) and warning/helping others ($p < .001$) to share misinformation.

Finally, we found that priming people to think about the accuracy of information decreased their likelihood of sharing both fact ($\beta = -0.093$, $p < .05$) and misinformation ($\beta = -0.120$, $p < .01$), positive ($\beta = -0.076, p < .05$) and negative information ($\beta = -0.144, p < .001$), while priming people to express their emotions increased their likelihood of sharing positive information ($\beta = 0.073$, $p < .05$), regardless of its facticity (Table 7), answering R3. In answering R4, it was found that the accuracy priming intervention showed similar effects on decreasing sharing intentions for people with different levels of informedness (Fig. 4). However, the emotion priming intervention increased the intentions for both the misinformed and informed individuals to share positive information, but not so much for the uninformed ones, though the interactions were not statistically significant (see Table A2 in the online appendix).

4. Discussion

We observed consistent patterns in two COVID-19 studies that both misinformed and uninformed individuals were more likely to spread misinformation than the informed ones, but the misinformed were always more so than the uninformed. The uninformed were generally not motivated to share neither fact nor misinformation. It is the misinformed individuals that we need to be most precautious about in terms of spreading misinformation in risk scenarios. These findings were also

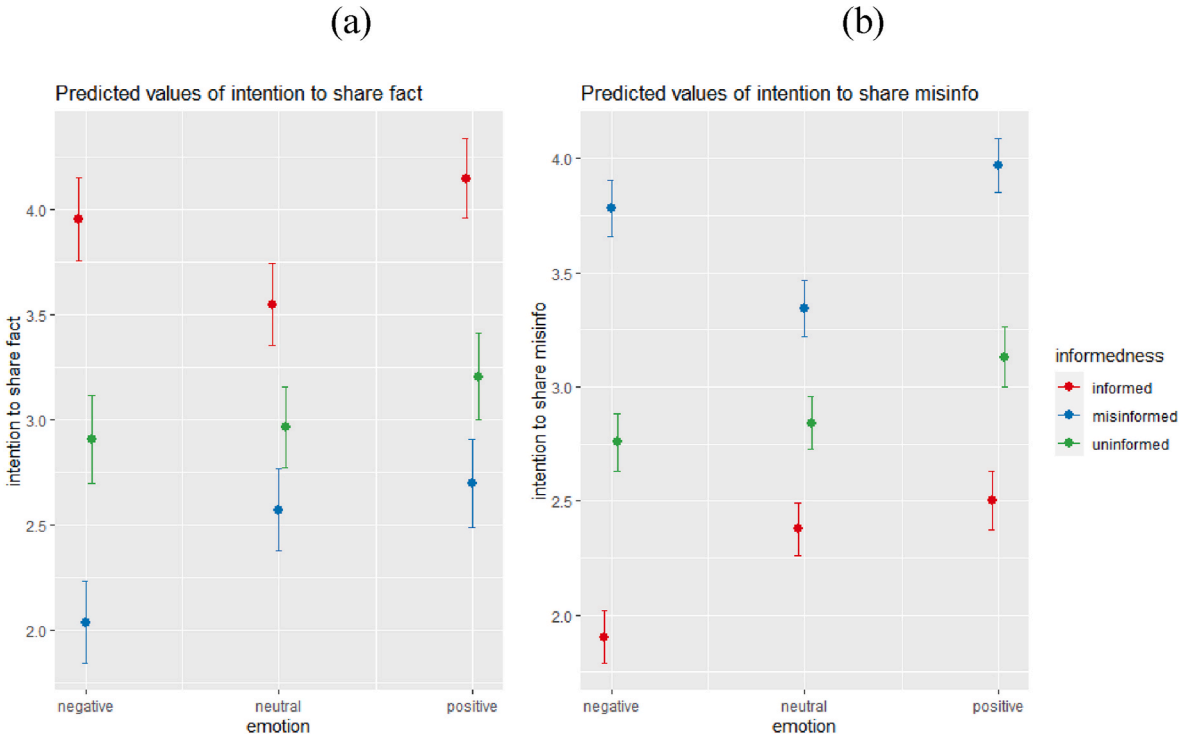

Fig. 2. The effect of emotions on the intentions to share fact or misinformation by levels of informedness.

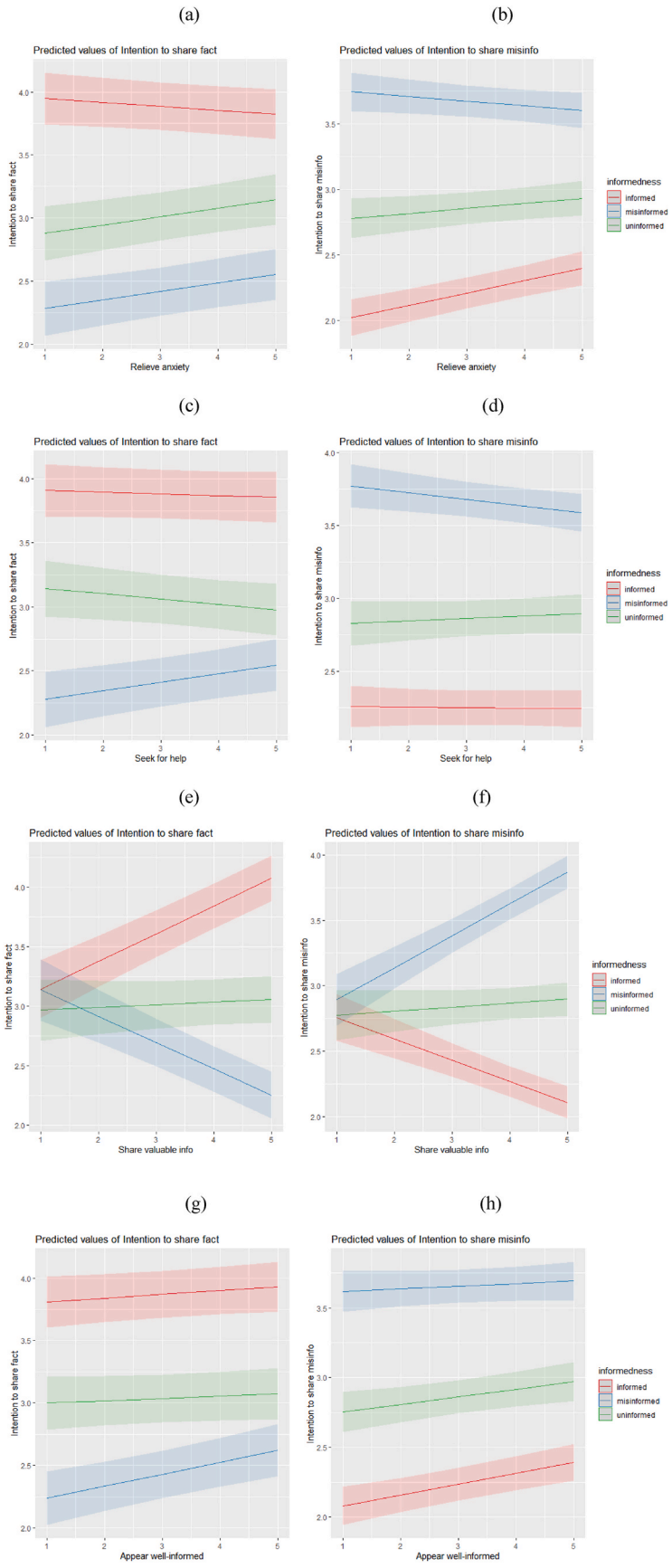

Fig. 3. The effects of motivations on the intentions to share fact or misinformation by levels of informedness.

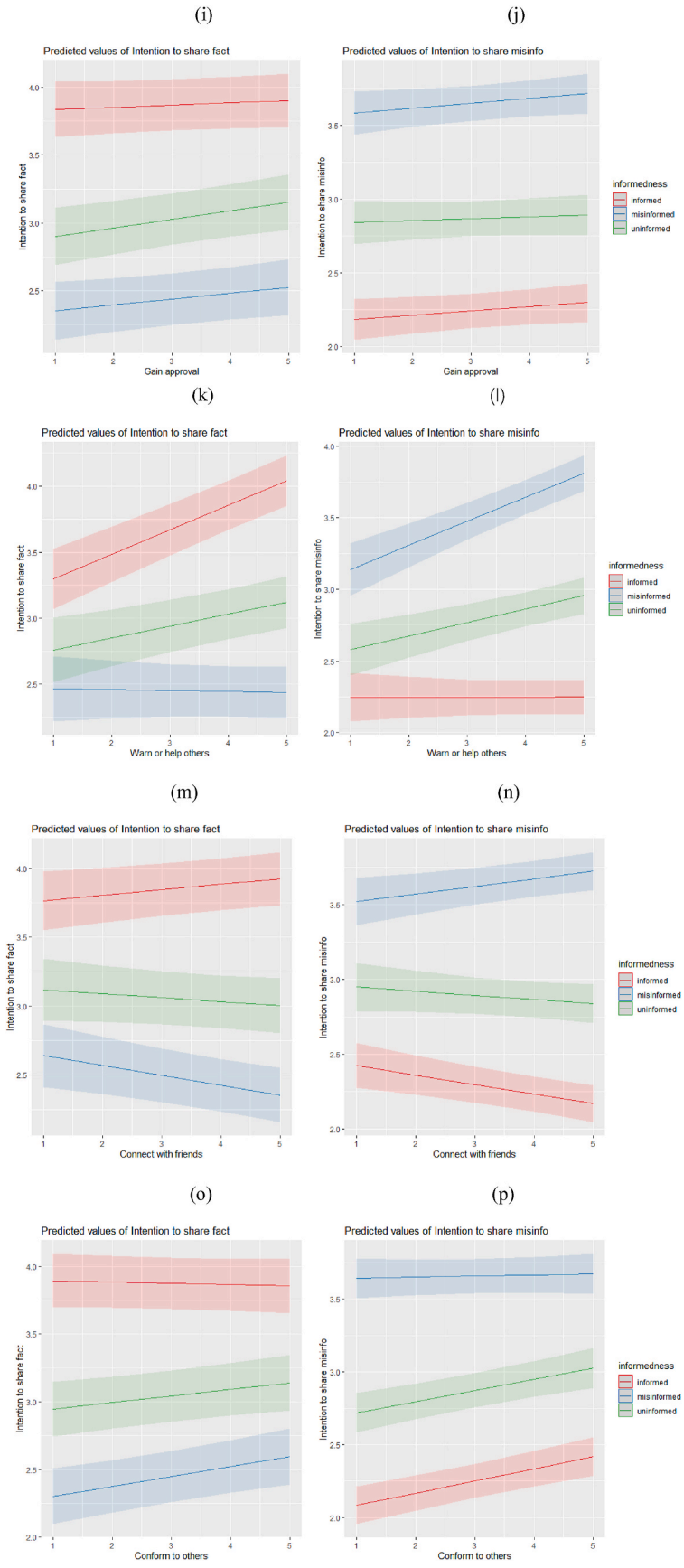

Fig. 3. (*continued*).

Table 7
Mixed effects linear regressions of cognitive and emotional primes on sharing COVID-19 related (mis)information online, Study 2.

	Full Sample	Fact	Misinfo	Positive info	Negative info
Condition	*β (se)*	*β (se)*	*β (se)*	*β (se)*	*β (se)*
Experimental condition					
Cognition-Behavior	−.089*** (.027)	−.093* (.037)	−.120** (.034)	−.076* (.037)	−.144*** (.035)
Emotion-Behavior	.014 (.027)	.022 (.037)	.056 (.034)	.073* (.037)	.009 (.035)
Pseudo R^2	.185	.008	.007	.034	.039
N	20,597	8237	12,360	10,298	10,299

Note: Table entries are mixed effects linear regression coefficients, and standard errors appear in parentheses; the pseudo R^2 representing variances explained by the fixed effects was calculated based on formula developed by Nakagawa et al. (2017); all the predictors appeared in Table 6 are also included in these models, but not presented here for simplicity; *$p < .05$, **$p < .01$, ***$p < .001$.

replicated using data from our previous study on the diffusion of misinformation under food safety risk in China (Wang, He, Xu, & Zhang, 2020; see Study 3 in the online appendix for more details about the replication).

We also observed that the patterns for the misinformed to share misinformation were generally in line with that for the informed to share fact. The misinformed laypeople do not diffuse falsehood deliberately; in contrary, they spread misinformation that they believed to be true, to have informational values, to be able to improve their social standing, and to be able to warn or help others, the same reasons for the informed to spread truth. A recent study that provided contradictory evidence to Vosoughi et al. (2018) suggested that the differences in the depth, breadth, structural virality, and speed of false- and true-news cascades disappeared after controlling for cascade size, implying that the mechanisms underlying the diffusion of true and false information might be quite similar (Juul & Ugander, 2021). Our findings offered an explanation for this new observation. Juul and Ugander's work also suggested that the deeper, broader, and faster propagation of false information can almost entirely be explained by the higher person-to-person infectiousness of the information. But why is false information more attractive to vulnerable laypeople? This more important question is left unanswered.

In our two COVID-19 studies, we found that people's information sharing intentions were significantly associated with their risk perceptions. As people's perceived severity of COVID-19 increased, their information sharing intentions also increased significantly (as in Study 1); more specifically, the likelihoods for the informed to share fact and for the misinformed to share misinformation both increased significantly (as in Study 2). In other words, greater severity perceptions increased people's sharing intentions of information that they believed to be true. In terms of the perceived susceptibility to COVID-19, we found in Study 2 that it was positively associated with people's information sharing intentions, regardless of the veracity of the specific information.

We noticed that people's perceived severity of COVID-19 had not changed much, if not increased, from Study 1 to Study 2. At the time of Study 1, about 77.7% of the participants believed that COVID-19 pneumonia is a "serious" health threat, while 22% believed that it is a "moderate" health threat. At the time of Study 2, about 53.2% of the participants "strongly agreed" and 39.1% "agreed" that COVID-19 pneumonia is a serious health threat.[5] However, people's perceived susceptibility to COVID-19 was relatively low compared to their perceived severity at Study 2, as only 1.5% of the participants believed that they were "highly likely" to get infected with COVID-19 (9% indicated "very likely"), while about 13.7% indicated "completely unlikely" and 47.3% "very unlikely." A news article published by Chinanews on January 1, 2021 reported that there were 529 new infections in December 2020 in Mainland China, including 407 cases of imported infections from abroad and only 122 domestic infections.[6] Therefore, people's susceptibility to COVID-19 might have decreased due to the low number of infected cases reported at the time of Study 2 under the strict "Zero COVID" policy implemented in China.[7] Combined, it is suggested that even though people perceived COVID-19 as a serious health threat, most of them believed that the chance for themselves to suffer from the bad consequences of infection was low, implying that people's perceived risk of COVID-19 might have decreased at the time of Study 2. In any case, it is interesting to observe that in almost a year since the outbreak of COVID-19 pandemic, the impact of people's risk perceptions on their information sharing intentions was persistent and strong, even after the pandemic and people's knowledge about COVID-19 had developed.

However, the same positive relationship between perceived risk and information sharing intentions was not observed in our food safety study (see the online appendix). On the contrary, a negative relationship was identified. The conflicting results may be partially attributed to different operationalizations of risk perception in these studies. But we argue that such differences could largely be attributed to the underlying psychological mechanisms for laypeople to react to (mis)information when coping with risk of different levels. Although food safety frauds have become prominent problems in recent years in China and posed a threat on public health (see Wang et al., 2020), such a threat is not immediately life-devastating. Therefore, people's perceived risk can be seen as low to moderate considering the two psychological dimensions of risk as discussed earlier (Peters & Slovic, 1996). In low-to moderate-risk scenarios, people's information sharing behaviors may be mostly motivated by self-centered reasons, such as relieving uncertainty or anxiety as a reduction of cognitive dissonance (Wang et al., 2020). In high-risk scenarios like the COVID-19 pandemic, however, the motivations to share information were largely collective and altruistic in nature–people share and reciprocate information as collective actions responding to the disaster that affects the humankind.

The effects of emotions on people's information sharing behaviors were also different in situations with different risk levels. In high-risk scenarios like the COVID-19 pandemic, positive emotions (e.g., happy, or hopeful) always induced more information sharing behaviors than negative or neutral emotions, regardless of whether the individuals were informed, uninformed, or misinformed. The impact of positive emotions was especially prominent when people were emotionally primed before indicating their sharing intentions. Whereas in low-to moderate-risk scenarios, negative emotions often induced more sharing intentions than positive feelings (see the food safety study in the online appendix). This evidence implies an evolutionary strategy for human beings to cope with disasters like the ongoing COVID-19 pandemic–they rely on a shred of hope to collectively overcome this difficult time. An analysis of Twitter trends between January and April 2020 also indicated an increase in the sense of positivity encompassing hope, gratitude, and human resilience as the COVID-19 crisis developed (Lwin et al., 2020).

Content analyses of COVID-19 (mis)information also supported our speculations. By analyzing 222 unique pieces of COVID-19 misinformation identified between January 22 and October 31, 2020 from major fact-checking websites in China, we found that 69% (153 pieces) were

[5] Even though perceived severity was measured slightly differently in Study 1 and Study 2, we observed that over 92% of the participants either "strongly agreed" or "agreed" that COVID-19 pneumonia is a serious health threat, likely indicating an increasing perceived severity.

[6] News report by Chinanews on January 1, 2021, retrieved from: https://www.chinanews.com.cn/gn/2021/01-01/9376666.shtml

[7] Even though perceived susceptibility was not measured in Study 1, we felt confident to assert that their susceptibility perceptions should be lower at the time of Study 2 than Study 1 with people's increasing knowledge about the virus itself, the infectious rate, and the overall epidemic situations.

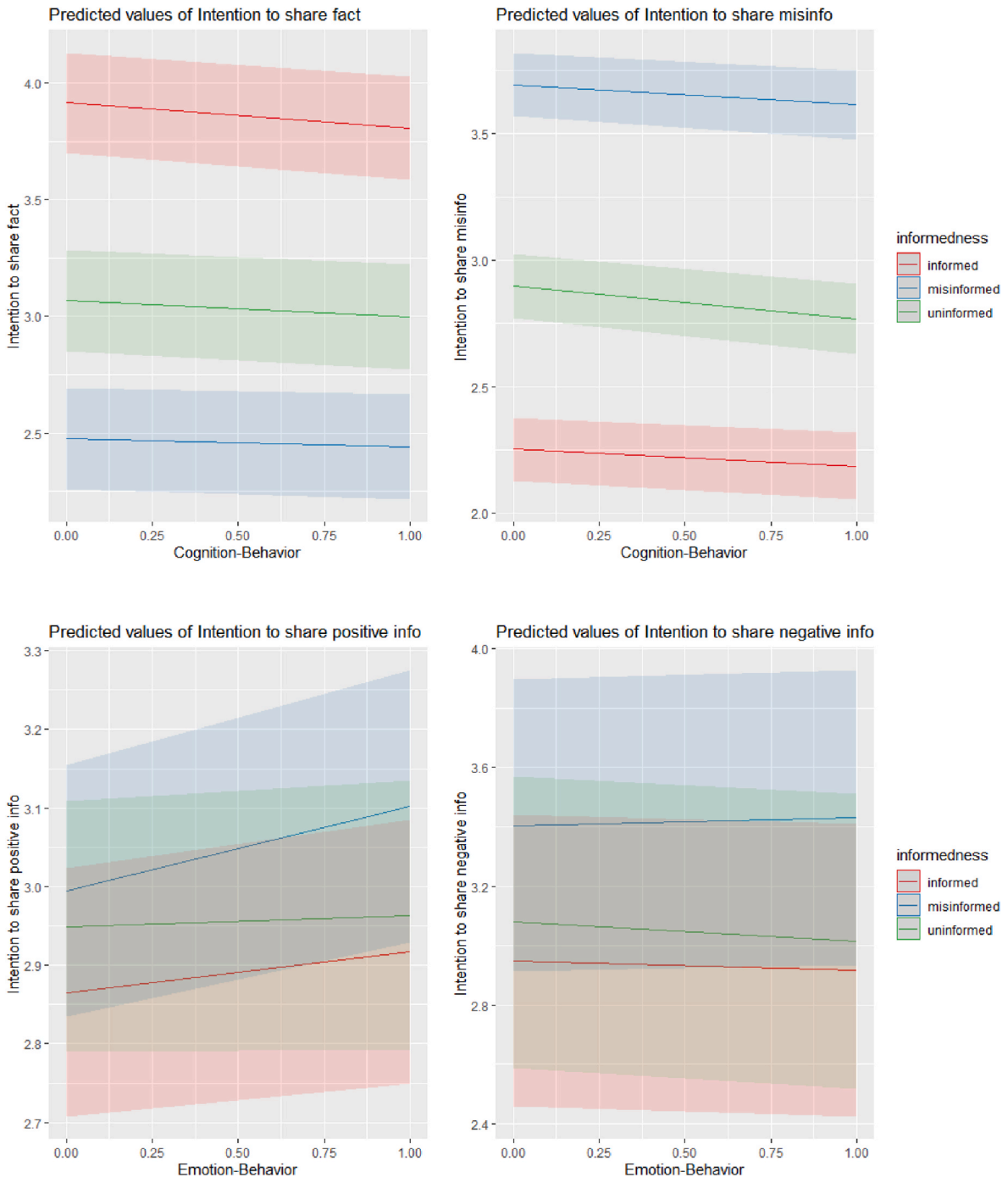

Fig. 4. The effects of accuracy-nudge and emotion priming on the intentions to share fact, misinformation, positive and negative information by levels of informedness.

concerned with preventative measures, e.g., means or remedies to prevent or cure the disease. A similar study conducted between January 1 and May 26, 2020 in the U.S. also revealed that "miracle cures" accounted for 56.5% (295,351 articles) of all the COVID-19 misinformation conversations and ranked first among the 11 sub-topics of misinformation (Evanega et al., 2020). By contrast, as indicated by our food safety study, over 78% of food safety misinformation spread on Chinese social media between 2015 and 2019 delivered bad news that induced negative feelings (Wang et al., 2020). This implies that the virality of misinformation under risk is a function of both the emotional arousals of the message and the risk levels of the specific situation. In other words, misinformation arousing negative emotions tends to go viral in low-to moderate-risk situations, while those arousing positive feelings that give people a sense of hope tends to go viral in high-risk scenarios.

How positive and negative emotions affect (mis)information sharing differently in situations with different risk levels has important practical implications. At the early stage of the COVID-19 pandemic, there were lots of uncertainties and people were lack of sufficient knowledge about this new virus and its harm to human health. Therefore, their perceived risk was high, and fear and anger were the dominant emotions people experienced (e.g., Lwin et al., 2020). To overcome such negative emotions triggered by the epidemic during its high-risk period, people tended to embrace (mis)information stirring positivity. As tools, like

vaccines, rapid diagnostic tests, and antivirals, have been developed to deal with COVID-19, people will eventually learn to live with the coronavirus, treat it as "endemic," and make risk calculations regarding it just like they normally do with influenza and other respiratory viruses (see Hartman, 2021; Servick, 2022). In fact, many countries, including the United States, Canada, and Europe, have removed nearly all COVID-19-related restrictions, and announced to live with COVID since February 2022. With a gradual recession of the epidemic and a decline of people's risk perceptions of COVID-19, we expect that (mis)information triggering negative emotions would become more appealing. When the "pandemic" is eventually treated as an "endemic," the motivations for people to spread (mis)information would be driven primarily by self-centered reasons rather than collective ones. The kind of misinformation delivering "bad news," such as the side-effects of vaccination, the long-term sequelae of COVID-19, etc., may become what we need to be alert about in the future.

To summarize, misinformation was not more likely to be spread than truth after controlling for individual factors; the only reason that misinformation appears to be diffused farther, faster, deeper, and more broadly online is that it seems more appealing to laypeople by nature. In other words, "good news" appears to be more appealing in higher-risk scenarios while "bad news" appears to be more appealing in lower-risk scenarios regardless of whether the news is true or false, since such information can help people adjust their risk perceptions and cope with risk situations accordingly. Our findings point to three possible solutions to reduce misinformation spreading under risk: (1) to improve people's accuracy judgment, (2) to balance people's risk perceptions, and (3) to prevent people from being emotionally charged. We found that nudging people to think about the accuracy of information made them more critical and skeptical to new information they encounter online–it not only decreased their intentions to share misinformation, consistent with previous findings by Pennycook et al. (2020, 2021), but also decreased their intentions to share true information. If properly implemented, the accuracy-nudge interventions could be beneficial in reducing the inattention-based spreading of misinformation and leaving more room for the circulation of accurate information released by more credible sources, given people's limited attention and cognitive capacity in the overloaded information environment.

In addition, research on self-monitoring techniques has suggested that people who monitored their emotions and coping strategies showed increased emotional self-awareness, such as being able to recognize emotional states, identify and differentiate various emotions within different contexts, etc., which in turn would lead to mental health benefits and productive decision making (e.g., Kauer, et al., 2012). Self-monitoring is defined as a personality trait that reflects individuals' ability to monitor and regulate self-presentation, emotions, and behaviors in response to social environments and situations (Snyder, 1974). Low self-monitors are individuals who let their emotions or dispositions on various issues guide their behaviors, while high self-monitors are individuals who have high social sensitivity and change their behaviors to adapt to changing situations (Gangestad & Snyder, 2000). An ideal self-monitoring is that people have neither high nor low self-monitoring tendencies, but are able to monitor themselves to a certain extent (Gangestad & Snyder, 2000; Snyder & Cantor, 1980). Research has suggested that self-monitoring interventions can be effective in producing favorable behaviors in many areas, such as decreasing depressive symptoms (e.g., Kauer, et al., 2012), improving academic performance (e.g., Arslantas & Kurnaz, 2017), increasing physical activities (e.g., Page, Massey, Prado-Romero, & Albadawi, 2020), etc. If properly implemented, we expect that the self-monitoring interventions could also be beneficial in monitoring people's emotions and coping strategies under risk, which in turn would lead to a reduction of misinformation diffusion.

We must also acknowledge some limitations of our studies. First, since our research was conducted in China, there might be some cultural differences in terms of motivations affecting people's information sharing intentions under risk. The Chinese culture values reciprocity (e.g., Liu, 2017) and collectivism (e.g., Markus & Kitayama, 1991). Our findings may not be generalizable to other cultures, especially Western cultures that value more on individualism. However, altruistic motivations of (mis)information sharing have also been identified in studies conducted in other cultures, including but not limited to Nigeria (e.g, Apuke & Omar, 2021), Singapore (e.g., Duffy et al., 2020), UK (e.g., Plume & Slade, 2018), Denmark and Norway (e.g., Munar & Jacobsen, 2014), and the U.S. (e.g., Constant et al., 1994). Considering that the COVID-19 pandemic is a global crisis, how people from different cultural backgrounds cope with it may share more commonalities than differences.

Second, there may be other factors affecting people's (mis)information sharing intentions in the online community that were omitted in our studies. In the current research, we considered psychological factors at the individual level, information attributes at the message level, and contextual factors at the situation level. In terms of people's emotions aroused by the specific (mis)information, for instance, we only measured its valence (positive versus negative), but not the levels of emotional arousals, which may also be associated with people's information sharing intentions. Moreover, specific categories of emotions, such as fear, anger, happiness, etc., were not differentiated in our studies, but their impacts on information sharing intentions might be different, deserving further research attention.

The current research shed new lights on our understanding of misinformation sharing, especially the underlying psychological mechanisms for the misinformed, uninformed, and informed individuals to spread (mis)information under risk. It also contributed to the scholarship of persuasive communication in terms of understanding why the persuasiveness of messages with distinct emotional appeals (hope vs. fear) are different in situations with different levels of risk (high vs. low). Based on limited data and observations, our findings are intriguing yet tentative. For future research, we suggest three possible directions: (1) to examine the interplay of information attributes (e.g., emotional appeals including both valence and levels of arousal) and situational features (e.g., risk levels) in more scenarios, (2) to explore factors affecting people's veracity judgment of various types of information in situations with different levels of risk; and (3) to experiment with various self-monitoring intervention strategies to test their effectiveness in reducing misinformation sharing behaviors.

Credit author statement

Hongzhong Zhang designed Study 1 and collected the data. Rui Wang designed Study 2 and collected the data. Rui Wang conducted data analyses for both Study 1 and Study 2, drafted the manuscript, and made the revisions. Both authors approved the final version of the manuscript.

Acknowledgement

This research is partly funded by Beijing Association for Science and Technology. The authors are also very grateful to Yuan He, Liaoliao Wei, Zhiruo Chang, and Hongchen Zhang for their helpful assistance, as well as the anonymous reviewers and editors for their thoughtful and valuable comments and suggestions.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2022.107486.

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