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COVID-19 Misinformation on Social Media and Public's Health Behavior: Understanding the Moderating Role of Situational Motivation and Credibility Evaluations

Zapan Barua[1] ⓘ

Abstract

The spread of misinformation on social networking conduit regarding COVID-19 pandemic poses deleterious consequences on public health. The author advance the body of knowledge on tackling misinformation to generate positive health behavior responses by proposing a conceptual framework based on the theory of persuasion and behavior change. Furthermore, as a belief antecedent, conspiracy theory is also used in this study. The author, using structural equation modeling technique, explored the three hundred seventy-three participants' belief in conspiracy theory and religious misinformation and their influence on intention and behavior. Those direct relationships were tested by the joint moderating role of situational motivation and credibility evaluations. The study revealed that the situational motivation and credibility evaluation jointly and individually (in some cases) weaken the strong positive relationship between misinformation (conspiracy theory and religious misinformation) and health belief, health belief and intention, and intention and health behavior regarding COVID-19. The findings of this study offer guideline for policymakers to generate favorable health behavior regarding COVID-19 and any other epidemic or pandemic. Directions for researchers to any further extensions are also placed.

Keywords COVID-19 · Public's health behavior · Conspiracy theory · Misinformation · Situational motivation · Credibility evaluations

Introduction

Every corner of the world is experiencing massive global health threats as well as the severe socioeconomic impact of the COVID-19 pandemic. Since large amount of COVID-19-related data is generated online, misinformation on COVID-19 on social media is making the management of COVID-19 as the most perplexing healthcare task in the twenty-first century. Though social networks are viewed as a structural determinant of health, the misinformation regarding the COVID-19 on social networks is so vast (Loomba et al.,

✉ Zapan Barua
  zapan@cu.ac.bd

1 Department of Marketing, University of Chittagong, Chattogram 4331, Bangladesh

2021) that Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization (WHO), was compelled to declare the COVID-19 pandemic as "infodemic" (WHO, 2020a). Misinformation about COVID-19 on social media might be a cause of losing lives. Along with false treatments of COVID-19, various misinformation has been spread about the COVID-19 vaccine on social media that might generate negative public health behavior. For instance, misinformation through conspiracy such as "coronavirus vaccine changes human DNA," "placing a microchip in the human body through COVID-19 vaccine to observe human movement," and "coronavirus vaccine destroys women's fertility and makes men impotent" can evade people from vaccination and thus can ultimately incur death without vaccination since scientific research reported that the number of cases and deaths among the vaccinated is extremely trivial compared to the number among the unvaccinated (Ellyatt, 2021).

Consequently, the current period is described as "an era of fake news" where misinformation is produced in an advertent or inadvertent way (Wang et al., 2019). Fake news, also known as junk news or pseudo-news, is perilous for almost all sectors and in some cases especially in the health sector is life-threatening (Wang et al., 2019). Misinformation is defined as inaccurate information shared unconsciously without any intention to make harm, while disinformation is defined as inaccurate information shared consciously to make harm intentionally (Wardle & Derakhshan, 2017). For this study purpose, the author would like to consider misinformation as a mother term if the purpose is not clear for sharing it to bring all sorts of false information regarding COVID-19 pandemic. However, the current decade is certainly embracing the heightened spread of misinformation all over the world, for example, Xu et al. (2020) noted that network diameter and virality of misinformation had larger effect than those of true information about Zika, because of the advancement in technology which has introduced social networking sites Twitter, Instagram, Facebook, and WeChat. Furthermore, the internet usage rate, as well as mobile phone, is increasing in an exponential way all over the world. Even developing countries such as Bangladesh experience the same (Sagib & Zapan, 2014, Barua et al., 2016).

Researchers noted that the misleading post on social media pertaining to public health information regarding disease was found to be far more popular than the ones broadcasting accurate and relevant to public health (Sharma et al., 2017). The world's first social media pandemic COVID-19 (Guynn, 2020) is also misleading by misinformation on social media, and we have observed that the panic situation has been created by the misinformation about COVID-19 in many countries. Consequently, by saying "we need a vaccine against misinformation," Dr. Mike Ryan, Executive Director of WHO's Health Emergencies Programme, urges the social science researchers to contribute to the field (WHO, 2020b). Furthermore, though the adverse consequences of misinformation were observed during the other epidemics like H1N1 virus (swine flu in 2009), Ebola virus (2014), and Zika virus (2015) too, still there is a lack of proper understanding of the theory about how misinformation affect the public health during an epidemic or pandemic. Hence, Tan et al. (2015) suggested that the theoretical development for the direction of effects of misinformation on public health could make a passage to comprehend the mitigation of disastrous consequences of misinformation. Furthermore, Jang et al. (2019) contended that the literature is scant about how social media contribute to the proliferation of unverified health information or misinformation.

For well management of misinformation regarding any natural epidemic and other social incidents such as political or religious, this study proposes an esoteric insight. Furthermore, as called by the Executive Director of WHO's Health Emergencies Programme and other researchers, this study is an effort to contribute in the field of health sector regarding

COVID-19 in particular and information communication in general. Thus, the main contributions of this study are two-fold. First, it examined the public belief in government to public level conspiracy and religious misinformation and its effects on intention and health behavior response. Second, the study tested the joint moderating role of situational motivation and credibility evaluations in relationships between conspiracy theory and health belief, religious misinformation and health belief, health belief and intention, and intention and health behavior. In the current situation of the pandemic, the discoveries of the study are important to deploy and implement required policies to generate positive and favorable health behavior responses.

To achieve the objectives, a conceptual framework was developed based on the theory of persuasion and behavior change that explain beliefs, intentions, and behaviors rigorously. The theory of persuasion and behavior change is followed in this study because a growing number of evidence indicates that public health and health-promotion interventions are found to be more effective when they are based on social and behavioral science theories than those missing a theoretical base (Glanz & Bishop, 2010). Furthermore, as a soft theoretical support and a belief antecedent, "Conspiracy Theory" is also introduced in this study. The theory is tested empirically by considering two important sources of misinformation, (i) conspiracy theory and (ii) religious misinformation; they were considered based on the extensive study of the literature on both pandemic and misinformation where the author found huge talk online about them. For example, The Guardian (2020) reported that faith leaders or religious leaders in different countries endorsing that their faith in religions will prevent them from being affected by COVID-19. The virus as a biological weapon, created by a country to destroy another country' is an example of international level conspiracy. But there is government to public level conspiracy too known as local level conspiracy. For example, "I don't think that COVID-19 is a dangerous disease," a statement of a high-level government official can mislead people to respond unfavorably regarding the COVID-19. Agley and Xiao (2021) asserted that COVID-19-centered conspiracy theory has a substantive, negative real-world effects but remains largely unstudied. Furthermore, though most of the previous studies examined the international level conspiracy, this study is the first in terms of the testing impact of local-level conspiracy on public health behavior.

Literature Review

Defining Misinformation

Precise definition of misinformation, disinformation, and mal-information was proposed by Wardle and Derakhshan (2017). As defined by them, misinformation is false information or misleading content disseminated without the intention to make harm of the audience; disinformation is false information or manipulated or fabricated content disseminated consciously with the purpose to make harm; and mal-information is authentic private information spread to the public with intention to create harassment or hate speech. Bode and Vraga (2015) defined misinformation as the manifestation or belief in objectively inexact information. Tan et al. (2015) defined misinformation as apparently false information. A health-related specific definition of misinformation is given by Chou et al. (2018) as "health-related claim of fact that is currently false due to a lack of scientific evidence." Thus, misinformation could be defined as the one which is shared unconsciously without

knowing the scientific or peer-review fact that whether it was proofed correct or incorrect or was verified by professionals.

Conspiracy Theory

There have been conspiracies against big accidents and successes in the history. The COVID-19 pandemic is no exception. However, the belief in conspiracy has been defined as "the unnecessary assumption of conspiracy when other explanations are more probable" (Aaronovitch, 2009, p. 29). Though some conspiracy theories are harmless (Clarke, 2019) like the accident of Princess Diana and the assassination of John F. Kennedy, there are some conspiracy theories coupled with negative consequences (Brotherton et al., 2013) like the origin and treatment of HIV (Bogart et al., 2010) and childhood vaccinations (Kata, 2010). The case of Princess Diana or the assassination of John F. Kennedy could be considered international level conspiracy, whereas treatment of HIV or fear against childhood vaccination as local or national conspiracy. The later one directly influences the public behavior, hence, harmful. For the COVID-19 pandemic, conspiracies have been spread just after its appearance to the world. For example, "the virus being a biological weapon, created by a country to destroy another country" could be considered an international level conspiracy, apparently not harmful to the publics. On the other hand, the local level conspiracy like "I don't think that COVID-19 is a dangerous disease" made by the current health minister of Bangladesh (Ei Somoy 365, 2020) could undermine the individual preparedness to response COVID-19, hence, harmful. The local level conspiracy theory may be made to protect their given chair or fight against opposite political party in a democratic country or for betterment of the inhabitant of a country.

Religious Misinformation

Faith leaders or religious leaders across the world are found to spread the misinformation about COVID-19. Faith leaders or religious leaders in a country, like Bangladesh, where almost 99.5 percent people are followers of different religions could produce huge followers' behavioral change. In Bangladesh, an Imam (Islamic Priest) of a mosque in Dhaka City (Capital of Bangladesh) was inspiring believers to visit mosque by endorsing that "we enter into mosque by cleaning ourselves, so there is no possibility that coronavirus will attack us" (Kadir, 2020). In March 2020, some Imams in Bangladesh also claimed that COVID-19 is a curse of Allah and provoked Muslim disciples to protest the shutdown of mosques (Rashid, 2020). A super spread religious misinformation in Bangladesh is eating Thankuni (Centella asiatica) three times per day uttering Bismillah (starting in the name of Allah) would shield COVID-19 infection (Rumor Scanner Bangladesh, 2020). In India, some Islamic Imam spread that no Muslim should take vaccine because there are some elements in vaccine that are made from pork meat since eating pork is strongly prohibited in Islam (BBC, 2021a). Some believers in Hinduism in India endorsing that cow urine will protect them from the virus. Tanzania's president John Magufuli was inspiring people to visit churches and mosques by stating that "the virus cannot survive in the body of Christ, it will burn" (The Guardian, 2020). The fact is that there is no scientific evidence about those kinds of statements, hence, considered misinformation and harmful in a situation like COVID-19 contagious disease. A Greek Orthodox bishop states that slaughtered fetuses are used to create COVID-19 vaccine (BBC, 2021b) which creates in vaccine hesitancy. In Israel, a Jewish scholar utters that the COVID-19 vaccine will make people gay (BBC,

2021b). Furthermore, some evangelical Christians in the USA were debating that whether the COVID-19 vaccine is the mark of the beast, sign of the devil, and end of the time (BBC, 2021b). Abbas et al. (2021) reported that Pakistani illiterates believe that COVID-19 vaccine was developed to make Muslim infertile.

Credibility Evaluations

Research shows that the credibility evaluations is subjective. Many factors influence the users to evaluate the credibility of the information or misinformation they receive. Sundar (2008) found 26 factors are influential to motivate the publics for evaluating credibility web content. From them, trustworthiness, expertise, representative quality, and reliability are important among others. A recent study, by Ginsca et al. (2015), also considered previously mentioned four factors as the main components of credibility. Trustworthiness and expertise are considered the source credibility, whereas quality and reliability are considered message credibility (Kakol et al., 2017). However, according to the extensive investigation in communication study, the concept of credibility incorporates message, source, and media credibility (Metzger et al., 2003). In the case of public health issue, media credibility is also significant, because source credibility is ensured by traditional media, whereas social media conduit (the today's biggest platform for receiving information) does not ensure it since most of the contents in social media are published by users themselves (Wang et al., 2019). Though source credibility is ensured by traditional media, source evaluations is still important than mere exposure to those sources. Hence, credibility evaluations of information or misinformation by public about health-related issue like COVID-19 are urgent to take necessary actions where there is no vaccine that has been created as of today (June 25, 2020) for COVID-19.

Situational Motivation

Trémeau et al., (2013, p. 44) defined situational motivation as "the motivation individuals experience when they are engaging in an activity." It is the motivation that assists individuals to begin and finish an action. Public wants to get rid of the panic of COVID-19. They are curious about it. They want to know true health-related information about the issue. Since the COVID-19 pandemic is a global health crisis as well as individual's problem, consequently, individuals engage oneself in different platforms, which might work as motivation for him/her. However, an operational definition of situational motivation is provided by Kim and Grunig (2011, p. 132) as "the extent to which a person stops to think about, is curious about, or wants more understanding of a problem." The definition also noted that peoples are curious, and they want more understanding of the problem, i.e., COVID-19, that might help them to comprehend real scenario about the health-related issue such as diagnostic and treatment of the COVID-19 disease. Furthermore, Glanz and Bishop (2010) noted that public knowledge, attitudes, reactions to stress, and motivation are significant individual determinants of health behavior.

Theory of Persuasion and Behavior Change

Several persuasion and behavior change theories have been used to comprehend the individual and social factors that affect public health behaviors (Tan et al., 2015). The reason

behind popularity of behavior change theory in recent years is that the theory is a process of behavior change rather than an event (Glanz & Bishop, 2010).

Hence, persuasion and behavior change theories lucidly explain the individual's beliefs, intentions, and behaviors. Behavioral beliefs, as noted by Fishbein and Ajzen (2010), is the outcome expectancies correlated with a specific behavior, and beliefs are intellectualized as imperative explanatory element for an individual's stance toward espousing a health behavior. Health behavioral intention is considered the primary predictor of health behavior (Noar et al., 2007) and an outcome of health beliefs. Health behavior is the actual usage or responses to a (mis)information or health campaign. Though the literature supports extensive evidences of examining the influence of health information on beliefs in numerous areas such as physical activity (Bauman et al., 2008), alcohol consumption (de Graaf et al., 2015), safe sex practice (Bleakley et al., 2009), tobacco (Dunlop & Romer, 2010; Kelly & Manning, 2014), nutrition (Booth-Butterfield & Reger, 2004), and others, there are very few studies examined and explicitly modeled misinformation exposure as predictor of health beliefs (Tan et al., 2015).

Hypothesis Development

As mentioned earlier, the study is based on the theory of persuasion and behavior change. Hence, following the McGuire's Communication-Persuasion Matrix (McGuire, 1989), three preconditions (information exposure and attention, information process, and learning from the information) are there to occur belief. Tan et al. (2015) advocated that information exposure is likely to foundation of beliefs consistent with the information. However, some believers in Hinduism in India endorse that cow urine will protect them from the virus. Tanzania's president, John Magufuli, encouraged its peoples to visit churches and mosque by announcing that "The virus cannot survive in the body of Christ, it will burn" (The Guardian, 2020). Bangladesh is also no exception. Exploratory investigation revealed that religious fundamentalists are more prone to believe in false information (Bronstein et al., 2019). On the other hand, van Prooijen and Jostmann (2013) noted that conspiracy beliefs are prone to happen when publics feel insecurity and trust that corruptions in government are elevated. Bangladesh, as reported by the Berlin-based Transparency International, ranked 14th among the highest corrupt countries in the Global Corruption Perception Index 2019 (Ahammad 2020). Furthermore, Al-Qahtani et al. (2016) noted that feeling insecurity and beliefs in government corruption are prone to contribute to the intensification of conspiracy beliefs about Zika. Even a little fraction of aficionados to a specific conspiracy theory can be sufficient to produce serious harm, noted by Sunstein and Vermeule (2009). Furthermore, social media misinformation is positively associated with the likelihood of believing health misinformation (Wu et al., 2022). Based on the above, we can conclude that the peoples of Bangladesh are also likely to believe in conspiracy about COVID-19. Grounded on the persuasion process, therefore, the authors postulate that exposure to religious misinformation and conspiracy theories would predict health beliefs.

Hypothesis 1A (H_{1a}) Exposure to conspiracy has an impact on individual's belief about COVID-19.

Hypothesis 1B (H_{1b}) Exposure to religious misinformation has an impact on individual's belief about COVID-19.

Likelihood of an action or intention to engage in the behavior is considered the immediate outcome of beliefs. Beliefs as important variables of persuasion research influence the one's intention to engage in behavior. According to Ajzen (1985), three forces determine the intention. Perceived behavioral control, one of them, arises from beliefs about behavioral barriers, resources, and opportunities. The religious misinformation and conspiracy theories are considered the resources for beliefs people receives through social media. Attitude toward the behavior, another force that determines the intention, is a function of beliefs (Ajzen, 1985). Intention echoes one's incitement to engage in a behavior (Bae & Kang, 2008). Attitude toward the behavior is essential to exert the influence of intention on behavior (Ajzen, 1991). Furthermore, pioneers in this field opined that intention is the most proximate interpreters of actual behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). Accordingly, this study hypothesizes that health beliefs have an effect on intentions and that intention in turn influences behaviors about COVID-19.

Hypothesis 2 (H$_2$) Beliefs in COVID-19 conspiracy and religious misinformation predict individual's intention.

Hypothesis 3 (H$_3$) Higher intention to perform behavior would predict actual health behavior about COVID-19.

Situational motivations and credibility evaluations are introduced as moderators in the proposed relationships. Many researchers noted that beliefs in misinformation would have substantial influences on behavior. For example, Kuran (1998) noted that conspiracy belief has had hefty consequences on behavior. Furthermore, Sunstein and Vermeule (2009) opined that a little belief in conspiracy can be sufficient to produce harmful behavior. Brennen et al. (2020) suggested that COVID-19 misinformation can engender a severe risk to public health. Djalante et al. (2020) advised that religions can simultaneously play strong positive and negative roles during pandemic. By mentioning Baron and Kenny (1986), Barua et al. (2018) advocated that introduction of moderating or mediating variables could produce better understanding of the relationships in the case when there is strong relationship between endogenous and exogenous variables. Furthermore, credibility evaluations would assist the publics to not believe misinformation and conspiracy through debunking the source or message originality, resulting in lower negative behavioral intention and actual behavior. In addition, situational motivation like COVID-19 online training and certification would help the publics to recognize the negative consequences of belief in misinformation and conspiracy, ultimately lowering likelihood of action and behavior. Accordingly, the study hypothesizes that situational motivations and credibility evaluations moderate the relationships proposed in hypotheses 1 to 3 such that those relationship will be weaker for greater level of situational motivation and credibility evaluation. Therefore, the moderating hypotheses are as follows:

Hypothesis H$_{4a}$ Situational motivation moderates the relationship between conspiracy and health belief

Hypothesis H$_{4b}$ Situational motivation moderates the relationship between religious misinformation and health belief

Hypothesis H₄c Situational motivation moderates the relationship between health belief and intention

Hypothesis H₄d Situational motivation moderates the relationship between intention and health behavior

Hypothesis H₅a Credibility evaluation moderates the relationship between religious misinformation and health belief

Hypothesis H₅b Credibility evaluation moderates the relationship between conspiracy and health belief

Hypothesis H₅c Credibility evaluation moderates the relationship between health beliefs and intention

Hypothesis H₅d Credibility evaluation moderates the relationship between intention and health behavior

A conceptualized structural framework, which exhibits the moderating role of situational motivations and credibility evaluations, is presented in Fig. 1.

Research Method

Instrument Development

The instrument was developed by including both previously validated scale and some self-developed items. Some items were faintly modified to fit the current study purpose. For conspiracy theories, five items were adapted from Brotherton et al. (2013). All the items adapted for conspiracy beliefs were related to local level conspiracy (government to public) (see Appendix) though Brotherton et al. (2013) have also introduced scale for global level conspiracy. Three items for religious misinformation were self-developed based on the intensive literature review related to religious groups', faith leaders', priests', and maulanas' opinion pertaining to COVID-19. Situational motivation was measured by using four-item scale, three items were adapted from Kim and Grunig (2011) and Yan et al. (2018) and one item–"I need more COVID-19 information to improve my health literacy"–was self-developed. Five-item credibility evaluation scale was adapted from Meyer (1988). Health

Fig. 1 Conceptualized structural framework
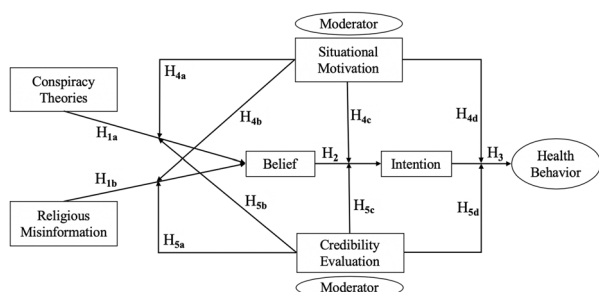
belief was measured with three-item scale validated by Baesler and Burgoon (1994). Intention was measured by the scale proposed by Bae and Kang (2008). WHO, CDC, and other health-related organizations made a number of precious statements about how an individual can respond and protect him/her from COVID-19. Finally, therefore, six items for COVID-19 behavioral responses were adopted from Barua et al. (2020) who developed the scale by following the guidelines and recommendation specified by WHO (WHO, 2020c) and Center for Diseases control (CDC) (CDC, 2020). Five-point Likert scale ranged from "1 = strongly agree," to "3 = no opinion," to "5 = strongly disagree" was used for most of the constructs of the study, but the scale for situational motivation, credibility evaluations, and behavioral responses was coded reversely.

Data and Participants

The current study considered people with the age more than 18 years to participate in the survey and from any part of Bangladesh. This study followed simple random sampling technique for online data collection. The link of structured questionnaire using Google docs was delivered through social media and email to collect data following the suggestions of Barua et al. (2020) and Barua and Barua (2021), and 397 responses were received. After eliminating incomplete responses, 373 responses were retained for the final study. The psychographic properties of the response are presented in Table 1, where most of the participants were young and found to believe in Islam.

Data Analysis and Results

As a variance-based structural equation model (SEM) technique, the partial least squares (PLS) method was employed to analyze the data. PLS is considered "silver bullet" for its robustness and rigor in data analysis (Hair et al., 2011) with a combination of both principle component analysis and least squares path analysis. In covariance-based SEM approaches, multivariate normality of data is a prerequisite which is not mandatory in PLS-SEM technique (Hair et al., 2011). Though the multiple regression analysis was widely used in the past to analyze the moderating effect (Yu et al., 2017), it has limitation of handling no more than one dependent variable (Baron & Kenny, 1986). This problem is removed in PLS-SEM which includes moderating effect with multiple dependent variables. Following the previous studies (Goodhue et al., 2007; Yu et al., 2017), therefore, the current study also considered PLS-SEM for moderating effect analysis. As a PLS-SEM analysis software, the paper employed SmartPLS 3.0 (Ringle et al., 2015).

Measurement Model Validation

The data were analyzed following the two-stage approach recommended by pioneer in the variance-based structural equation model (Hair et al., 2011). The outer model or measurement model includes unidirectional predictive associations between latent factors and its accompanying observed indicators and thus helps to measure psychometric properties of data, i.e., internal reliability and validity of the constructs, whereas the inner model or the structural model shows the significance of the relationships between the endogenous and exogenous constructs and thus tests the proposed hypotheses. However, the measurement model was assessed for factor loadings of individual indicators

Table 1 Participants' psychometric properties

Dimensions	Frequency	Percentage
Gender		
Female	171	45.83
Male	202	54.17
Age		
18–30	79	21.18
31–40	172	46.11
41–50	85	22.79
50–60	37	9.92
Experience in using social media		
Less than 5 years	82	21.98
6–10 years	180	48.26
> 10 years	111	29.76
Religions		
Islam	218	58.45
Hinduism	78	20.91
Buddhism	60	16.09
Christianity	14	3.75
Non-believers	3	0.80
Education		
Highschool	55	14.75
Honors	121	32.44
Masters	180	48.26
PhD	7	1.88
Others	10	2.68

or reliability of individual items, construct reliability, convergent validity, and discriminant validity. Factor loadings of individual indicator or reliability of individual items was found to range from 0.802 to 0.886, surpassing the critical level of 0.7 (Hair et al., 2011). Table 2 shows all the constructs' Cronbach's alpha and composite reliability to have more than 0.770 suggesting the construct reliability (Fornell & Larcker, 1981; Hair et al., 2010). Furthermore, Table 2 also shows the AVE of all constructs ranged from 0.522 to 0.743; the values are compared positively against the recommended value 0.50 (Fornell & Larcker, 1981), and, hence, the construct convergent validity was ensured.

The discriminant validity of the constructs was checked by following the cross loadings and Fornell-Larcker (shown in the Table 3) criteria. All the indicators were found to load to their corresponding constructs with higher loadings than the cross loadings on others factors. In the Fornell-Larcker criteria in Table 3, the square root of the AVE along the diagonal should be higher than the correlation coefficients (off-diagonal) between the constructs to their relevant rows and columns, but the authors found a little dispute for the situational motivation×health belief (SM*HB) − situational motivation×religious misinformation (SM*RM) construct. The difference is too small, 0.095, and hence can be ignored (Ab Hamid et al., 2017). Cross loadings and Fornell-Larcker criteria, therefore, show the discriminant validity of the scale by ensuring factors are not perfectly correlated.

The assessment of measurement model indicates that the model has acceptable level of item reliability, construct reliability, convergent, and discriminant validity, ensuring that

Table 2 Construct reliability and validity

Construct	CA	CR	AVE
Conspiracy theories (CT)	0.885	0.916	0.685
Religious misinformation (RM)	0.770	0.867	0.684
Health belief (HB)	0.791	0.877	0.705
Intention (IN)	0.859	0.905	0.703
Behavioral responses (BR)	0.913	0.935	0.743
Situational motivation (SM)	0.864	0.906	0.707
Credibility evaluations (CE)	0.909	0.932	0.733
Situational motivation×conspiracy theories (SM*CT)	0.957	0.960	0.548
Situational motivation×health belief (SM*HB)	0.924	0.934	0.542
Situational motivation×intention (SM*IN)	0.949	0.949	0.539
Situational motivation×religious misinformation (SM*RM)	0.927	0.937	0.554
Credibility evaluations×conspiracy theories (CE*CT)	0.968	0.970	0.568
Credibility evaluations×health belief (CE*HB)	0.943	0.949	0.555
Credibility evaluations×intention (CE*IN)	0.954	0.957	0.527
Credibility evaluations×religious misinformation (CE*RM)	0.934	0.942	0.522

CA Cronbach's alpha, *CR* composite reliability, *AVE* average variance extracted

the scales are statistically fit to extend the analysis from measurement to structural model and moderating effects.

Analysis of the Moderating Effects

The authors used PLS to test the main effects and moderating effects. Figure 2 shows the main effects of the variables in the model excluding the moderator variable, and Fig. 3 shows the main effects including the moderating variables. Figure 4 shows the moderating effects of moderating variables. In Fig. 4, for example, to test the moderating effect, situational motivation (moderator) and conspiracy theories (predictor) were multiplied to generate an interaction variable (situational motivation×conspiracy theories) to predict health belief. However, model 3 in Table 4 and Fig. 4 clearly indicates the moderating effects of situational motivation and credibility evaluation according to the empirical study suggested by Baron and Kenny (1986).

From the moderating hypotheses, the hypotheses H_{4b} ($\beta = -0.048$, $t = 1.512$, $p <$ n.s) and H_{5d} ($\beta = -0.041$, $t = 1.235$, $p <$ n.s) were not found significant, that is, situational motivation did not moderate the relationship between religious misinformation and health belief; and credibility evaluations did not moderate the relationship between intention and behavioral responses, respectively. However, situational motivation was found to negatively moderate the relationship between health belief and intention and thus supports the hypotheses H_{4c} ($\beta = -0.23$, $t = 5.51$, $p < 0.01$). More specifically, greater level of situational motivation makes the strong relationship weaker between the health belief and intention. Interestingly, situational motivation was found to positively moderate the relationship between conspiracy theory and health belief and negatively moderate the relationship between intention and health behavioral responses, which are contrary to hypotheses H_{4a} (with $\beta = 0.069$, $t = 1.87$, $p < 0.05$) and H_{4d} (with $\beta = -0.067$, $t = 1.853$, $p < 0.05$),

Table 3 Discriminant validity (Fornell-Larcker criterion)

| SV/AVE	BR	CE	CE*CT	CE*HB	CE*IN	CE*RM	CT	HB	IN	RM	SM	SM*CT	SM*HB	SM*IN	SM*RM
BR	0.862														
CE	0.419	0.856													
CE*CT	0.232	0.202	0.754												
CE*HB	0.304	0.240	0.719	0.745											
CE*IN	0.144	0.166	0.533	0.603	0.726										
CE*RM	0.241	0.223	0.677	0.721	0.575	0.722									
CT	−0.295	−0.422	−0.672	−0.619	−0.441	−0.588	0.828								
HB	−0.395	−0.563	−0.598	−0.739	−0.514	−0.640	0.658	0.839							
IN	−0.566	−0.392	−0.406	−0.491	−0.374	−0.463	0.453	0.557	0.839						
RM	−0.353	−0.522	−0.552	−0.622	−0.478	−0.686	0.657	0.750	0.524	0.827					
SM	0.300	0.161	0.288	0.298	0.258	0.291	−0.309	−0.297	−0.258	−0.277	0.841				
SM*CT	0.179	0.285	0.465	0.318	0.250	0.314	−0.434	−0.332	−0.327	−0.359	0.183	0.740			
SM*HB	0.172	0.292	0.348	0.337	0.350	0.364	−0.337	−0.326	−0.329	−0.369	0.202	0.736	0.736		
SM*IN	0.086	0.254	0.267	0.323	0.368	0.317	−0.345	−0.333	−0.310	−0.369	0.168	0.562	0.610	0.734	
SM*RM	0.161	0.266	0.329	0.347	0.341	0.379	−0.354	−0.354	−0.358	−0.358	0.157	0.726	0.831	0.624	0.745
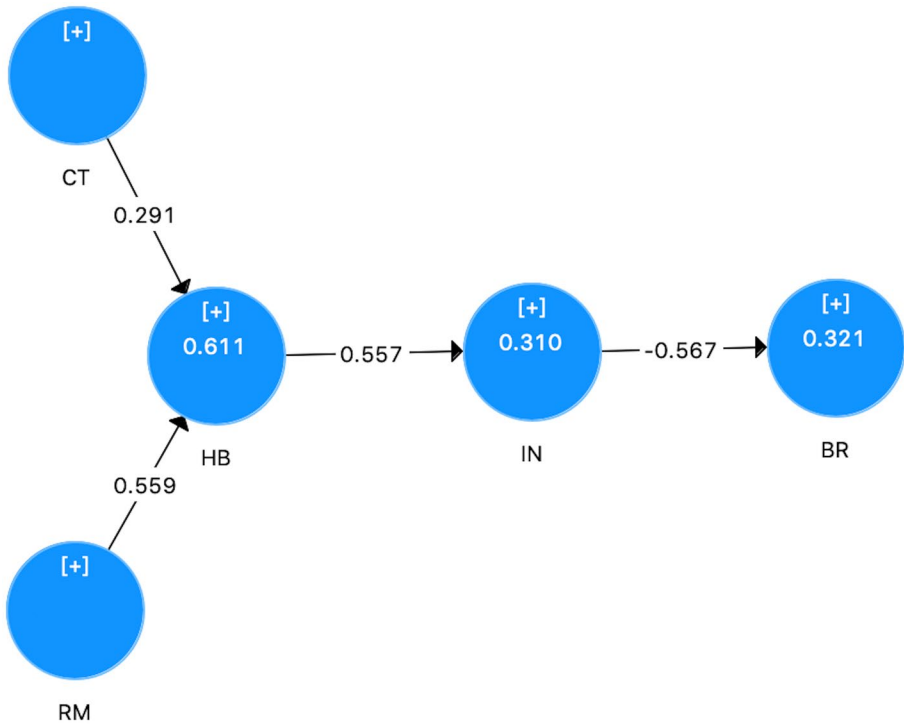
Fig. 2 Main effects of variables excluding moderators

respectively. On the other hand, credibility evaluation was found to significantly and negatively moderate the relationship between religious misinformation and health belief, conspiracy theory and health belief, and health belief and intention and thus support the hypotheses H_{5a} ($\beta = -0.086$, $t = 2.570$, $p < 0.05$), H_{5b} ($\beta = -0.115$, $t = 3.282$, $p < 0.01$) and H_{5c} ($\beta = -0.102$, $t = 2.590$, $p < 0.05$), respectively. More precisely, the authors found that credibility evaluation decreases the strength of the impact of conspiracy theory and religious misinformation on health belief as well as the impact of health belief on intention.

Assessment of the Structural Model

In this step, this study tests the proposed relationship considering path coefficient (β) and t-statistics at a significance level of 0.05 ($p < 0.05$). Bootstrap resampling technique was followed to test the structural model with 5000 iterations of resampling (Hair et al., 2011). All the four hypotheses (excluding moderating effects hypotheses) in the model were found to reach the significance level 0.05 level. The structural model path analysis coefficients for misinformation, health belief, intention, and behavior were as follows: conspiracy theory → health belief ($\beta = 0.122$, $t = 2.11$, $p < 0.05$), religious misinformation → health belief ($\beta = -0.311$, $t = 5.438$, $p < 0.05$), health belief → intention ($\beta = -0.273$, $t = 3.236$, $p < 0.05$), intention → behavioral responses ($\beta = -0.496$, $t = 8.347$, $p < 0.001$). Conspiracy theory and religious misinformation predicted health belief and thus support the
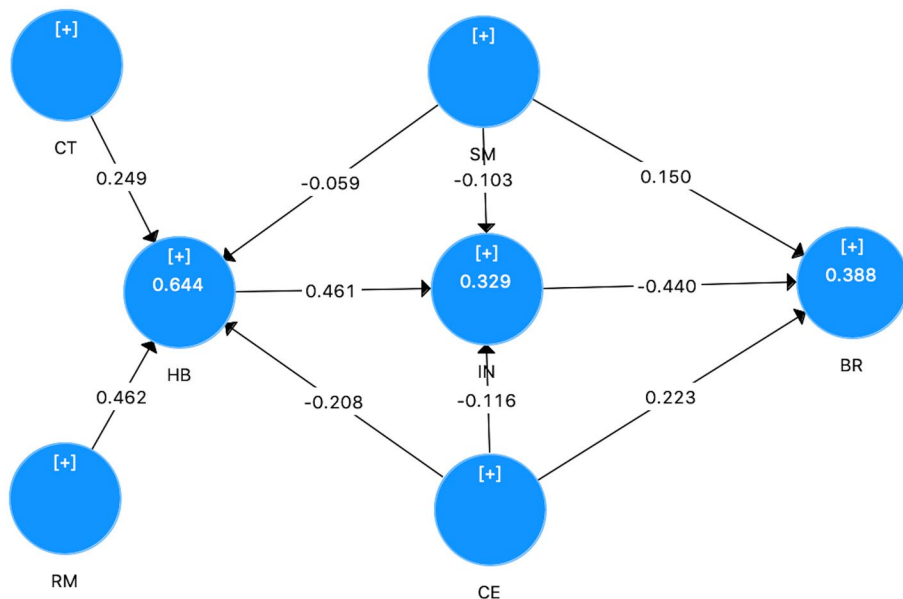
Fig. 3 Main effects of variables including moderators

hypotheses H_{1a} and H_{1b}. In addition, health belief predicted intention, supporting hypothesis H_2. Finally, intention is found to negatively influence the behavioral responses (supporting hypothesis H_3).
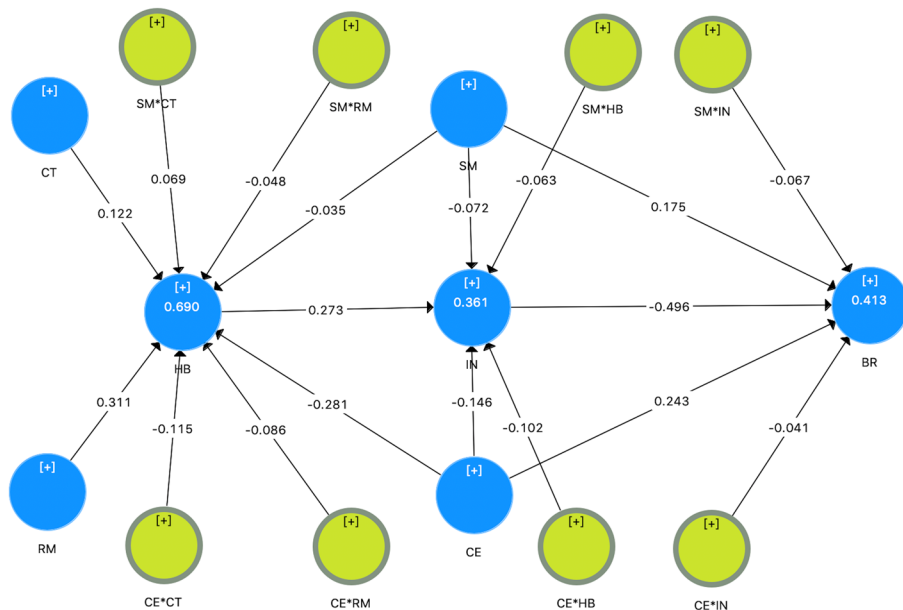

Fig. 4 Structural model and path coefficients including interaction effects

Table 4 Baron and Kenny test of moderating effects

Latent	Sample ($n = 273$)					
	Model 1		Model 2		Model 3	
CT−>HB	0.291		0.249		0.122	
RM−>HB	0.559		0.462		0.311	
HB−>IN	0.557		0.462		0.273	
IN−>BR	−0.567		−0.441		−0.496	
Moderators main effects						
SM−>HB			−0.059		−0.034	
CE−>HB			−0.208		−0.282	
SM−>IN			−0.103		−0.073	
CE−>IN			−0.115		−0.146	
SM−>BR			0.150		0.175	
CE−>BR			0.223		0.243	
Moderators interaction effects						
SM*CT−>HB					0.069	
SM*RM−>HB					−0.047	
CE*CT−>HB					−0.115	
CE*RM−>HB					−0.086	
SM*HB−>IN					−0.063	
CE*HB−>IN					−0.102	
SM*IN−>BR					−0.067	
CE*IN−>BR					−0.041	
R^2	R^2	$\triangle R^2$	R^2	$\triangle R^2$	R^2	$\triangle R^2$
Health belief	0.611	0.608	0.644	0.639	0.690	0.681
Intention	0.310	0.308	0.329	0.321	0.361	0.349
Health behavior	0.321	0.319	0.388	0.381	0.413	0.402

Furthermore, Hair et al. (2011) supported that R^2 values of 0.25, 0.50, or 0.75 for dependent variables in the structural model can be considered weak, moderate, or strong, respectively. This study revealed a substantial portion of variance explained with R^2 values 0.69 for health belief, 0.361 for intention, and 0.413 for behavioral responses, that is, the model discovered the adequate level of variance of health belief, intention, and behavioral responses. The variance explained shown in Fig. 4 for endogenous variable is a sign of model fitness and stability. Compared to model 1 and model 2, model 3 is very much acceptable in all aspects (see Figs. 2, 3 and 4).

Conclusion and Discussion

As the current global situation urge, the purpose of this study is to explore the potential effects of conspiracy theories and religious misinformation on COVID-19 behavioral responses based on the theory of persuasion and behavior change and to reveal how situational motivation and credibility evaluation change the individual behavioral responses regarding the COVID-19. The hypotheses are developed based on the extensive and careful review of the literature related to conspiracy theories, religious misinformation, theory

of persuasion and behavior change, and COVID-19 pandemic, as well as other epidemics like Zika virus and Ebola virus. However, health beliefs about the COVID-19 behavioral responses, according to the findings of the study, are significantly and positively influenced by the conspiracy theories and religious misinformation (H_{1a} and H_{1b}) which supports the theoretical assertions of Pennycook et al. (2020) and Bronstein et al. (2019), respectively. Furthermore, this result also corroborates the recent empirical finding of Wu et al. (2022) who noted that COVID-19 social media misinformation has significant relation with the likelihood of believing health misinformation. A major reason behind strong confirmation of H_{1b} could be the respondent setting. All the respondents were from Bangladesh, a country with more than 99.5 percent believers in different religions. According to the findings, this religious belief sometimes leads publics to believe in misinformation delivered by faith leaders in a situation like pandemic. These influences are found to turn weaker in the presence of situational motivation and credibility evaluation (see Figs. 2 and 4). More specifically, credibility evaluation is found to have strong influence on the participants in reducing their belief in conspiracy theories and religious misinformation.

On the other hand, though situational motivation is found to positively influence the relationship between conspiracy theories and health belief, they together deteriorate the participants' belief in conspiracy theories and religious misinformation. The direct strong effect of health belief on intention (H_2) is found to be influenced by both the situational motivation and credibility evaluation which assist the participants to not show strong intention (see Figs. 2 and 4) on their health behavior related to COVID-19 based on their beliefs in conspiracy theories and religious misinformation (H_{4c} and H_{5c}). In comparison to the direct effect of intention on health behavioral responses between Figs. 2 and 4, the authors discovered that joint moderating effect of both situational motivation and credibility evaluation makes the strong effect of intention on health behavioral responses weaker though the results showed that individual credibility evaluation did not influence the relationship (H_{5c}) and situational motivation negatively influences the relationship (H_{4c}).

One important thing to note here is that the authors hypothesized negative relationship between intention and behavior (H_3) because the participants who were likely to believe conspiracy theory and religious misinformation would like to show positive intention to follow or believe conspiracy theory and religious misinformation, which influence them to not follow the guidelines of the WHO or CDC. The scale of health behavioral responses, therefore, was related to the compliance of COVID-19 rules and regulations given by the WHO, CDC, and others and established a negative relationship with intention. For example, one item of the health behavioral response "I do maintain at least 1 m (3 feet) distance between myself and others" would have negative relation with the intention who believe faith leaders or conspiracy theory because the people are going to religious institutions (influenced by religious misinformation) or going to their works (influenced by government to public level conspiracy) where maintaining such distance is hardly possible. The people who believe untrue information regarding COVID-19 are not likely to maintain social distancing or physical distancing, washing hands, courtesy of coughing, covering of mouth and nose with mask. etc. This empirical finding (H_3) corroborates the recent assertion of researchers (Pennycook et al., 2020; Rosenberg et al., 2020) who note that the misinformation generates less response to advice on COVID-19 issues and turn them to be ineffective like in social distancing and others. Furthermore, from hypothesis 3, it is also suggested that the greater the belief in conspiracy about COVID-19, the greater the unfavorable responses are. The literature review suggests that government and government-owned

organizations can make conspiracy for many reasons. For example, they provide some misinformation sometimes amid a pandemic for the betterment of its economy as well as to not to lose their present political position and given chair. As empirical result shows, this conspiracy leads detrimental public responses amid a pandemic like COVID-19. However, the empirical finding for H_3 also buttress the postulation of researchers Kuran (1998) and Sunstein and Vermeule (2009) who advised that conspiracy belief produces serious harms and hefty consequences of behavior. However, this relationship is found to be weaker in the presence of moderating effects of credibility evaluation and situational motivation. Health behavior responses to COVID-19 is a matter of death-and-live, and hence, peoples are likely to evaluate credibility of information, and situational motivation could influence them to adopt favorable as well as hygienic behavior to COVID-19. However, this empirical result partly validates the theoretical statement of Austin and Dong (1994) who noted that credibility evaluation can shape the way public respond to messages.

However, this study is one of the forefront studies in validating some important assertions related to misinformation and public health behavioral responses regarding COVID-19. In this study, the authors proposed a conceptual framework based on the extensive literature review about COVID-19, misinformation, and the theory of persuasion and behavior change. Consequently, the study contributes in both the health sector research and communication research by addressing the public health behavioral responses and misinformation belief (conspiracy theory and religious misinformation).

Implications

The findings of the study suggest that participants are prone to believe in conspiracy and religious misinformation which ultimately influence them to show COVID-19-negative behavioral responses about maintaining the guidelines proposed by the WHO, CDC, and others. Furthermore, the presence of situational motivation and credibility evaluation is found to moderate their health belief, intention, and health behavior. Based on the findings, this study proposes some implications for both the responsible authority and publics. First, for situational motivation, COVID-19 online training course, awareness program on social networking sites, TV, etc. should increase in number so that the program can debunk the misinformation about COVID-19 in publics. By receiving the true information as situational motivation, publics will be competent to solve the problems, i.e., what to do or not to do. This will produce COVID-19 favorable behavioral responses. The authors hope that this suggestion will work in the case of other misinformation-related accident or event.

Second, the faith leaders could also provide valuable and true information about COVID-19 when they deliver religious statements to their respective religions' followers. This will also act as situational motivation which will encourage the publics to respond positively. However, in that case, government and non-government organization can come forward to work with religious faith leaders. A recent example regarding this could cite here from Bangladesh, a country with more than 99.5 percent of different religions followers of whom more than 90 percent are Muslim. When the government observed that some maulanas or imams are requesting believers to visit mosque during this COVID-19 pandemic, a government owned organization–the Islamic Foundation Bangladesh (IFB)–has started work with UNICEF with

the purpose that both of them will assist imams or maulanas to spread COVID-19 health-related information like diagnostic and treatment of the disease before or after the prayer as the maulanas or imam are "expert communicator" (UNICEF, 2020). This strategy could be applied to other regions in the world where it is reported that some faith leaders are spreading misinformation and to other event or accident like pandemic or epidemic where misinformation generates from faith leaders.

Third, the respective authority can initiate different measures to encourage the publics to evaluate the credibility of the (mis)information they receive via social media or other. As the authors mentioned earlier, social media, for its popularity, it is hardly possible to stop the spread of misinformation on social media conduit; hence, encouraging measures as key strategy can be taken to encourage the publics to evaluate the credibility of sources or message. Consequently, the "Stop The Spread," a recent joint campaign taken by the WHO and Government of the UK regarding misinformation and COVID-19, is a timely initiative to encourage the publics to evaluate the credibility of the (mis)information they receive through social media conduit (WHO, 2020d), or CoVerifi platform is also an effective website to verify information about COVID (Kolluri & Murthy, 2021). They emphasized on double checking the information comparing it with authentic spokespersons like the WHO, CDC, and regional and national health organizations.

Whatever the sources of misinformation are (conspiracy theory and religious misinformation), the joint moderating effects of both situational motivation and credibility evaluation play a significant role in changing the health behavior of the publics from negative to positive toward COVID-19. Though they play significant role, the government and responsible authorities' behaviors are also significant influencers in public responses. The government and responsible agencies, therefore, by taking shelter of conspiracy theories, should not misguide the publics. Conversely, international bodies, governments, local and regional organizations, religious faith leaders, and social networking sites should work together to implement the vaccine for misinformation.

Limitations and Anticipated Research Paths

In spite of the useful findings and conclusions, our research can be further improved by addressing some limitations the study has gone through. Albeit the response rate was reasonable, the small sample size can be considered a prime limitation of the study since misinformation travels all the corners of the globe with the support of internet and social media. Secondly, the respondents are only from Bangladesh; hence, caution is needed to generalize the findings of the study, particularly about hypothesis H_{1b}, which sustenance that public strongly belief religious misinformation because all the peoples around the globes are not believers of God i.e., there are atheist in the world too. Therefore, they are not bound to listen and follow the faith leaders around the world. Depending on the characteristics of the religions' believers and non-believers, the strength of prediction might differ. Since researchers note that COVID-19 misinformation can come from numerous sources (Rosenberg et al., 2020), hence, it can be a new path for research to include some other sources of misinformation.

Appendix. List of measures and factor loading (FL)

Constructs	Code	Reflective latent measures	FL	Source
Conspiracy	CT1	The government keeps many important secrets from the public	0.825	Brotherton et al. (2013)
Theories	CT2	The rapid spread of COVID-19 is the result of the deliberate, concealed efforts of some organizations	0.829	
	CT3	Government-funded scientists manipulate evidence in order to support existing government policy	0.824	
	CT4	A lot of information about diseases and treatments is withheld from the public	0.839	
	CT5	The government fakes evidence relating to significant world events to deceive citizens	0.821	
Religious	RM1	The information provided by our religious Priest/Moulana/Monk about COVID-19 are correct	0.811	Barua et al. (2020)
Misinformation	RM2	The information provided by our religious Priest/Moulana/Monk about COVID-19 are not harmful	0.802	
	RM3	The information provided by our religious Priest/Moulana/Monk is more accurate than the information of scientists/doctors about COVID-19	0.867	
Health belief	HB1	The information I receive from faith leaders and government about COVID-19 through social media greatly influenced me	0.853	Baesler and Burgoon (1994)
	HB2	I felt the information from faith leaders and government about COVID-19 through social media was very persuasive	0.817	
	HB3	I do have much confidence in the claims by faith leaders and government about COVID-19	0.848	
Intention	IN1	I plan to follow the path shown by the faith leaders and government	0.838	Bae and Kang (2008)
	IN2	I intend to follow the path shown by the faith leaders and government	0.830	
	IN3	I expect to follow the path shown by the faith leaders and government	0.847	
	IN4	I am likely to follow the path shown by the faith leaders and government	0.840	
Health	BR1	I do wash my hands thoroughly with alcohol-based hand rub or wash them with soap and water	0.857	Barua et al. (2020)
Behavior	BR2	I do maintain at least 1 m (3 feet) distance between myself and others	0.830	
	BR3	I avoid touching eyes, nose, and mouth	0.886	
	BR4	I do cover my nose and mouth with my bent elbow or a tissue when I cough or sneeze	0.873	
	BR5	I wear face mask when I go out on emergency	0.861	

Constructs	Code	Reflective latent measures	FL	Source
Situational	SM1	I feel it is worth paying attention to online COVID-19 information	0.861	Kim and Grunig (2011) and Yan et al. (2018), self-developed
Motivation	SM2	My knowledge about COVID-19 is not sufficient	0.832	
	SM3	I am curious about online COVID-19 information	0.845	
	SM4	I need more COVID-19 information to improve my health literacy	0.826	
Credibility	CE1	I do double-check the information about COVID-19 received through social media	0.852	Meyer (1988)
Evaluation	CE2	The comments I read about COVID-19 under a post on social network is useful	0.831	
	CE3	The comments I read about COVID-19 under a post on social network is unbiased	0.871	
	CE4	The comments I read about COVID-19 under a post on social network is accurate	0.862	
	CE5	The comments I read about COVID-19 under a post on social network is trustworthy	0.866	

Declarations

Ethics Approval Not applicable.

Consent to Participate Not applicable.

Conflict of Interest The author declares no competing interests.

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