SSM - Population Health 21 (2023) 101343

Contents lists available at ScienceDirect

SSM - Population Health

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

Health persuasion through emoji: How emoji interacted with information source to predict health behaviors in COVID-19 situation☆

Tingyi S. Lin *, Yue Luo

Department of Design, National Taiwan University of Science and Technology, Taiwan Tech, #43, Keelung Rd., Sec.4, Da'an Dist., Taipei City, 106335, Taiwan

ARTICLE INFO

Keywords:
Emoji
Preventive behavioral intention
Information source
Perceived fear
Congruity theory
Health communication

ABSTRACT

By providing health information through visual communication, public health organizations can effectively guide and persuade people to adopt healthy behaviors, which is critical in the context of public health crises. In this study, drawing upon congruity theory and the premise of visual communication, we examined how information source and emoji may shape people's preventive and self-protective behaviors through perceived fear (PF) and perceived controllability (PC). Using a convenience sample of 210 participants, we conducted a 2 (emoji: with versus without) × 2 (information source: official versus unofficial) between-subject experiment. The results indicated that, compared with nonuse, the use of emoji in information resulted in higher PF, stronger preventive behavioral intention (PBI), and lower PC. In addition, a strong interaction effect was observed between emoji and the source of information on PBI. When emoji were added to health information released by an unofficial organization, the text outperformed that from an official agency in persuading people to adopt preventive behaviors. Furthermore, we determined that PF mediated the effect of emoji on PBI, but only for unofficial information sources. These results provide a reference for enhancing the effectiveness of health information including visual cues, such as emoji.

1. Introduction

With its spread worldwide, COVID-19 has not only changed the daily routines, attitudes, and rational judgment of humans but also affected the overall economic system and public policies. With the pandemic spreading further and the situation constantly changing, the communication of accurate and effective information has become extremely critical. Effective information can minimize damage and prevent widespread illness and disease. In addition, in view of emergency management and preventive health education, more active discussions and awareness are immediately required. However, the obstacles in information communication and exchange during the pandemic have raised some concerns regarding the accuracy and practicability of public information communication. One urgent problem in this challenging information environment is to provide evidence-based messages to help reach at-risk populations and influential information senders (King & Lazard, 2020). Also, the application of visual communication plays a critical role in media environments. Therefore, given the prominence of visual cues within media environments, specific recommendations on how and when visual means should be used to communicate scientific risks and health information are urgently required but remain inadequate, although some cogent suggestions have been made.

Rimal et al. (2011) proposed that behavioral researchers should shift their focus from determinants to their attributes. Given the critical role of visual stimuli in health information communication, research on health behaviors may assign visual attributes to determinants to identify more effective methods for promoting health and well-being. Although the National Cancer Institute (2002, 2007) provided some methods for the design of health information communication materials, only general and vague advice on selective images was offered. The University of Michigan Center for Health Communications Research offers a data bank of visual decisions to health communicators called Visualizing Health (http://www.vizhealth.org/); this data bank offers advice for visualization methods during the demonstration of data messages. The visual elements and methods listed in this data bank have been widely used with the Creative Commons License. However, although this resource is considerable, it is not yet fully user friendly. In addition, although several studies have indicated that visual information can

☆ Acknowledgements: This research was supported by National Science and Technology Council [MoST 111-2410-H-011-033-MY2].

* Corresponding author.
E-mail addresses: tingyi@mail.ntust.edu.tw (T.S. Lin), d10810802@mail.ntust.edu.tw (Y. Luo).

https://doi.org/10.1016/j.ssmph.2023.101343
Received 8 October 2022; Received in revised form 8 January 2023; Accepted 13 January 2023
Available online 21 January 2023

contribute to health promotion and risk communication (Ancker et al., 2006; Gaube et al., 2018; Gibson, 2003; Houts et al., 2006; King et al., 2014; Ray & Merle, 2020, pp. 1–12), no systematic studies have yet assessed audience responses and behaviors when they encounter visual cues.

With the popularization and rapid development of digital technology, computer-mediated communication (CMC) is being commonly used in daily life. Although multimodal signals are naturally generated in face-to-face communication, they are not easily offered in written CMC, especially in instant messaging (Ousterhout, 2017). Therefore, to compensate for the lack of nonverbal cues in CMC, emoji, emoticons, and symbols of facial expressions are being increasingly used. These items are considered to be highly similar to facial stimulation in the brain and are thereby regarded as a nonverbal communication tool (Bai et al., 2019; Yuasa et al., 2011). A growing number of people have also used emoji to communicate scientific information (O'Reilly-Shah et al., 2018; Troiano & Nante, 2018). In addition to being used as nonverbal cues, emoji are frequently discussed in various fields, such as marketing, communication, design, and public health. For example, several brands have used emoji in advertising and marketing to stimulate consumer behavior (Das et al., 2019). Some researchers have also used emoji as stimulus cues to explore the relationship between attitude and emotion in the field of food safety (Pinto et al., 2020; Ray & Merle, 2020, pp. 1–12). Emoji have even been used to narrate stories of cancer screening and to help patients manage their health conditions. However, because emoji are an emerging research topic in various fields, particularly in health information communication, their effects on the perception and behavior of people and society have not yet been fully discussed. For instance, no studies have yet examined whether the application of emoji to health information communication may affect people's intention to adopt self-protective or preventive behaviors. Also, other factors may have an effect along with the emoji in this process. Therefore, this study considers the addition of emoji to text messages as a visual strategy in health information communication and examined how emoji affect the degree to which communication recipients are persuaded to adopt health-related behaviors.

To investigate the effectiveness of emoji in health information, this study explored the role of emoji in health information and examined which and how stimuli persuaded people to adopt healthy behaviors. We also investigated how risk-related perceptions mediated the relationship between emoji and preventive behavioral intention (PBI). Specifically, we sought to answer the following research questions: (1) Does the application of emoji in health information communication have a persuasive effect on the recipients' PBI? (2) Does the existence of emoji interact with information sources to affect PBI? (3) Is the effect on PBI mediated by perceived fear (PF) or perceived controllability (PC)?

2. Theoretical background and hypothesis interpretation

2.1. Emoji and preventive behaviors in health communication

As a non-verbal cue, emoji contribute to the semantic comprehension of information, constituting elements such as word substitutes, punctuation marks, and emotion enhancers (Ousterhout, 2017; Provine et al., 2007). Huang et al. (2008) demonstrated that the use of emoji is positively related to the richness and perceived usefulness of information exchange. Several applications and studies have investigated the relationship of emoji with food safety, personal behavior guidance, and improvement of doctor–patient relationships. For instance, Ray and Merle (2020, pp. 1–12) added emoji to a restaurant inspection questionnaire assessing whether customers would revisit a restaurant, Gaube et al. (2018) used emoji to reinforce proper hand hygiene behavior, and Troiano and Nante (2018) used emoji as a communication medium between doctors and patients to help the patients better manage their own health. Other researchers have reported that adding emoji to texts improves recipients' natural understanding of information. For example, Ousterhout (2017) reported that emoji showing emotions served as a proxy for emotional communication because emotional facial expressions activated emotion-sensing neurons. These results all indicate that the scientific and systematic application of emoji is clearly an effective method for stimulating emotions and behaviors.

Health communication aims to provide accurate and clear information to the public with the objective of changing or promoting certain attitudes and behaviors in the target audience (Kaye et al., 2017). High impact health communication can catalyze behavioral changes, whereas behavioral intention is an essential predictor of people's adoption of health behaviors or disease prevention behaviors (Ajzen, 1991; Johnston et al., 2015; Luca & Suggs, 2013). Several studies have indicated that the different visual effects used in the communication of health messages—such as photographs, graphics, illustrations, and data visualizations—affect information recipients' interest in health-related topics (Ancker et al., 2006; Gibson, 2003; Houts et al., 2006). Other studies have indicated that stimuli such as visual images and graphics can convey risks, enhance emotions, and guide individuals toward correct behaviors when used in health information communication (Gaube et al., 2018; King et al., 2014; Ray & Merle, 2020, pp. 1–12). According to King and Lazard (2020), the strategic employment of visuals can be used to improve the quality of health information communication and reduce the information gap caused by communication barriers during public health crises. These results highlight the necessity of further research investigating the relevant role of visual elements in the communication of health information.

The ultimate goal of health information communication is to design persuasive messages that can positively affect health behaviors (Harrington, 2015). As highlighted in the SARS, Ebola, and H1N1 outbreaks, public awareness, preventive behaviors, and active social engagement are critical factors in the control of epidemics (Dorfan & Woody, 2011; Yang & Chu, 2018; Bell, 2004). Under several behavioral theories such as Theory of Planned Behavior (TPB), Protection Motivation Theory (PMT), and others, recent studies on preventive behaviors or health behaviors in the situation of COVID-19 were conducted in a way to measure PBI to predict health behaviors (Ahorsu et al., 2020; Ansari-Moghaddam et al., 2021; Roberts & David, 2021; Vann et al., 2022; Yıldırım et al., 2021). For example, to prevent the spread of COVID-19, the World Health Organization (WHO) recommended that people regularly wash their hands with soap and water, use an alcohol-based hand sanitizer, maintain a social distance, and cover their mouth and nose while coughing and sneezing. They also strongly recommended wearing a mask and frequently washing hands as preventive measures (World Health Organization, 2020). Corresponding preventive recommendations were introduced in different countries and regions, it may have a strong protective effect during public health crises when triggering preventive behaviors. Studies on preventive behaviors have indicated that visual aids and images may work together with text to shape people's decisions (Garcia-Retamero & Cokely, 2011; Seo et al., 2013). For example, Ray and Merle (2020, pp. 1–12) confirmed that unpleasant emoji can discourage customers from eating in restaurants, whereas pleasant emoji can enhance their sense of security in restaurants and reduce the cognitive processing of customers with low engagement. In another study, Shahab et al. (2007) indicated that showing smokers an image of a damaged artery can effectively encourage them to quit smoking. Therefore, given the aforementioned applications of emoji in health information communication, incorporating emoji into health messages may result in benefits not only for information recipients but also for information senders, enabling them to accurately get across their intended message. As such, we assume the following.

H1. Communicating health information with emoji strengthens the intention of information recipients to adopt preventive or self-protective behaviors.

2.2. Information sources and congruity theory

In addition to the persuasiveness of health information, the effect of a message source on recipients' cognition and behaviors is critical and thereby warrants further investigation. During the COVID-19 outbreak, social media became the channel providing the newest information on relevant diseases for the public, enabling them to communicate with their family, friends, and even strangers in real time (Jang & Baek, 2019). Since the emergence of COVID-19, research into information sources has covered both official agencies and unofficial organizations, emphasizing the importance of the timely release of real pandemic information through multiple channels (Zhenga et al., 2020). Within the pandemic scenario, people had considerable control over the information sources that they relied on or trusted and the information that they followed, especially when such information pertained to a health risk (Moon et al., 2021, pp. 1–11). In most cases, the health information provided by official agencies is considered highly authoritative (Min et al., 2020). When people gain access to more information, they no longer need to rely on a single official information source. In particular, when people realize that official information is limited or unreliable, they tend to seek unofficial channels or other organizations to obtain more information (Jang & Baek, 2019). In chaotic situations such as during the COVID-19 pandemic, people followed health information released on social media by both official agencies and unofficial organizations. According to Avery (2010) and Calvillo et al. (2020), the more that people pay attention to information released from a particular source, the more they are likely to trust that institutional source. Therefore, whether different information sources have different effects on the cognition and behavior of information recipients when such sources are combined with other factors (e.g., visual symbols in the message) warrants further investigation.

Congruity theory posits that people receiving two contradictory sets of messages likely experience cognitive dissonance (Osgood & Tannenbaum, 1955). However, if the two sets of messages are similar or coherent, the recipient is more likely to have a positive attitude toward the target because their cognitive dissonance is low (Osgood & Tannenbaum, 1955). Congruity theory is mostly applied to brand marketing and communication (Choi, 2008; Islam et al., 2018; Lee & Jeong, 2014), as well as in travel and tourism research (Chon & Olsen, 1991; Cifci, 2021; Sop, 2020). For instance, Islam et al. (2018) indicated that the consistency effect of brand image and value is the key factor driving consumers to participate in online brand communities (OBCs). Consistency results in people having a more positive perception or favorable behavior toward their preferred OBCs. Other studies have investigated business investment and analyzed leadership roles (Anglin et al., 2022; Mukarram et al., 2018). For example, compared with other individuals, Anglin et al. (2022) applied congruity theory to conclude that due to women and people of color fit better with the public's expectations of social entrepreneurs so they perform better in terms of raising funds for social enterprises. In advertising marketing, the source of advertising has been considered when exploring persuasiveness. Similar to marketing advertising, health information communication aims to convey health messages to affect people's attitudes and behaviors. People then compare the advertising messages with what they already know about the organization sending the messages (Dahlén et al., 2005).

Advertising messages that meet the audience's expectations result in a high degree of perceived credibility of the organization (Dahlén & Lange, 2004) because these messages result in perceptions of a stable brand and expected organizational attributes. If the message presented does not match the existing clues, the perceived credibility of the advertisement is low (Lutz et al., 1983). Baum et al. (2016) reported that consistency is a critical predictor of the persuasiveness and credibility of a message or advertisement. Compared with inconsistency, message consistency usually leads to a more positive attitude and evaluation among message recipients. Perceived consistency may also reinforce and validate existing patterns, thereby increasing the stability of organizational attributes (Erdem & Swait, 1998). Congruence models are widely used to study individual attitudes and thus measure individual preferences (Claiborne & Sirgy, 2015; Hegner et al., 2017; Shaikh et al., 2017). Schema congruity theory, proposed by Mandler (1981, pp. 3–36), explains the effect of consistency. Schema congruity is defined as the degree of perceived congruity between messages delivered by the media and existing information regarding the organization that releases these messages (Meyers-Levy & Tybout, 1989). According to Campbell and Goodstein (2001), people prefer consistency in high-risk situations. For example, during COVID-19, people preferred to receive health messages that had content that aligned with the attributes of its sources.

Congruity theory clearly focuses on promoting communication and persuasion (Osgood & Tannenbaum, 1955), which accords with the primary goals of health information communication, namely to communicate with people regarding relevant health information and boost their confidence in the organizations that release such information. Applying congruity theory in health information communication is expected to result in information recipients developing favorable attitudes and behaviors on the basis of their evaluation of the information (including emotion, risk, and controllability), including verbal and nonverbal cues. As predicted by congruity theory, upon receiving a health information message, people are likely to evaluate the message positively if the visual elements and information sources match (Bai et al., 2019; Kaye et al., 2017; Pardes, 2018; Robus et al., 2020). However, only a few studies have investigated the effect of congruity between emoji in messages and the messages' senders. Clarifying this correlation will offer qualitative benefits to decision-makers, communicators, and recipients in visual health information communication. This is because after receiving a visual health message, the public's attitude and their subsequent behavioral intention depend on their previous exposure to and experience of visual language and the information sources of the message.

Therefore, we propose the following.

H2. For health information released by unofficial organizations, messages containing emoji are more persuasive in promoting PBI than those without emoji. However, for health information released by official agencies, emoji do not have a significant effect.

2.3. PF and PC

Theories on health behaviors have attempted to examine two aspects: threat-related fears and phobias (e.g., the extended parallel process model [EPPM] and protection motivation theory [PMT]) and efficacy (e.g., EPPM and health belief model [HBM]; Witte, 1992; Rimal, Lapinski, Turner, & Smith, 2011; Janz & Becker, 1984).

Fear is an internal emotional response, a negative emotion caused by the threat of danger, harm, or pain, and associated with excessive avoidance of a stimulus (Fanselow & Lester, 1988). It is characterized by psychological subjective experience and physiological arousal (Dillard, 1994; Easterling & Leventhal, 1989; Witte, 1992). Using the EPPM, Witte (1994) illustrated how people process fear appeals, addressed cognitive and emotional factors related to information processing, and linked these processes to the success or failure of these fear appeals. A fear appeal is defined as an emotion that evokes fear perception by attempting to describe a substantial threat related to individuals in a persuasive message and then to offer effective behavioral advice (Moon et al., 2021, pp. 1–11; Witte, 1992).

Previous studies have employed perceived risk and PF in conjunction with advice from the EPPM to examine whether people can take appropriate preventive and protective measures during public health crises. Fear is triggered when a serious personal risk is perceived. According to Witte (1994), during health information communication, fear appeals may serve as an effective persuasion strategy. Using the assumptions of the PMT and EPPM, other researchers have applied fear appeals to social marketing to obtain the perceived health risks (Luca &

Suggs, 2013) and communicate the perceived efficacy of behavioral change to prevent disease (Johnston et al., 2015; Popova, 2012). For example, Andrade et al. (2020) reported that, within the context of COVID-19, women and young people had increased levels of PF compared with men, especially in those whose occupations are associated with a high risk of infection. In addition, in terms of food safety communication, health-conscious individuals may perceive nonorganic agricultural products to be high risk, which in turn increases their fear perception of pesticide residue hazards, and this fear awareness increases their willingness to buy organic agricultural products (Chou et al., 2020). In terms of visual communication, some researchers have also advocated the use of visual elements that evoke negative emotions, such as fear, to encourage consumers to adopt healthy behaviors. Typically, health warning labels use text and graphics to convey visual messages that describe the potential adverse health consequences of excessive consumption of a product, such as increased disease risk (Clarke et al., 2020). Studies on the effects of health warning labels have largely been performed in the context of tobacco and alcohol, given the ability of these substances to trigger self-reported fears (Brewer et al., 2019). Health warning labels that generate negative emotions such as fear may encourage people to quit smoking (Cho et al., 2018) and to adopt risk aversion behaviors (Kees et al., 2010). Some public health agencies have called for an improvement of the health warning labels on alcohol packages (RSPH, 2017). Eshghipour et al. (2019) confirmed that the use of fear appeals in health warning advertisements can effectively encourage consumers to adopt healthy behaviors, especially when the type and intensity of fear are properly combined in the message. Other studies have used visual elements, such as images and symbols, to elicit fear among users or consumers and thus affect their preventive or health behaviors. Supporting theories such as PMT and EPPM are derived from fear appeal– the attitude, the intention, and the actual behavior toward health are all associated with cognitive evaluations of risk and efficacy (Ajzen, 1991; Prentice-Dunn & Rogers, 1986). However, these investigations do not result in that emotion, particularly fear, can directly change health attitude, intention, and behavior (Nabi & Myrick, 2019). To respond this inquiry, many studies have explored if PF can induce people to increase their intention of preventive behaviors or even nudge their actual behaviors since the outbreak of COVID-19. Several findings have been discovered in the situation of COVID-19—(a) PF is the most influential predictor of health behavior (Harper et al., 2021); (b) PF can increase people's knowledge and self-efficacy (Roberts & David, 2021); and (c) PF promotes vaccination behavior (Vann et al., 2022). Similar outcomes were also validated in other surveys with different age groups and in different cultural regions (Ahorsu et al., 2020; Melki et al., 2022; Yıldırım et al., 2021, 2021uriņa et al., 2021). And yet, counterarguments were made to claim that fear does not predict high levels of protective behavior in public (Jørgensen et al., 2021). Instead, it may exacerbate existing stressors and psychological distress (Olapegba et al., 2022; Stolow et al., 2020) or even impedes the implementation of preventive behaviors. It is necessary to examine the role of PF in COVID-19 mitigation thoroughly due to different views are existed.

From a methodological perspective, different perception and evaluation factors may overlap. If these factors are not simultaneously considered, the association between a single perception factor and the outcome may be unclear (Li et al., 2020). In line with PF, PC is an internal belief that predicts behavior, motivation, and performance (Harris, 1996). It refers to a person's belief that they have the ability, resources, or opportunity to achieve positive outcomes or avoid negative effects through their actions (Coffee et al., 2009; Thompson, 1981), and it is regarded a secondary crucial assessment factor for coping with stress (Li et al., 2020). The learned helplessness model highlights the importance of controllability (Maier & Seligman, 1976). According to this model, perceived uncontrollability is the factor that determines feelings of helplessness and inability to properly respond. Abramson et al. (1978) proposed that people facing an uncontrollable condition experience deficits in motivation, cognition, and emotion. Cognitive deficits cause people to believe that their situation is uncontrollable, motivational deficits cause people to be unresponsive to any potential solutions to a negative situation, and emotional deficits refer to a state of depression that occurs when a person is in a negative situation that they believe is out of their control. In terms of visual mental intention and depressive symptoms, negative mental images may lead to emotional deterioration, which is perceived to be uncontrollable (Weβlau et al., 2015). According to Weβlau et al. (2015), higher depression scores are generally associated with lower levels of PC. Other researchers have also indicated that PC has a direct effect on prosocial behavior (e.g., donation intention; Lee, 2017). Nabi and other researchers have suggested that the study of fear in the field of health communication is often accompanied by other factors such as hope, emotional flow, etc. (Nabi, 2015; Nabi & Myrick, 2019). Recall that PC is conceptualized as a person's belief that they have the ability, resources, or opportunity to achieve positive outcomes or avoid negative effects through their actions (Coffee et al., 2009; Thompson, 1981). This definition aligns with self-efficacy, which essentially points to one's confidence in performing target behavior (Bandura, 1977). However, few studies have investigated whether PC affects behavioral outcomes in response to COVID-19. Therefore, examining the emotional, cognitive, and behavioral outcomes of the public in response to public health crises, such as COVID-19, as well as the causes and effects of these outcomes, is necessary. Examining PF and PC may enable better understanding of the role of visual information in health information communication and other potential mechanisms. Hence, we assume that.

H3. Compared with health information without emoji, health information containing emoji can (a) increase the PF and (b) decrease the PC of the public.

H4. PF and PC mediate the intertwined effects of emoji and information sources in health information on the receiver's PBI.

The conceptual and theoretical models that served as the research framework for this study are presented in Fig. 1.

3. Materials and methods

This study was performed in two stages, both of which were conducted online. In the pilot study, a single-factor in-group experiment was conducted to examine the quality of different information sources in three dimensions; this approach is convenient for selecting institutional representatives for formal experiments. In the formal experiment, a 2 (emoji: with or without) $\times$ 2 (information source: official or unofficial) between-subject experimental design was adopted, and the dependent variable was PBI.

3.1. Study design and participants

3.1.1. Pilot study

In addition to the Ministry of Health and Welfare (MOHW), which is the official agency that releases authoritative health information, several unofficial organizations provide reliable information to the public. People thus have multiple channels to search for health information. In order to select an unofficial organization corresponding to the MOHW, we considered three characteristics of effective communication, namely trustworthiness (De Jans et al., 2020), expertise (De Jans et al., 2020), and information quality (Ashfaq et al., 2020). We then assessed these three attributes using a five-level semantic scale (Table 1). Subsequently, we searched for health information related to COVID-19 on Facebook to further determine the correspondence. We selected three unofficial organizations because of their familiarity and frequency of use among the public, namely Health 2.0, Everyday Health, and Heho Health. A total of 50 participants (age: M = 33.66, SD = 9.80; 58% females) were included in this experiment.

Health 2.0 was selected as an unofficial organization according to the results of the Repeated-measures analysis. The results are shown in

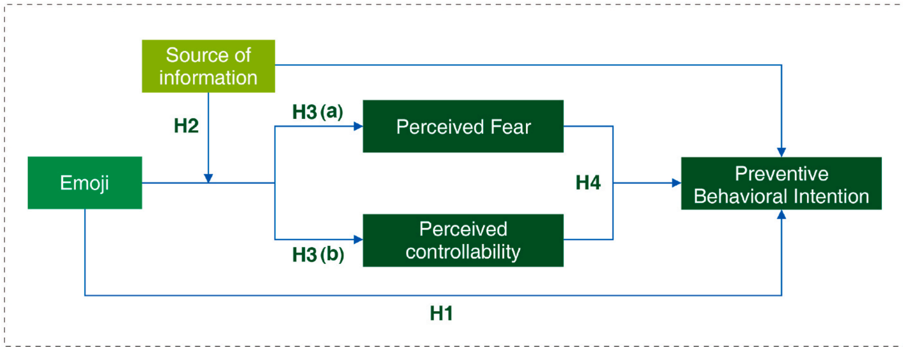

Fig. 1. Conceptual overview and framework of the study.

Table 1
The reliability of the pilot study.

Construct	Items	Cronbach's alpha
Trustworthiness (De Jans et al., 2020)	The health information released by this organization is : • dishonest/honest; • unreliable/reliable; • insincere/sincere; • untrustworthy/trustworthy	0.946
Expertise (De Jans et al., 2020)	The health information released by this organization is : • not expert/expert; • inexperienced/experienced; • unknowledgeable/knowledgeable; • unqualified/qualified; • unskilled/skilled	0.913
Information quality (Ashfaq et al., 2020)	The health information released by this organization is : • insufficient/sufficient; • inaccurate/accurate; • requirement not met/requirement met; • untimely/timely	0.886

Table 2
Characteristics of the study participants (N = 210).

Source		Mean or n (%)
Gender	Male	92 (43.8%)
	Female	118 (56.2%)
Age	20 years old and below	21 (10%)
	21–30	114 (54.3%)
	31–40	48 (22.9%)
	41–50	15 (7%)
	51–60	8 (3.8%)
	Over 60 years old	4 (1.9%)
Educational level	High school, senior high school and below	19 (9%)
	Associate college	8 (3.8%)
	Bachelor	75 (35.7%)
	Master and above	108 (51.4%)
Previous experience in searching, receiving and reading health information using Facebook	Yes	210 (100%)

section 4.1.

3.1.2. Formal experiment and participants

After the pilot study, we conducted the main experiment. All participants were recruited from the online panel of WJX, an online survey platform equivalent to Qualtrics. In total, 210 participants from Taiwan (age: $M = 29.91$, $SD = 10.62$; 56.2% female) were included in the study (Specific data are shown in Table 2). They were invited to browse a survey webpage. Once they had agreed to participate, they were assigned to one of four experimental conditions and then answered a questionnaire after reading the sample message. The experiment simulated health information regarding COVID-19, and the emoji in and source of information were manipulated.

3.2. Message stimuli

The stimuli for this experiment consisted of four posts on Facebook. The messages on the sample posts included basic information about transmission routes, cardinal symptoms, and anti-epidemic measures of COVID-19. The text content of all posts was controlled to be exactly the same. Three emoji highly related to the text were employed. Since these three emoji have clear meanings related to illness and fear of emotions, they were placed next to the corresponding symptom or emotion descriptions, specifically after "fever", after " difficulty breathing ", after "wearing a mask". In accordance with the results from the pilot study, the MOHW and Health 2.0 were used as information providers (See Appendix A for specific stimuli).

3.3. Measurements

Unless specified, the participants' responses were scored on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The average mean scores were considered indices for the related variables. Before measuring all relevant variables, we performed attention checks to examine the efficiency and reliability of the stimulus design. We then measured the dependent variable, PBI, and the value of PF and PC, which were mediators. Subjects' demographic information were recorded as well, including their age, gender, and educational level. To highlight the reliability of the measures, we also report the Cronbach alpha.

3.3.1. Attention checks

Before measuring all relevant variables, we performed a series of attention checks on the health information stimuli to test the validity and accuracy of the stimulus design. The manipulation test involved two measurement dimensions: whether the participants paid attention to the information included emoji and whether the participants believed that an official or unofficial unit had released the information. The participants were then asked to rate the items, on a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), in accordance with how much they agree with the items after reading the assigned health information.

3.3.2. PBI

The PBI measure was adapted from the study of Oh et al. (2021), who assessed people's intentions to protect themselves and inhibit some behaviors during COVID-19. A question regarding people's choice to be vaccinated against COVID-19 was also added. In total, participants were asked to answer six questions (e.g., "I will wear a mask to reduce the risk of COVID-19 infection"). Higher scores indicated stronger willingness to take preventive actions.

3.3.3. PF and PC

Scales adapted from the studies by Witte (1994) and Moon et al. (2021, pp. 1–11) were used to measure PF. Perceived fear was measured by assessing the level of frightened, tense, anxious, and uncomfortable when a message was received. PC was measured using the scale of Li et al. (2020), who asked their respondents to assess the controllability of nine items regarding the etiology, transmission methods, and duration of the outbreak when they received the message. Higher scores indicated greater PF and PC. Table 3 displays the measurement items used in the survey together with descriptive statistics.

3.4. Data analysis strategies

ANOVAs and moderated mediation analyses were performed to inspect the research question. ANOVAs were first used to assess the main effects of emoji and information sources, after which the interaction effects of emoji and information sources were determined. The PROCESS plug-in (version 3.5, Andrew F. Hayes, Columbus, OH, USA) of SPSS Statistics version 26 (IBM, Armonk, NY, USA) was used to perform mediation analysis (Model 7). Finally, whether PF and PC mediated the effect of the interaction between emoji and information source on PBI was investigated.

Table 3
Measurement reliability.

Construct	Items	Cronbach's alpha
Perceived Fear (Moon et al., 2021, pp. 1–11)	When I receive this information, I get… • Frightened; • Tense; • Anxious; • Uncomfortable	0.928
Perceive Controllability (Li et al., 2020)	When I receive this information, I rate the controllability of the following items: • The etiology; • The ways of transmission; • The infectiousness; • The time COVID-19 will last; • The effectiveness of the treatment; • The recovery rate; • The mortality; • The developmental trends of COVID-19; • The overall controllability of COVID-19	0.899
Preventive Behaviors Intention (Oh et al., 2021)	Ask about the level of consent for the following preventive behaviors: • I will wear a mask to reduce the risk of COVID-19 infection; • I will try not to go to public spaces, such as restaurants or department stores; • I will try not to attend parties; • I will try to wash my hands or use hand sanitizer more often to prevent the risk of COVID-19 infection; • I will cover my mouth and nose with my arms when I sneeze or cough; • I will actively consider getting the COVID-19 vaccine	0.955

4. Results

4.1. Results of the pilot study

Repeated-measures analysis of variance (ANOVA; Table 4) revealed significant differences among the four organizations in terms of trustworthiness (MOHW: $M = 3.46$, $SD = 0.14$; Health 2.0: $M = 3.35$, $SD = 0.08$; Everyday Health: $M = 3.13$, $SD = 0.08$; and Heho Health: $M = 2.98$, $SD = 0.08$), though the difference between the MOHW and Health 2.0 was not significant ($p = 0.54$). The results also revealed significant differences among the four organizations in terms of expertise (MOHW: $M = 3.60$, $SD = 0.12$; Health 2.0: $M = 3.40$, $SD = 0.09$; Everyday Health: $M = 3.22$, $SD = 0.09$; and Heho Health: $M = 3.05$, $SD = 0.08$), though the difference between the MOHW and Health 2.0 was again not significant ($p = 0.22$). In addition, significant differences were also discovered among the four organizations in terms of information quality (MOHW: $M = 3.64$, $SD = 0.12$; Health 2.0: $M = 3.37$, $SD = 0.08$; Everyday Health: $M = 3.18$, $SD = 0.08$; Heho Health: $M = 3.02$, $SD = 0.08$), MOHW and Health 2.0 were only marginally significantly different from each other ($p = 0.07$). The least significant difference (LSD) test was then conducted to perform a post hoc comparison, and the results indicated no significant differences between the MOHW and Health 2.0 in terms of these three attributes. No significant differences were found between an unofficial organization (Health 2.0) and the official institution (MOHW) at this stage of the study, supporting our claim that Health 2.0 is the representative of an unofficial organization.

4.2. Attention check results

Attention checks were conducted on emoji (with or without) and information sources (official or unofficial) in health information by using a series of independent-samples t tests. The results indicated that, compared with the participants in the group receiving health information without emoji ($M = 2.03$, $SD = 1.763$), the participants in the group receiving such information including emoji ($M = 5.77$, $SD = 1.724$) were more likely to notice emoji ($p = 0.000$). In addition, compared with participants in the unofficial condition group ($M = 2.87$, $SD = 2.185$), those in the official condition group ($M = 6.23$, $SD = 1.425$) were more likely to believe that the information was released by an official agency ($p = 0.000$). Therefore, both attention checks were successful.

4.3. Main effects

Our first goal was to answer RQ1, that is, whether the use of emoji in health information communication has a different persuasive effect on recipients' PBI than when no emoji are used. The results indicated that the use of emoji in health information communication had a significant main effect ($F(1,206) = 15.132$, $p = 0.000$, $\eta 2 = 0.068$). The PBI scores

Table 4
Results of repeated-measures ANOVA.

	dF	MS	F	P	LSD
Trustworthiness	1.680	4.190	5.262	0.01*	MOHW = Health 2.0 > Everyday Health > Heho Health
Expertise	1.716	4.961	7.624	0.002**	MOHW = Health 2.0 > Everyday Health > Heho Health
Information quality	1.699	6.260	10.105	0.000**	MOHW = Health 2.0 > Everyday Health > Heho Health

*$p < 0.05$.
**$p < 0.01$.

were higher in the group receiving information containing emoji than in the group receiving information not containing emoji (Memoji = 6.285, SD = 0.118 versus Mno-emoji = 5.633, SD = 0.119). This result supported H1. By contrast, information source did not have a significant effect on PBI. Regardless of whether the health information was released by an official agency or an unofficial organization, the effect on PBI was similar. Two-way ANOVA was used to answer RQ2. The results revealed a significant interaction effect between emoji and information source on PBI (F (1,206) = 5.095, p = 0.025, η2 = 0.024). Thus, emoji had a considerable effect on when people receiving health information from unofficial organizations. People who received information containing emoji were more likely to take preventive actions than those who received information without emoji (Memoji = 6.426, SD = 0.176 versus Mno-emoji = 5.395, SD = 0.165). However, for those who received health information from the official agency, the presence of emoji had no effect. Emoji increased the participants' PBI only in the context of health information released by the unofficial organization, hence supporting H3 (Fig. 2). Two-way ANOVA also indicated that emoji had a significant main effect in terms of PF ($F_{(1,206)} = 12.502$, $p = 0.001$, $\eta^2 = 0.057$). Hence, health information containing emoji increased the participants' PF, and the participants experienced higher levels of fear when they received health information containing emoji. In other words, PF was higher when emoji were used ($M_{emoji} = 3.853$, $SD = 1.322$) than when no emoji were used ($M_{no\text{-}emoji} = 3.202$, $SD = 1.404$), indicating that the use of emoji generated fear. Although no significant difference was observed in PF among the participants receiving information from an official versus an unofficial source, a significant interaction was observed between emoji and information source on PF ($F_{(1,206)} = 3.986$, $p = 0.047$, $\eta^2 = 0.019$; Fig. 3). When the participants received health information from the unofficial organization, the presence of emoji resulted in higher PF ($M_{\text{emoji}} = 4.064$, $SD = 0.198$ versus $M_{\text{no-emoji}} = 3.023$, $SD = 0.185$). By contrast, the presence of emoji resulted in lower PC. Within the dimension of PC, emoji had a significant main effect ($F_{(1,206)} = 9.355$, $p = 0.003$, $\eta^2 = 0.043$). Regardless of whether the information contained emoji, the results indicated that the epidemic was insufficiently controllable. When the participants received information containing emoji ($M_{\text{emoji}} = 2.913$, $SD = 0.072$), the level of PC was lower than when they received information without emoji ($M_{\text{no-emoji}} = 2.605$, $SD = 0.071$). These results indicated that the use of emoji not only increased the levels of fear but also decreased the perception of controllability. Hence, similar to the result for PF, the main effect of the information source was nonsignificant. However, a marginally significant interaction effect was observed between emoji and information

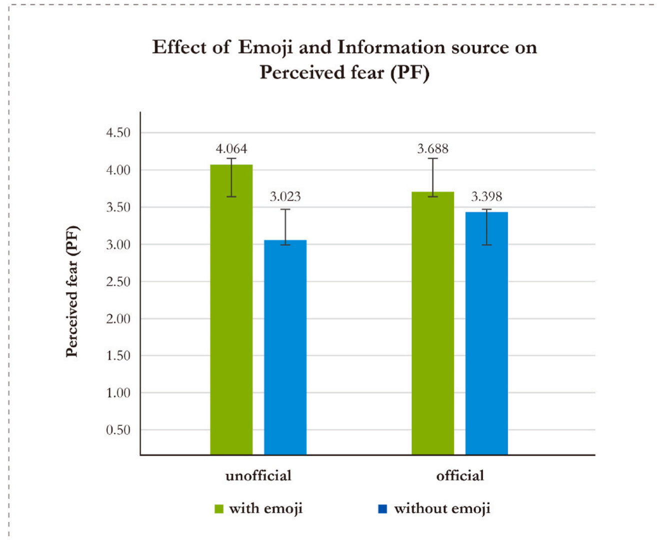

Fig. 3. Interaction effect of emoji and information source on PF.

source on PC ($F_{(1,206)} = 3.288$, $p = 0.071$, $\eta^2 = 0.016$; Fig. 4). When health information containing emoji was released by the official agency ($M_{\text{emoji}} = 2.557$, $SD = 0.094$), the participants believed that the epidemic was less controllable than when information without emoji was released ($M_{\text{no-emoji}} = 3.048$, $SD = 0.104$). This effect was weaker when the information source was an unofficial organization. Therefore, the results regarding PFand PC supported H3; that is, the use of emoji in health information communication can increase people's PFand decrease their PC (Table 5).

4.4. Moderated mediation effects

According to the two-way ANOVA results, the use of emoji in health information and the information source had a significant interaction effect on PF but a marginally significant interaction effect on PC. The purpose of RQ3 was to determine whether PF and PC mediate the effect of the emoji and information source interaction on PBI. To answer this question, a moderated mediation analysis was performed using the PROCESS plug-in of SPSS Statistics, and Model 7 was selected. The significance of the indirect effects was investigated using the bootstrap

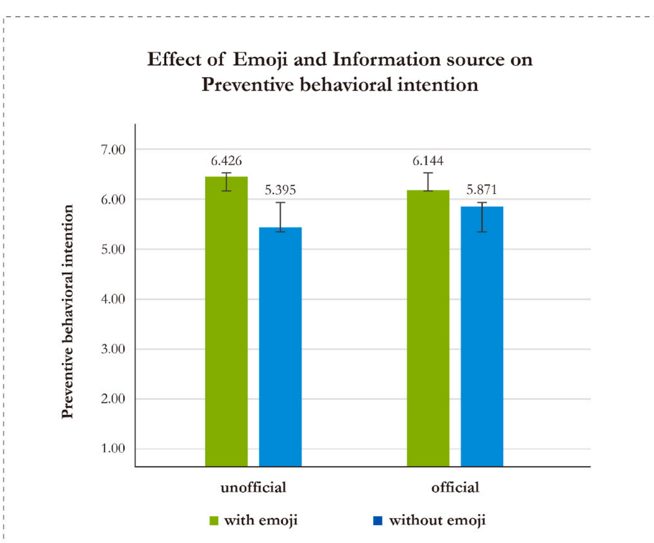

Fig. 2. Interaction effect of emoji and information sources on PBI.

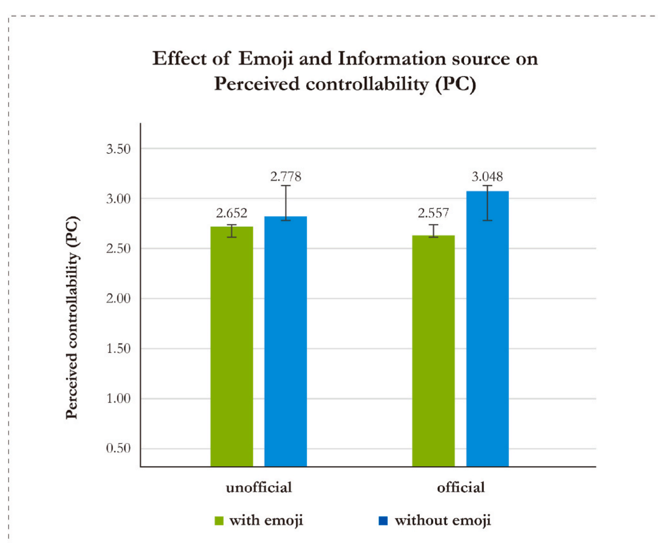

Fig. 4. Interaction effect of emoji and information source on PC.

Table 5
Two-way ANOVAs of PBI, PF, and PC.

	Source	dF	MS	F	P	η^2
Preventive behavioral intention (PBI)	Emoji	1	22.126	15.132	0.000**	0.068
	Information sources	1	0.493	0.337	0.562	0.002
	Emoji x Information sources	1	7.450	5.095	0.025*	0.024
Perceived fear (PF)	Emoji	1	23.019	12.502	0.001**	0.057
	Information sources	1	3.001E-5	0.000	0.997	0.000
	Emoji x Information sources	1	7.340	3.986	0.047*	0.019
Perceived controllability (PC)	Emoji	1	4.928	9.355	0.003**	0.043
	Information sources	1	0.397	0.754	0.386	0.004
	Emoji x Information sources	1	1.732	3.288	0.071+	0.016

*$p < 0.05$.
**$p < 0.01$.

method, with 95% confidence intervals (CIs) estimated using 10,000 bootstrap samples. As shown in Fig. 5, the first result indicated that the moderated mediation index of PF was significant ($b = 0.107$, 95% CI [−0.412 to −0.003]). When health information was released by an unofficial organization, emoji clearly had an indirect effect on PBI. The presence of emoji increased the likelihood of preventive and self-protective behavior by increasing the participants' PF ($b = 0.100$, 95% CI [0.066–0.450]). However, the indirect effect of emoji was not significant ($b = 0.060$, 95% CI [−0.054 to 0.190]) in the context of receiving health information from the official agency. Thus, PF did not mediate the effect of emoji presence in official health information on PBI. In addition, emoji seemed to be zineffective in increasing PBI when health information was received from the official agency because they did not increase the PF of receiving and reading information. The results further indicated that the moderated mediation index of PC was not significant ($b = 0.041$, 95% CI [−0.036 to 0.131]). Regardless of whether the information was released by the official or unofficial institution, PC did not mediate the interaction effect of emoji and information source in health information on PBI. Therefore, these results partially supported H4.

5. General discussion

This study investigated the feasibility of using emoji in health information communication and their applicability across different information sources. The results offer some valuable insights, with three of the four hypotheses confirmed and the remaining hypothesis partially tested. Specifically, we compared the persuasiveness of health information with versus without emoji, including whether the use resulted in increased PBI and PF and decreased PC. We also compared the persuasiveness of health information released by official and unofficial institutions. Finally, we determined the mediator of the interaction effects between emoji and information source on PBI.

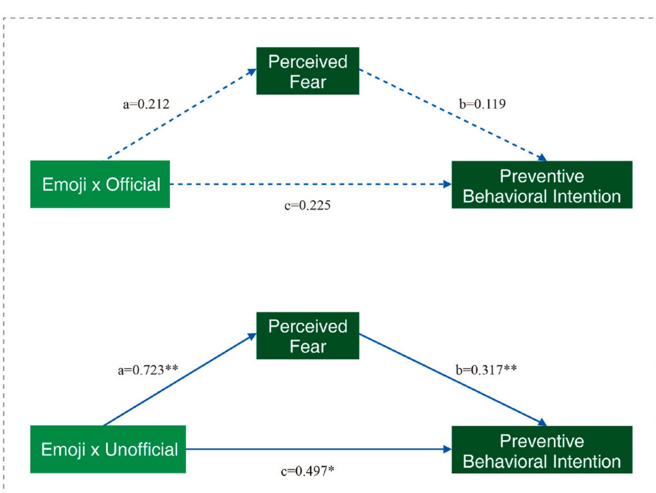

Fig. 5. Mediation model for PF.

This study was focused on the role of visual elements in health information communication during persistent public health crises. Unlike social and media communication, visual health information communication requires the use of visual communication strategies to improve the public's health awareness and reduce misinformation and disparities (Gaube et al., 2018; Harrington, 2015; King & Lazard, 2020; Ray & Merle, 2020, pp. 1–12). Emoji are used as visual stimuli to disseminate health information regarding preventive behaviors, prompt perceptions and behavioral intentions with visual attributes, and shape people's decisions to enhance their PBI, increase their PF, and reduce their PC. As expected, emoji inspired fear in the public that tended to be similar to their emotional valence. Simultaneously, emoji also made people aware of the uncontrollable nature of the health environment and enhanced their intention to adopt self-protective and preventive behavior. These results agree with those of previous research (King & Lazard, 2020; Seo et al., 2013; Garcia-Retamero & Cokely, 2011; Rimal et al., 2011) in which visual strategies were used to identify favorable health and well-being improvement methods.

Our results further indicated that, the information source did not affect PBI, PF, or PC. This result agrees with those of previous studies on information sources in other contexts (Zhenga et al., 2020; Calvillo et al., 2020; Moon et al., 2021, pp. 1–11; Jang & Baek, 2019; Avery, 2010). When a public health crisis occurs and multiple channels become available to obtain health information, people stop depending on a single official agency (Jang & Baek, 2019; Moon et al., 2021, pp. 1–11). However, the effect of using emoji was found to vary from one source to another. When emoji are used in health information released by an unofficial organization rather than an official organization, people are more persuaded to take preventive actions. Use of emoji does not affect how persuasive an official agency is deemed to be. If a public health crisis continues to spread, the health information provided by official institutions often becomes highly authoritative (Min et al., 2020), whereas unofficial organizations tend to be more concerned with providing care and being close to the people. According to congruity theory, people perceive emoji to be inconsistent with the image of official agencies. Information recipients may consider official agencies to be characterized by authority and rigor, which somewhat contradict the impression of lightness that is established by the use of emoji. By contrast, unofficial organizations' use of emoji is likely to be perceived as being more suitable. In the context of receiving health information, people's positive attitudes and behavioral intentions are directly proportional to the level of correspondence between visual elements and information sources (Campbell & Goodstein, 2001; Osgood & Tannenbaum, 1955). These results agree with Mandler's (1981, pp. 3–36) schema congruity theory. From a theoretical perspective, our results complement the emerging literature on text-based health messaging.

Therefore, unofficial organizations are encouraged to publish health information that incorporates attractive and narrative visual images to improve the public's awareness of their risk and preventive mechanisms for self-protection (Guidry et al., 2019; World Health Organization, 2020).

Finally, in addition to having an interaction effect on PBI, both emoji and information source affect PF and PC. As with PBI, the PF boost that emoji provides is considered a favorable outcome of health information released by unofficial organizations. Unofficial organizations use negative emotional valence and disease-related emoji, which potentially induce more fear, to supplement their health information. We discovered that PC was lowest under the condition of an official organization and use of emoji. In other words, when people receive health information from an official agency and it does not contain emoji, they perceive themselves as being relatively unable to control the duration and transmission routes of the epidemic. More interestingly, we also examined the mediating role of PF and PC. The results indicated that PF may mediate the effect of emoji use (or nonuse) on PBI, especially when health information is released by an unofficial organization. This result is broadly consistent with those of previous studies assessing fear and behavioral intention in various contexts. In health behavior research, scholars have called for an appropriate combination and use of visual elements of negative emotional valence to trigger fear perception, thereby encouraging people to adopt healthy behaviors (Brewer et al., 2019; Cho et al., 2018; Clarke et al., 2020; Eshghipour et al., 2019; Kees et al., 2010). Despite the fact some studies in the context of COVID-19 have demonstrated that fear is not a complete predictor of preventive behavior (Jørgensen et al., 2021; Olapegba et al., 2022; Stolow et al., 2020), the conclusions of our study are based on the role of visual stimuli in this context. We found that when emoji were employed by unofficial organizations for health communication, people elevated their intentions for preventive or healthy behaviors, a process mediated by PF and not just fear of intervention. Of course, the effects of fear are necessarily variable. Fear may transform into hope or be accompanied by a richer emotional flow under healthy persuasion (Nabi, 2015; Nabi & Myrick, 2019). Research on PF should continue to focus on different application contexts and more comprehensive profiles. Although the study revealed a marginally significant interaction between emoji use and information source, PC does not have the same mediating function. In a pandemic situation, such as during COVID-19, unofficial organizations may appropriately use visual stimulants, such as emoji, with emotional and supplementary textual meanings to strengthen a logical fear appeal to the public, thereby encouraging people to take preventive actions. Official agencies may also use highly authoritative, rigorous, and professional health information to reduce the level of PC among the public, to inform the public of the importance of their health, and to improve the health and well-being of society overall. According to our results, official agencies and unofficial organizations may provide above recommendations to disseminate visual health information during public health crises. Different sources of information may play differing roles in the context of pandemics.

6. Conclusions

In this study, we determined that the persuasive effects of health information, with or without emoji versus from official or unofficial sources, considerably differed. This paper aims to investigate whether the application of emoji, a digital artifact, in health communication can influence the perceptions and behavioral intentions of the public. More specifically, we examined whether an effective visual strategy exists for implementing emoji in visual health information communication during public health crises. We believe that our results may help people better understand and evaluate sudden public health crises and thus make accurate decisions. Our results may also provide insight for public health authorities, information designers, and health information communication experts into the optimal design, delivery, and dissemination of appropriate health information.

Emoji are highly capable of promoting more accurate, comprehensible, and persuasive health information communication as well as improving saving cognitive resources for the execution of subsequent behavioral tasks. Thus, if used strategically and appropriately, visual symbols such as emoji may reduce message recipients' cognitive load and strengthen their behavioral intention. The results of this study suggest that unofficial organizations can effectively enhance the fear that people perceive by using visual symbols (e.g., emoji) in the context of risk communication and preventive behaviors. This should encourage people to adopt appropriate prevention behaviors, especially during public health crises.

7. Limitations and future research

To the best of our knowledge, this is the first study empirically examining how PF, PC, and behavioral intention are related to the use of emoji in health information communication. Although this offers a starting point in this field, several questions remain unanswered. In addition, all conclusions presented herein should be evaluated in light of several limitations. Firstly, this study was conducted in the context of the COVID-19 outbreak. It differs from previous epidemics we have encountered in–that it is long-lasting, the virus mutates rapidly, our scientific knowledge during that time is limited, and many questions still remain. The impact of COVID-19 on people's livelihood are severe and far-reaching. The conclusions of this study were situated in the specificity of COVID-19. Secondly, we did not introduce elements from established theories (e.g., the EPPM, PMT, and the HBM) as mediators in the analysis of the interaction between emoji and information source on PBI. Although we fully investigated and assessed people's negative perceptions, such as PF and PC, positive perceptual factors may lead to different behavioral responses. Alternatively, guiding self-protection by stimulating positive cognition and emotion may have unexpected effects. Therefore, other factors affecting people's perceptions and behavioral responses to health information containing emoji should be assessed in future research. Moreover, we selected three negative emotion- and illness-related emoji. Obtaining more information regarding the applicability and usability of emoji with differing emotional valence, such as positive or neutral emoji or a mixture, would be helpful. Future research should also include more variables to assess the dimensions of personal psychological characteristics and thus more accurately assess the effect of emotion and cognition orientation on persuasiveness. Finally, as this study focused on the measurement of PBI, the PBI was not always consistent with the actual behavior taken. Behavioral intention refers to the motivational factors that influence one's willingness to exert to attain a goal (Ajzen, 1991; Johnston et al., 2015; Luca & Suggs, 2013). The stronger intension to perform the behavior, the more likely the behavior will be performed. Subjects' behavioral intentions toward actual action can be further investigated. Also, a more detailed screening of stimuli to ensure whether the designated meanings of visual elements, i.e., icons or emoji, can communicate effectively or efficiently to users in future studies is required. For now, we would predict that since emoji of any type are informal and thus a poor fit in some situations, there would not be significant differences in the effects of different types of emoji. The effects of emoji seem to differ greatly depending on the outcome variable and expression of the text. Additionally, we explored a new area by examining the use of emoji in health information communication. Emoji can also be used in other fields, such as in news, advertising, and interactive apps, which may be particularly interesting to investigate. Although the validity of visual persuasion for health should be continually investigated in the field of health information communication and information design, this study highlights the emerging prospects of the application of emoji in visual health information communication.

Ethical Statement for solid state ionics

Hereby, I/Tingyi S. Lin/consciously assure that for the manuscript/Health Persuasion through Emoji: How Emoji Interacted with Information Source to Predict Health Behaviors via Fear/the following is fulfilled.

1) This material is the authors' own original work, which has not been previously published elsewhere.
2) The paper is not currently being considered for publication elsewhere.
3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
5) The results are appropriately placed in the context of prior and existing research.
6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

The violation of the Ethical Statement rules may result in severe consequences.

To verify originality, your article may be checked by the originality detection software iThenticate. See also http://www.elsevier.com/editors/plagdetect.

Authorship contributions

Tingyi S. Lin: Conceptualization, Methodology, Investigation, Writing-Reviewing and Correcting.

Yue Lou:, Methodology, Data Curation, Writing-Original draft preparation.

Conflicts of interest

All authors declare that they have no conflicts of interest.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2023.101343.

References

Abramson, L. Y., Seligman, M. E. P., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87*, 49–74.
Ahorsu, D. K., Lin, C. Y., & Pakpour, A. H. (2020). The association between health status and insomnia, mental health, and preventive behaviors: The mediating role of fear of COVID-19. *Gerontology and Geriatric Medicine, 6*, Article 2333721420966081.
Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211.
Ancker, J. S., Senathirajah, Y., Kukafka, R., & Starren, J. B. (2006). Design features of graphs in health risk communication: A systematic review. *Journal of the American Medical Informatics Association, 13*(6), 608–618.
Andrade, E. F., Pereira, L. J., Oliveira, A. P. L. D., Orlando, D. R., Alves, D. A. G., Guilarducci, J. D. S., & Castelo, P. M. (2020). Perceived fear of COVID-19 infection according to sex, age and occupational risk using the Brazilian version of the Fear of COVID-19 Scale. *Death Studies*, 1–10.
Anglin, A. H., Courtney, C., & Allison, T. H. (2022). Venturing for others, subject to role expectations? A role congruity theory approach to social venture crowd funding. *Entrepreneurship: Theory and Practice, 46*(2), 421–448.
Ansari-Moghaddam, A., Seraji, M., Sharafi, Z., Mohammadi, M., & Okati-Aliabad, H. (2021). The protection motivation theory for predict intention of COVID-19 vaccination in Iran: A structural equation modeling approach. *BMC Public Health, 21*(1), 1–9.
Ashfaq, M., Yun, J., Yu, S., & Loureiro, S. M. C. (2020). I, Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents. *Telematics and Informatics, 54*, Article 101473.
Avery, E. J. (2010). The role of source and the factors audiences rely on in evaluating credibility of health information. *Public Relations Review, 36*(1), 81–83.
Bai, Q., Dan, Q., Mu, Z., & Yang, M. (2019). A systematic review of emoji: Current research and future perspectives. *Frontiers in Psychology, 10*, 2221.
Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191.
Baum, M., Schäfer, M., & Kabst, R. (2016). Modeling the impact of advertisement-image congruity on applicant attraction. *Human Resource Management, 55*(1), 7–24.
Bell, D. M. (2004). Public health interventions and SARS spread, 2003. *Emerging Infectious Diseases, 10*(11), 1900.
Brewer, N. T., Parada, H., Jr., Hall, M. G., Boynton, M. H., Noar, S. M., & Ribisl, K. M. (2019). Understanding why pictorial cigarette pack warnings increase quit attempts. *Annals of Behavioral Medicine, 53*(3), 232–243.
Calvillo, D. P., Ross, B. J., Garcia, R. J., Smelter, T. J., & Rutchick, A. M. (2020). Political ideology predicts perceptions of the threat of covid-19 (and susceptibility to fake news about it). *Social Psychological and Personality Science, 11*(8), 1119–1128.
Campbell, M. C., & Goodstein, R. C. (2001). The moderating effect of perceived risk on consumers' evaluations of product incongruity: Preference for the norm. *Journal of Consumer Research, 28*(3), 439–449.
Choi, E. J. (2008). *An exploratory study of the effect of shopping congruence on perceptions, attitudes, and purchase intentions in online and offline stores*. Retailing: Michigan State University.
Chon, K. S., & Olsen, M. D. (1991). Functional and symbolic congruity approaches to consumer satisfaction/dissatisfaction in consumerism. *Journal of the International Academy of Hospitality Research logo*, (3).
Cho, Y. J., Thrasher, J. F., Yong, H. H., Szklo, A. S., O'Connor, R. J., Bansal-Travers, M., … Borland, R. (2018). Path analysis of warning label effects on negative emotions and quit attempts: A longitudinal study of smokers in Australia, Canada, Mexico, and the US. *Social Science & Medicine, 197*, 226–234.
Chou, F. S., Wang, C. C., Lai, M. C., Tung, C. H., Yang, Y. J., & Tsai, K. H. (2020). Persuasiveness of organic agricultural products: Argument strength, health consciousness, self-reference, health risk, and perceived fear. *British Food Journal*.
Cifci, I. (2021). Testing self-congruity theory in Bektashi faith destinations: The roles of memorable tourism experience and destination attachment. *Journal of Vacation Marketing, 13567667211011758*.
Claiborne, C. B., & Sirgy, M. J. (2015). Self-image congruence as a model of consumer attitude formation and behavior: A conceptual review and guide for future research. In *Proceedings of the 1990 academy of marketing science (AMS) annual conference* (pp. 1–7). Cham: Springer.
Clarke, N., Pechey, E., Kosīte, D., König, L. M., Mantzari, E., Blackwell, A. K., … Hollands, G. J. (2020). Impact of health warning labels on selection and consumption of food and alcohol products: Systematic review with meta-analysis. *Health Psychology Review*, 1–24.
Coffee, P., Rees, T., & Haslam, S. A. (2009). Bouncing back from failure: The interactive impact of perceived controllability and stability on self-efficacy beliefs and future task performance. *Journal of Sports Sciences, 27*(11), 1117–1124.
Dahlén, M., & Lange, F. (2004). To challenge or not to challenge: Ad-brand incongruency and brand familiarity. *Journal of Marketing Theory and Practice, 12*(3), 20–35.
Dahlén, M., Lange, F., Sjödin, H., & Törn, F. (2005). Effects of ad-brand incongruence. *Journal of Current Issues and Research in Advertising, 27*(2), 1–12.
Das, G., Wiener, H. J., & Kareklas, I. (2019). To emoji or not to emoji? Examining the influence of emoji on consumer reactions to advertising. *Journal of Business Research, 96*, 147–156.
De Jans, S., Van de Sompel, D., De Veirman, M., & Hudders, L. (2020). # Sponsored! How the recognition of sponsoring on Instagram posts affects adolescents' brand evaluations through source evaluations. *Computers in Human Behavior, 109*, Article 106342.
Dillard, J. P. (1994). Rethinkin the study of fear appeals: An emotional perspective. *Communication Theory, 4*(4), 295–323.
Dorfan, N. M., & Woody, S. R. (2011). Danger appraisals as prospective predictors of disgust and avoidance of contaminants. *Journal of Social and Clinical Psychology, 30*(2), 105.
Easterling, D. V., & Leventhal, H. (1989). Contribution of concrete cognition to emotion: Neutral symptoms as elicitors of worry about cancer. *Journal of Applied Psychology, 74*(5), 787.
Eshghipour, N., Jafar, P., & Ekhtiari, H. (2019). The behavioral responses of consumers to the intensity and type of fear appeals used in anti-obesity advertisements: An experimental study on college students in tehran. *Journal of Biostatistics and Epidemiology*.
Fanselow, M. S., & Lester, L. S. (1988). *A functional behavioristic approach to aversively motivated behavior: Predatory imminence as a determinant of the topography of defensive behavior*.
Garcia-Retamero, R., & Cokely, E. T. (2011). Effective communication of risks to young adults: Using framing and visual aids to increase condom use and STD screening. *Journal of Experimental Psychology: Applied, 17*(3), 270.
Gaube, S., Tsivrikos, D., Dollinger, D., & Lermer, E. (2018). How a smiley protects health: A pilot intervention to improve hand hygiene in hospitals by activating injunctive norms through emoticons. *PLoS One, 13*(5), Article e0197465.

Gibson, R. (2003). Effects of photography on issue perception. In *Communication and emotion* (pp. 331–354). Routledge.
Guidry, J. P., Carlyle, K. E., LaRose, J. G., Perrin, P., Messner, M., & Ryan, M. (2019). Using the health belief model to analyze Instagram posts about Zika for public health communications. *Emerging infectious diseases, 25*(1), 179.
Harper, C. A., Satchell, L. P., Fido, D., & Latzman, R. D. (2021). Functional fear predicts public health compliance in the COVID-19 pandemic. *International Journal of Mental Health and Addiction, 19*(5), 1875–1888.
Harrington, N. G. (2015). Introduction to the special issue: Message design in health communication research. *Health Communication, 30*, 103–105.
Harris, P. (1996). Sufficient grounds for optimism?: The relationship between perceived controllability and optimistic bias. *Journal of Social and Clinical Psychology, 15*(1), 9.
Hegner, S. M., Fetscherin, M., & Van Delzen, M. (2017). Determinants and outcomes of brand hate. *The Journal of Product and Brand Management*.
Houts, P. S., Doak, C. C., Doak, L. G., & Loscalzo, M. J. (2006). The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence. *Patient Education and Counseling, 61*(2), 173–190.
Huang, A. H., Yen, D. C., & Zhang, X. (2008). Exploring the potential effects of emoticons. *Information & Management, 45*(7), 466–473.
Islam, J. U., Rahman, Z., & Hollebeek, L. D. (2018). *Consumer engagement in online brand communities: A solicitation of congruity theory*. Internet Research.
Jang, K., & Baek, Y. M. (2019). When information from public health officials is untrustworthy: The use of online news, interpersonal networks, and social media during the MERS outbreak in South Korea. *Health Communication, 34*(9), 991–998.
Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health Education Quarterly, 11*(1), 1–47.
Johnston, A. C., Warkentin, M., & Siponen, M. (2015). An enhanced fear appeal rhetorical framework. *MIS Quarterly, 39*(1), 113–134.
Jørgensen, F., Bor, A., & Petersen, M. B. (2021). Compliance without fear: Individual-level protective behaviour during the first wave of the COVID-19 pandemic. *British Journal of Health Psychology, 26*(2), 679–696.
Kaye, S. A., White, M. J., & Lewis, I. (2017). The use of neurocognitive methods in assessing health communication messages: A systematic review. *Journal of Health Psychology, 22*(12), 1534–1551.
Kees, J., Burton, S., Andrews, J. C., & Kozup, J. (2010). Understanding how graphic pictorial warnings work on cigarette packaging. *Journal of Public Policy and Marketing, 29*(2), 265–276.
King, A. J., Jensen, J. D., Davis, L. A., & Carcioppolo, N. (2014). Perceived visual informativeness (PVI): Construct and scale development to assess visual information in printed materials. *Journal of Health Communication, 19*(10), 1099–1115.
King, A. J., & Lazard, A. J. (2020). Advancing visual health communication research to improve infodemic response. *Health Communication, 35*(14), 1723–1728.
Lee, S. A., & Jeong, M. (2014). Enhancing online brand experiences: An application of congruity theory. *International Journal of Hospitality Management, 40*, 49–58.
Li, J. B., Yang, A., Dou, K., Wang, L. X., Zhang, M. C., & Lin, X. Q. (2020). Chinese public's knowledge, perceived severity, and perceived controllability of COVID-19 and their associations with emotional and behavioural reactions, social participation, and precautionary behaviour: A national survey. *BMC Public Health, 20*(1), 1–14.
Luca, N. R., & Suggs, L. S. (2013). Theory and model use in social marketing health interventions. *Journal of Health Communication, 18*(1), 20–40.
Lutz, R. J., MacKenzie, S. B., & Belch, G. E. (1983). *Attitude toward the ad as a mediator of advertising effectiveness: Determinants and consequences*. ACR North American Advances.
Maier, S. F., & Seligman, M. E. (1976). Learned helplessness: Theory and evidence. *Journal of Experimental Psychology: General, 105*(1), 3.
Mandler, G. (1981). *The structure of value: Accounting for taste*. San Diego: Center for Human Information Processing, Department of Psychology, University of California.
Melki, J., Tamim, H., Hadid, D., Farhat, S., Makki, M., Ghandour, L., & Hitti, E. (2022). Media exposure and health behavior during pandemics: The mediating effect of perceived knowledge and fear on compliance with COVID-19 prevention measures. *Health Communication, 37*(5), 586–596.
Meyers-Levy, J., & Tybout, A. M. (1989). Schema congruity as a basis for product evaluation. *Journal of Consumer Research, 16*(1), 39–54.
Min, C., Shen, F., Yu, W., & Chu, Y. (2020). The relationship between government trust and preventive behaviors during the COVID-19 pandemic in China: Exploring the roles of knowledge and negative emotion. *Preventive Medicine, 141*, Article 106288.
Moon, W. K., Atkinson, L., Kahlor, L. A., Yun, C., & Son, H. (2021). *US political partisanship and COVID-19: Risk information seeking and prevention behaviors*. Health Communication.
Mukarram, S. S., Saeed, A., Hammoudeh, S., & Raziq, M. M. (2018). Women on Indian boards and market performance: A role-congruity theory perspective. *Asian Business & Management, 17*(1), 4–36.
Nabi, R. L. (2015). Emotional flow in persuasive health messages. *Health Communication, 30*(2), 114–124.
Nabi, R. L., & Myrick, J. G. (2019). Uplifting fear appeals: Considering the role of hope in fear-based persuasive messages. *Health Communication, 34*(4), 463–474.
National Cancer Institute. (2002). *Making health communication programs work (NIH Publication No. 02–5145)*. Washington, DC: U.S. Government Printing Office.
National Cancer Institute. (2007). *Designing print materials: A communications guide for breast cancer screening (NIH publication No. 07–6100)*. Washington, DC: U.S. Government Printing Office.
Oh, S. H., Lee, S. Y., & Han, C. (2021). The effects of social media use on preventive behaviors during infectious disease outbreaks: The mediating role of self-relevant emotions and public risk perception. *Health Communication, 36*(8), 972–981.
Olapegba, P. O., Chovwen, C. O., Ayandele, O., & Ramos-Vera, C. (2022). Fear of COVID-19 and preventive health behavior: Mediating role of post-traumatic stress symptomology and psychological distress. *International Journal of Mental Health and Addiction, 20*(5), 2922–2933.
O'Reilly-Shah, V. N., Lynde, G. C., & Jabaley, C. S. (2018). Is it time to start using the emoji in biomedical literature? *Bmj*, 363.
Osgood, C. E., & Tannenbaum, P. H. (1955). The principle of congruity in the prediction of attitude change. *Psychological Review, 62*(1), 42.
Ousterhout, T. (2017). *An investigation on the cognitive effects of emoji usages in text*. Doctoral dissertation, University of Copenhagen, Faculty of Humanities.
Pardes, A. (2018). *The complete history of emoji. Wired*. https://www.wired.com/story/guide-emoji/. (Accessed 17 May 2021).
Pinto, V. R. A., Teixeira, C. G., Lima, T. S., Prata, E. R. B. D. A., Vidigal, M. C. T. R., Martins, E., … de Carvalho, A. F. (2020). Health beliefs towards kefir correlate with emotion and attitude: A study using an emoji scale in Brazil. *Food Research International, 129*, Article 108833.
Popova, L. (2012). The extended parallel process model: Illuminating the gaps in research. *Health Education & Behavior, 39*(4), 455–473.
Prentice-Dunn, S., & Rogers, R. W. (1986). Protection motivation theory and preventive health: Beyond the health belief model. *Health Education Research, 1*(3), 153–161.
Provine, R. R., Spencer, R. J., & Mandell, D. L. (2007). Emotional expression online: Emoticons punctuate website text messages. *Journal of Language and Social Psychology, 26*(3), 299–307.
Ray, E. C., & Merle, P. F. (2020). *Disgusting face, disease-ridden place?: Emoji influence on the interpretation of restaurant inspection reports*. Health Communication.
Rimal, R. N., Lapinski, M. K., Turner, M. M., & Smith, K. (2011). The attribute-centered approach for understanding health behaviors: Initial ideas and future research directions. *Studies in Communication Sciences, 11*(1), 15–34.
Roberts, J. A., & David, M. E. (2021). Improving predictions of COVID-19 preventive behavior: Development of a sequential mediation model. *Journal of Medical Internet Research, 23*(3), Article e23218.
Robus, C. M., Hand, C. J., Filik, R., & Pitchford, M. (2020). Investigating effects of emoji on neutral narrative text: Evidence from eye movements and perceived emotional valence. *Computers in Human Behavior, 109*, Article 106361.
Royal Society for Public Health (RSPH). (2017). Labelling the point: Towards better alcohol health information. Retrieved from https://www.rsph.org.uk/uploads/assets/uploaded/4ae31b49-c4d74355ad94a660aba36108.pdf.
Seo, K., Dillard, J. P., & Shen, F. (2013). The effects of message framing and visual image on persuasion. *Communication Quarterly, 61*(5), 564–583.
Shahab, L., Hall, S., & Marteau, T. (2007). Showing smokers with vascular disease images of their arteries to motivate cessation: A pilot study. *British Journal of Health Psychology, 12*(2), 275–283.
Shaikh, S., Malik, A., Akram, M. S., & Chakrabarti, R. (2017). Do luxury brands successfully entice consumers? The role of bandwagon effect. *International Marketing Review*.
Sop, S. (2020). Self-congruity theory in tourism research: A systematic review and future research directions. *European Journal of Tourism Research, 26*, 2604-2604.
Stolow, J. A., Moses, L. M., Lederer, A. M., & Carter, R. (2020). How fear appeal approaches in COVID-19 health communication may be harming the global community. *Health Education & Behavior, 47*(4), 531–535.
Šuriņa, S., Martinsone, K., Perepjolkina, V., Kolesnikova, J., Vainik, U., Ruža, A., … Rancans, E. (2021). Factors related to COVID-19 preventive behaviors: A structural equation model. *Frontiers in Psychology, 12*.
Thompson, S. C. (1981). A complex answer to a simple question: Will it hurt less if I can control it. *Psychological Bulletin, 90*(1), 89–101.
Troiano, G., & Nante, N. (2018). Emoji: What does the scientific literature say about them?-A new way to communicate in the 21th century. *Journal of Human Behavior in the Social Environment, 28*(4), 528–533.
Vann, R. J., Tanner, E. C., & Kizilova, E. (2022). Perceived access, fear, and preventative behavior: Key relationships for positive outcomes during the COVID-19 health crisis. *Journal of Consumer Affairs, 56*(1), 141–157.
Weßlau, C., Cloos, M., Höfling, V., & Steil, R. (2015). Visual mental imagery and symptoms of depression–results from a large-scale web-based study. *BMC Psychiatry, 15*(1), 1–13.
Witte, K. (1992). Putting the fear back into fear appeals: Reconciling the literature. *Communication Monographs, 59*(4), 329–349.
Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model (EPPM). *Communication Monographs, 61*(2), 113–134.
World Health Organization. (2020). Health topics- coronavirus (prevention), web site. https://www.who.int/health-topics/coronavirus#tab=tab_2.
Yang, L. K. (2017). *Who are more likely to donate?: The effects of perceived controllability on empathy and pro-social behaviour*. 서울대학교 대학원. Doctoral dissertation.
Yang, J. Z., & Chu, H. (2018). Who is afraid of the Ebola outbreak? The influence of discrete emotions on risk perception. *Journal of Risk Research, 21*(7), 834–853.
Yıldırım, M., Geçer, E., & Akgül, Ö. (2021). The impacts of vulnerability, perceived risk, and fear on preventive behaviours against COVID-19. *Psychology Health & Medicine, 26*(1), 35–43.
Yuasa, M., Saito, K., & Mukawa, N. (2011). Brain activity associated with graphic emoticons. The effect of abstract faces in communication over a computer network. *Electrical Engineering in Japan, 177*(3), 36–45.
Zhenga, G. W., Siddikb, A. B., Yanc, C., & Masukujjamand, M. (2020). Official and unofficial media information and the public panic during the COVID-19 pandemic in China: An empirical analysis. *Revista Argentina de Clinica Psicologica, 29*(5), 1538–1551.