Information Processing and Management 59 (2022) 102792

Contents lists available at ScienceDirect

Information Processing and Management

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

Appeal to the head and heart: The persuasive effects of medical crowdfunding charitable appeals on willingness to donate

You Wu [a], Xing Zhang [b,*], Quan Xiao [c]

[a] Economics and Management School, Wuhan University, Wuhan, China
[b] Wuhan Textile University, Wuhan, China
[c] School of Information Management, Jiangxi University of Finance and Economics, Jiangxi, China

ARTICLE INFO

Keywords:
Medical crowdfunding
Charitable appeals
Aristotle's three modes of persuasion
ANOVA
Text analysis
Econometric model

ABSTRACT

Medical crowdfunding helps low-income patients raise money for medical treatment and has grown tremendously in recent years. The most appropriate messaging strategy for writing charitable appeals to attract donations remains unclear. This study fills this gap by drawing on Aristotle's three modes of persuasion to explore factors affecting willingness to donate to medical crowdfunding projects from three aspects: logos, pathos, and ethos. This study adopted a multi-method approach by conducting two laboratory experiments ($N = 125$ and $N = 123$) and a field study ($N = 1645$). Analysis of variance (ANOVA) in Study 1 showed that high information quality ($F = 9.774$, $p = 0.002$) and gain frame ($F = 8.620$, $p = 0.004$) have positive effects on the trustworthiness of the project initiator (ethos), which in turn promoting potential donors' willingness to donate ($\beta = 0.339$, $p = 0.001$). Study 2 confirmed the findings about information quality in Study 1, and further show that there was no significant difference between gain-first and gain-last frame on trustworthiness and willingness to donate ($p > 0.05$). Then, information quality is further detailed into three sub-dimensions in Study 3: text length, number of images, and number of health-related words. The results of ordinary least squares (OLS) regression with robust standard error indicate that the text length ($\beta = 0.350$, $p < 0.001$) and number of images ($\beta = 0.048$, $p < 0.001$) positively influence donation behavior, but the opposite conclusion yields health-related words ($\beta = -0.027$, $p < 0.01$). This study provides theoretical insights into the role of medical crowdfunding charitable appeals by verifying the persuasion effects of rational, emotional, and credibility appeals. This study also contributes to persuasion theory by highlighting the role of emotional appeals and identifying the mediating impact of credibility appeals in the context of medical crowdfunding. This study also has important practical implications by guiding funders to write persuasive charity appeals that will attract the attention of potential donors.

1. Introduction

World Bank and the World Health Organization estimate that health care cost forces more than 100 million people into extreme poverty each year (Aizenman, 2017). A study published in The American Journal of Medicine reported that 42% of new cancer patients deplete their life savings in two years because of treatment (Beres, 2018). People are increasingly struggling to raise money for medical

* Corresponding author.
E-mail address: zhangxing1981@126.com (X. Zhang).

https://doi.org/10.1016/j.ipm.2021.102792
Received 16 May 2021; Received in revised form 17 July 2021; Accepted 11 October 2021
Available online 2 November 2021

treatment and thus crowdfunding campaigns for medical expenses have grown tremendously in recent years. Medical crowdfunding is a type of charitable crowdfunding, which refers to the practice of using the Internet to raise money from donors to pay for healthcare expenses. For example, Qingsongchou, the largest medical crowdfunding platform in China, now has possessed more than 600 million registered users worldwide, helped over 2.55 million families, and raised beyond 36 billion in charitable donations. However, many medical crowdfunding projects that fail to raise the required money still exist. Thus, the success factors of medical crowdfunding must be understood. Currently, the literature on the success of crowdfunding project mainly focuses on reward-based crowdfunding and examines several factors, such as website quality, project characteristics, social network of project initiators, and motivations of donors (Agrawal, Catalini, & Goldfarb, 2015; Bagheri, Chitsazan, & Ebrahimi, 2019; Liu, Suh, & Wagner, 2018; Wang & Wang, 2018). There is scant literature on the content characteristics of the medical crowdfunding project information. This limits our understanding of how to evaluate the contents of medical crowdfunding projects and promote the success of these projects.

On medical crowdfunding platforms, project initiators can write their appeals to describe their personal experiences of illness and fiscal pressure to attract potential donors (Zhang, Hu, & Xiao, 2021). Therefore, medical crowdfunding project initiators should write a charitable appeal to persuade others to donate. Despite the importance of charitable appeals, research on the persuasive effects of charitable appeals on donation is in its early stages. Particularly, knowledge about how message construction (e.g., rhetorical strategies) affects donors' decisions is limited. Correspondingly, this study draws on Aristotle's three modes of persuasion to examine the message construction of charitable appeal and its persuasive effect on willingness to donate in the medical crowdfunding context.

We conducted two laboratory experiments and a follow-up field study to achieve our research objectives. The experiment conducted in Study 1 was designed to empirically test whether logical appeal (logos) and emotional appeal (pathos) had positive impacts on credibility appeal (ethos) and willingness to donate in the context of medical crowdfunding. On the basis of Study 1, we also used a laboratory experiment in Study 2 to further explore the co-existence and order effects of emotional appeal. The focus of Study 3 was to verify our experiment results and investigate the finer dimensions of information quality in a real-life context. The complementary features of laboratory experiment and field study enable us to more robustly demonstrate the importance of rational and emotional persuasive strategies used in medical crowdfunding charitable appeals in attracting donations.

2. Theoretical background

2.1. Medical crowdfunding and charitable appeal

Crowdfunding is a new fundraising model to raise financial resources in the form of donation or exchange of some rewards via the Internet to support specific purposes (Strausz, 2017). Crowdfunding can be categorized into four types based on their returns: reward-, lending-, equity-, and donation-based crowdfunding. Medical crowdfunding is a type of donation-based crowdfunding that uses websites to raise money from donors to pay for healthcare-related expenses (Snyder, Crooks, Mathers, & Chow-White, 2017). Traditional charity fundraising campaigns are often limited to specific groups and regions, whereas medical crowdfunding reduces the temporal and spatial barriers to fundraising. Enabling the recipients to access to medical treatment and avoid the risk of "medical bankruptcy" can provide substantial benefits to them. Despite the important effect of medical crowdfunding on society and the economy, research on medical crowdfunding remains scarce (Burtch & Chan, 2019). As crowdfunding project initiators attempt to persuade potential backers with a compelling story, the description of the project is very important for potential backers to understand the project (Zheng, Li, Wu, & Xu, 2014). The medical crowdfunding platform matches potential donors to recipients in need of financial assistance by acting as a point of contact (Ba, Zhao, Song, & Zhu, 2021; Ba, Zhao, Zhou, & Song, 2020; Burtch & Chan, 2019). Each recipient has an opportunity to persuade donors to make a giving decision by showing them a personable charitable appeal. This fundraising mechanism sheds light on the importance of the charitable appeal.

The existing literature attempts to understand the characteristics of crowdfunding appeals to improve the success rate of crowdfunding projects. Previous literature has mainly focused on reward-based crowdfunding and identified several rational characteristics, such as the text length, number of images and videos, and electronic word of mouth. For example, Bi, Liu, and Usman (2017) explored information affecting investor behavior in the reward-based crowdfunding context. They demonstrated that signals of project quality (i.e., project introduction word and video count) and electronic word of mouth (i.e., "like" count and numbers of reviews) positively influence funder investment decisions. Allison, Davis, Webb, and Short (2017) also found that product quality and usefulness have a positive relationship with rewards-based crowdfunding performance. These identified rational characteristics are not necessarily appropriate for the medical crowdfunding context. Moreover, medical crowdfunding can be regarded as a type of philanthropy, and individuals are motivated to donate money because of their compassion for patients suffering from diseases. Therefore, the emotional characteristics of charitable appeals are noteworthy because they can evoke a great emotional response and inspire people to donate.

In addition, previous studies in the IS field have demonstrated that perception of the credibility of information sources can promote online behavior. Given that no material return on donations in charitable crowdfunding exists, the perceived credibility of the project is also an important prerequisite for helping behavior (Liu et al., 2018). The credibility of charitable appeal is also likely to facilitate medical crowdfunding donation. Consequently, this study adopts Aristotle's three modes of persuasion to construct a holistic view of charitable appeal content factors that affect medical crowdfunding willingness to donate from three aspects: rational, emotional, and credibility appeals.

2.2. Aristotle's three modes of persuasion

Persuasion refers to making the recipient agree with a point of view and/or take an action (Li, Kankanhalli, & Kim, 2016). Aristotle

proposed three modes of persuasion (also known as "three proofs"), namely, ethos, logo, and pathos (Alkhirbash, 2016). First, ethos (Greek for "character") is an ethical appeal to the credibility of the source. Audiences may believe that the persuader is authoritative or trustworthy depending on the character of the persuader. In the medical crowdfunding context, the project initiator needs the ethos appeal to convince the potential donors that he/she is a person of integrity and high moral character to gain their donations. Thus, we use the trustworthiness of the project initiator for credibility appeal (ethos) in the current study.

Second, logos (Greek for "word") is a rational appeal to the audience. Rational appeal emphasizes providing information logically and rationally. Theory of rational action argues that people rely on rational calculations and that they tend to consider first the efficiency and consequences of a certain action before performing it (Goldthorpe, 1998). Thus, persuaders could convince their audience by using facts, figures, cases, and statistics (Han, Shin, Chung, & Koo, 2019). Through rational arguments, previous studies have also confirmed that many people are persuaded to give money to help the poor (Lindauer et al., 2020). The initiator of a medical crowdfunding project can provide high-quality information (e.g., detailed text and pictures of medical bills) to make their donation request reasonable. Therefore, we use information quality for rational appeal (logos) in the current study.

Third, pathos (Greek for "suffering" or "experience") is an emotional appeal to the audience. People's emotional responses could make them change their thoughts (Alkhirbash, 2016). Theory of rational action is based on the assumption that people behave rationally (Goldthorpe, 1998; Mou & Benyoucef, 2021). However, many scholars have disputed this basic idea, arguing that people sometimes make irrational decisions. Considerable research has also revealed that pro-social behaviors heavily rely on intuition and are often inhibited by reasoning and reflection (Lindauer et al., 2020; Rand, Greene, & Nowak, 2012). Instead, they suggested that emotions are the main drivers of moral decision-making (Lindauer et al., 2020). Thus, persuaders need to be aware of the emotions they want to elicit in their audiences (Cockcroft & Cockcroft, 2005). The persuasive process can arouse a variety of emotions, such as sadness, compassion, anger, happiness, and so on. In the medical crowdfunding context, beneficiaries can use a gain-framed message to exhibit their optimism in fighting the disease to motivate potential donors to give them encouragement and help. They can also use a loss-framed message to show their painful feelings of suffering from the disease to evoke sympathy from potential donors. Thus, we use message framing for emotional appeal (pathos) in this study.

Existing literature on reward-based crowdfunding mainly focused on the ethos and logos modes. However, charity beneficiaries should appeal to the heart, not just the head, to increase charitable donations. The pathos appeal is also important in persuading others to perform acts of philanthropy. Hence, this study empirically examines how to persuade others by mixing ethos, logos, and pathos in the medical crowdfunding context.

2.3. *Message framing*

Tversky and Kahneman (1981) believed that the way information is framed can lead to different judgments and decisions of information recipients. For example, presenting two pieces of information of equal value in a gain (positive) and a loss (negative) manner, respectively, will lead to unequal decisions made by the information recipients (Chang & Lee, 2009). The gain frame (positive frame) emphasizes the positive outcomes that can be achieved by performing a targeted action, whereas the loss frame (negative frame) stresses the negative consequences of not performing the requested action (Seo & Park, 2019).

Charitable appeals can be framed in gain terms (e.g., "This patient will have an opportunity for treatment and survival if you donate money") or loss terms (e.g., "This patient will loss an opportunity for treatment and die if you will not donate money"). Previous studies have suggested that information framed in gain or loss terms has a greater influence on individuals' decisions than information presented neutrally. However, research on which message frame is more persuasive has so far proved inconclusive. On the one hand, some studies suggest that the loss frame is more persuasive than the gain frame. For example, Chang and Lee (2009) found that negative frame brings greater donation intentions than the positive one. Similar results were found when help was given instead of monetary donations. In the field study conducted by Chou & Murnighan, 2013, the method of describing blood donation as "preventing death" produces higher rates of actual blood donation than the method of describing it as "life-saving." On the other hand, some studies found that people prefer positive messages which can lead to happiness rather than negative messages that cause pain. For example, Borah and Xiao (2018) concluded that health information using a gain frame is more credible than using a loss frame. Reinhart, Marshall, Feeley, and Tutzauer (2007) found that the former leads more favorable attitudes toward organ donation than the latter. Therefore, the present study investigates whether gain and loss frames exert different effects on willingness to donate in the medical crowdfunding context.

As the gain and loss frames are often used together in actual medical crowdfunding charity appeals, whether the co-existence of gain and loss frame would be more persuasive than a separate message frame is questionable. Additionally, the presentation order of gain and loss frames is also worthy of discussion.

3. Research model and hypotheses development

3.1. *Credibility appeal*

In the previous literature on persuasion, trustworthiness and expertise have been considered as two aspects of source credibility (Appel & Mara, 2013). Trustworthiness refers to "the degree to which an audience perceives the assertions made by the communicator to be ones that the speaker considers valid'' (Pornpitakpan, 2004, p. 244). In medical crowdfunding contexts, project initiators are typically patients or their family members, whose source credibility is largely derived from perceived trustworthiness without much regard to their expertise. Therefore, this study focuses on trustworthiness in credibility appeal.

Trustworthiness has been identified as the key determinant of persuasion (Smith, Menon, & Sivakumar, 2005). Information is persuasive and likely to lead to behavior change when the trustworthiness of the information source is perceived to be high (Jin, Yin, Zhou, & Yu, 2021; López & Sicilia, 2014; Shi, Zheng, & Yang, 2020). Larrimore, Jiang, Larrimore, Markowitz, and Gorski (2011) argued that lenders chose to fund a borrower in the peer-to-peer lending environment presumably because of the borrower's trustworthiness. Medical crowdfunding accompanies the increased risk of fraud while providing treatment funding for many people. As such, the medical crowdfunding project initiators need to present an image of trustworthiness to increase their success in getting donations. Thus, we propose the following:

H1: Trustworthiness has a positive influence on the willingness to donate.

3.2. Rational appeal

Information quality refers to "the content of the information source" (Klobas, 1995, p. 96). Information quality affects the behavior of the information receiver (Chakraborty, 2019). According to the theory of rational action, people will perform actions that seem reasonable (Goldthorpe, 1998). Individuals can judge the quality of information in terms of informativeness, accuracy, authority, relevancy, and timeliness, based on their own information needs. Information quality plays a crucial role in reducing uncertainty and establishing the trustworthiness of information providers (Larrimore et al., 2011; Yi, Yoon, Davis, & Lee, 2013). Kelton, Fleischmann, and Wallace (2008) demonstrated trust acts as a mediator between information quality and usage. Thus, trustworthiness can be viewed as an evaluation of the information quality, which determines whether to use that information (Lucassen & Schraagen, 2010).

In the current study, we focus on three aspects that illustrate the information quality of charitable appeal: the text length, number of images, and number of health-related words. Fundraisers' trustworthiness is highly correlated with the extent to which they elaborate their product descriptions (Kim, Por, & Yang, 2017). Longer texts and several images improve the completeness and relevance of the information (Cheng & Ho, 2015; Huang, Chen, Yen, & Tran, 2015). Therefore, elaborating on a charitable appeal by adding text and images improves the quality of the appeal and leads to high trustworthiness. Additionally, individuals need to consider the semantic characteristics of the information when judging the quality of the information (Lucassen & Schraagen, 2011; Xiao, 2021; Yin & Zhang, 2020). Initiators of the medical crowdfunding project can improve the accuracy of information by using more health-related words (e.g., disease symptoms) than just emphasizing their feelings when describing their disease in charitable appeal. In this way, potential donors can have high confidence in the trustworthiness of the initiator's situation. The completeness and accuracy of the information make the individual feel confident in its reliability (Liang, Wu, & Huang, 2019). Accordingly, we propose the following:

H2a: High information quality has a greater effect on trustworthiness than low information quality.

Some scholars believe that donation is a rational action that involves both altruism and self-interest (Zhong & Lin, 2018). Likewise, Lindauer et al. (2020) argued that many people are persuaded through rational arguments to donate their money to help others. Previous studies have also empirically verified that information quality is positively associated with argument quality and funding success (Ahlers, Cumming, Günther, & Schweizer, 2015; Mollick, 2014). For example, Mollick (2014) suggested that the quality of project information reflects the readiness of a crowdfunding project, which would be taken into account by potential backers in their investment choices. Ahlers et al. (2015) also demonstrated that the provision of equity and information about risk positively influence funding success.

Specific to the three aspects of information quality that are of interest to this study, similar conclusions were also drawn. A large word count in the project introduction makes the funders feel that the project is of high quality to be invested (Bi et al., 2017). Images can also attract viewers' attention, inspire their sympathy, and facilitate donation (Karimi & Wang, 2017). Furthermore, Larrimore et al. (2011) found that several quantitative words about the borrower increase funding success in a peer-to-peer lending platform. Hence, a charitable appeal with long text and many images and health-related words will improve the information quality of the appeal and persuade the people to donate. Accordingly, we propose the following:

H2b: High information quality has a greater effect on willingness to donate than low information quality.

3.3. Emotional appeal

The way that information is framed influences the judgments of recipients of the information. Pan and Chiou (2011) found that consumers are more likely to trust in online negative word-of-mouth information than in positive information. Nevertheless, other studies have come to the opposite conclusion. For example, some scholars suggested that positive information has higher credibility evaluations than negative ones (Meirick & Nisbett, 2011). Borah and Xiao (2018) also concluded that health information on Facebook presented in a gain frame is more reliable than that in a loss frame. In the medical crowdfunding context, a gain-framed charitable appeal that describes the positive outcome of performing the pro-social behavior of potential donors will bring happiness and satisfaction to them. Therefore, potential donors are more likely to trust the positive outcome painted by the gain frame than its counterpart. Additionally, charitable appeals with excessive use of loss frames may make people feel manipulated (Sargeant & Woodliffe, 2007). Accordingly, we propose the following:

H3a: A gain frame has a greater effect on trustworthiness than a loss frame.

According to the theory of impact philanthropy, a donor prefers to have a unique role and influence on the person they are helping (Duncan, 2004). The gain frame allows potential donors to see the positive consequences of helping others, which can increase perceptions of the importance of helping behavior. Moreover, a positive feeling and pro-social behavior can form a positive feedback loop. In other words, engaging in pro-social behavior promotes individuals' positive affect and emotions. These positive feelings broaden their way of thinking and draw their attention from themselves toward the needs of others (Aknin, Van de Vondervoort, &

Hamlin, 2018). Thus, people may be more likely to perform good deeds when positive feelings are inspired by the gain than the loss frame. Thus, we propose the following:

H3b: A gain frame has a greater effect on willingness to donate than a loss frame.

Order effects of information presentation have been demonstrated in a variety of persuasion settings (Haugtvedt & Wegener, 1994). The presentation order of message framing in the charitable appeal may also affect potential donors' decisions and judgments. Two types of order effects are often examined when studying the order effects of opposing information: the primacy effect (judgments are in line with the first information) and the recency effect (judgments are in line with the second information).

Horgarth and Einhorn's (1992) belief adjustment model provides predictions for information order effects on human's final beliefs. This model suggests that recency effects occur when individuals receive mixed information sequentially and need to make a decision instantly. In other words, information received later has more influence on individuals' final belief than that received earlier (Buda & Zhang, 2000). The working memory model also argues that people prioritize the most recent information in their time-constrained information processing because the capacity of their memory systems is limited (Baddeley & Hitch, 1974). Thus, when two message frames are placed in a charitable appeal, the influence of the later message frame is greater. We have argued earlier that a gain frame plays an important role in trustworthiness and willingness to donate. Hence, we suggest that presenting the gain frame last (gain-last frame) in a charitable appeal has a greater influence than presenting it first (gain-first frame). Accordingly, we propose the following:

H4a: A gain-last frame has a greater effect on trustworthiness than a gain-first frame.

H4b: A gain-last frame has a greater effect on willingness to donate than a gain-first frame.

On the basis of the above analysis, we develop the research model (Fig. 1).

4. Research studies and results

4.1. Overview of studies

In this work, we designed and conducted three empirical studies to test our research hypotheses. Table 1 summarizes the information about these studies. Study 1 is a controlled laboratory experiment ($N = 125$) based on which we manipulated the logical appeal (information quality), emotional appeal (message framing), and measured the credibility appeal (trustworthiness) of medical crowdfunding charitable appeal and examined their effects on willingness to donate. Study 2 is a laboratory experiment ($N = 123$) to further test whether the two different orders of message frames that appear in charitable appeals have the same effect on willingness to donate. Study 3 is a field study wherein we crawled medical crowdfunding project data ($N = 1645$) from a real platform and verified the effects of logical appeal and emotional appeal on actual donation amounts. We also refined the information quality into three dimensions (i.e., number of images, text length, and number of health-related words) and examined their influences on donation amount. All three studies consistently revealed that both logos (appeal to the head) and pathos (appeal to the heart) strategies in medical crowdfunding charitable appeals play positive roles in attracting donations.

Our research design fulfills the three purposes of a multi-method research, namely, expansion, corroboration, and compensation (Venkatesh, Brown, & Bala, 2013). First, we used the donation amount as the dependent variable in the field study, thus allowing us to extend our experimental findings to actual donation behaviors. Moreover, the field study expanded the two experimental studies by measuring three sub-dimensions of information quality and examining their impacts on the amount of the donation. Doing so can help enrich our understanding of the roles of different information content characteristics. Second, the three studies corroborated one another by demonstrating consistent findings across methods. Third, the research design leveraged the strengths and compensated for the limitations of each approach. Overall, the experimental approach provides higher internal validity for verifying causality by excluding the effects of confounding variables. Meanwhile, the field study increases external validity by applying and testing research model in the real-world setting.

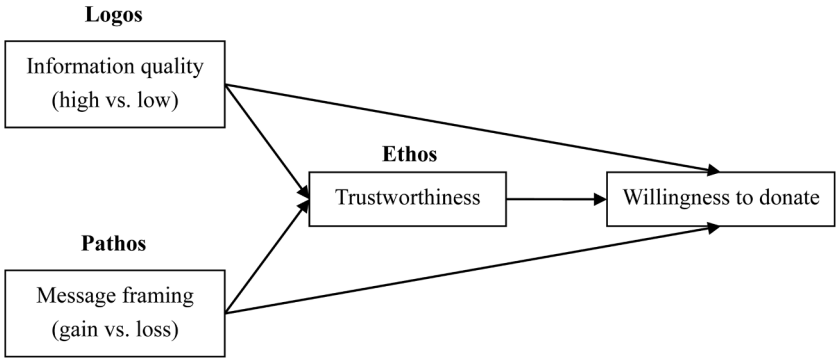


Fig. 1. Research model.

Table 1
Summary of studies.

Study	Method	Aims	Participants	Dependent variables	Tests	Related hypotheses	Key findings
Study 1	Laboratory experiment	Study 1 explores the relationship among information quality, message framing, trustworthiness and willingness to donate.	125 students	Willingness to donate	ANOVA	H1, H2a, H2b, H3a, H3b	Trustworthiness has a positive influence on the willingness to donate. High information quality has a greater impact on trustworthiness and willingness to donate than low information quality. Gain frame has a greater impact on trustworthiness and willingness to donate than loss frame.
Study 2	Laboratory experiment	Study 2 validates some conclusions in Study 1 and further investigates the order effects of gain and loss frames.	123 students	Willingness to donate	ANOVA	H1, H2a, H2b, H4a, H4b	Trustworthiness has a positive influence on the willingness to donate. High information quality has a greater impact on trustworthiness and willingness to donate than low information quality. There was no significant difference between gain-first and gain-last frame on trustworthiness and willingness to donate.
Study 3	Field study	Study 3 verify the findings of experiments and investigate finer dimensions of information quality in a real context.	1645 real projects	Donation behavior	OLS regression with robust standard error	H2b, H3b	Text length and the number of images significantly facilitate donation behavior. Positive emotion had a marginally significant effect on donation behavior, while negative emotion has none.

4.2. Ethical issues

The requirement for ethical approval in management research involving human participants is a means of improving the rights of research participants and protecting the ethical integrity of a research (Greenwood, 2016). Thus, to employ a clearer and more ethically transparent process in addressing the research governance issues, we obtained research permission and ethical approval from our institutional ethical committee.

Prior to the start of the experiments, we also asked the study participants to sign an informed consent form. This form contained descriptions of the purpose and process of the experiment. We explained to the participants the potential benefits they could obtain as well as the risks in participating in the study. In line with previous practice (Makri, Blandford, & Cox, 2011), we also informed the participants that we would ensure confidentiality and that we would respect their privacy by keeping participant data anonymous.

4.3. Study 1: laboratory experiment

4.3.1. Research purpose and experiment design

Study 1 aims to explore the impacts of information quality, single message frame (gain or loss frame) and trustworthiness on willingness to donate. In laboratory experiments, the investigator can effectively control the study variables by randomly assigning subjects to different treatment groups and controlling for the effects of confounding variables (Kjeldskov & Graham, 2003; Zhang & Adipat, 2005). Thus, it is easy to manipulate information quality and message framing and isolated their effects on credibility and willingness to donate in a laboratory experiment.

A between-subject laboratory experiment with a 2 (information quality: high versus low) $\times$ 2 (message framing: gain versus loss) factorial design was conducted to test the hypotheses. We simulated a medical crowdfunding website and designed four webpages for the experiment (as shown in the Appendix A). A fictional medical crowdfunding project was shown in these webpages, and two factors were experimentally manipulated: information quality and message framing. The respondents were randomly assigned to one of four treatment conditions by viewing different webpages.

4.3.2. Manipulation

Manipulations of message framing Gain- and loss-framed fictional medical crowdfunding appeals began with a story about a child with a congenital heart disease who needs money for treatment, but his parents cannot afford it. The gain-framed appeal stresses

the benefits of donating to the project (e.g., your help will save my child's life!), whereas the loss-framed appeal stresses potential losses of non-donation decisions (e.g., please do not let my child leave this world so early!).

Manipulations of information quality Information quality was manipulated depending on the text length, number of images, and number of health-related words in the fictional medical crowdfunding project appeal. High-quality information was manipulated by long appeal text, many images and health-related words. The design of low-quality information is the opposite, that is, short appeal text, few images and health-related words.

To reduce confusion, the platform name was hidden from the webpage, and the username was displayed as an "anonymous user." We also replaced the child beneficiary's name by "child" instead of "son" or "daughter" to avoid the influence of gender difference.

4.3.3. Measurement

For the two latent constructs in the research model, we adapted the scales from existing literature to fit the medical crowdfunding context. All questions were measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). We conducted the back-translation method to translate the original scales written in English into Chinese. We compared the original English version and back-translated English version of the questionnaire to improve translation accuracy. After developing the original questionnaire, we sent the questionnaire to three experts in the domain of information systems and medical crowdfunding to enhance the content validity of our study. According to the experts' opinions, we made revisions to ensure that these items were unambiguous. Table 2 shows the final measurement items.

4.3.4. Experimental procedure

A total of 152 students from a university in China were recruited for the main experiment. We told the participants that the extra credit they would receive was based merely on their participation and not on the opinions they expressed to encourage them to answer truthfully. Additionally, they were informed that this survey served exclusively scientific purposes and would not disclose any personal information. We conducted the main experiment in the following sequence. First, the participants were randomly assigned to four treatment conditions. Next, they were asked to listen to an introduction about the experiment task. Then, they were instructed to perform a task that required them to browse the corresponding webpage for four minutes. Last, the participants were asked to complete a questionnaire. The questionnaire included demographic and experience questions, measurement items of trustworthiness and willingness to donate, and manipulation check items for information quality and message framing.

We screened 152 returned answers and excluded those with a filling time of less than four minutes and with the same answers to all questions. Finally, 125 valid samples were obtained, and women accounted for 61.6%. No significant differences were found among the subjects across the four experimental conditions in terms of gender ($p = 0.948$).

4.3.5. Manipulation check and measurement validation

Information quality manipulation check Participants were asked to rate on a five-point Likert scale ranging from (1) low-quality information to (5) high-quality information. The results of an independent samples *t*-test announced that the score of high information quality was significantly higher than that of low information quality ($M_{\text{high}} = 3.732$, $M_{\text{low}} = 2.323$, $t = 10.142$, $p < 0.001$).

In this experiment, information quality was comprehensively evaluated from three aspects: the text length, number of images, and number of health-related words. We also performed manipulation tests on these three sub-dimensions to ensure the rigor of the experimental design. Subjects scored the text length by using a five-point Likert scale, with "1–5" representing the increasing degree of short to long. Participants were asked to rate on a five-point Likert scale ranging from (1) low information quality to (5) high information quality. The results of an independent samples *t*-test indicated that the mean value of long text was significantly higher than that of short text ($M_{\text{long}} = 3.836$, $M_{\text{short}} = 2.375$, $t = -8.950$, $p < 0.001$). Therefore, text length successfully manipulated. Similarly, the results of an independent samples *t*-test reported that the mean value of more-images group was significantly higher ($M_{\text{more-images}} = 3.721$, $M_{\text{less-images}} = 2.234$, $t = -8.370$, $p < 0.001$). Thus, number of images was successfully manipulated. Besides, the mean value of more health-related words group was significantly higher than that of less health-related words group ($M_{\text{more}} = 3.639$, $M_{\text{less}} = 2.359$, $t = -7.374$, $p < 0.001$). As a result, health-related words successfully manipulated. In summary, the manipulation of information quality was successful.

Message framing manipulation check Participants rated the statement tone of project description, with "1–5" representing the increasing degree of negative to positive (Chien & Chang, 2015; Tugrul & Lee, 2018). The results stated that the mean value of gain

Table 2
Measurement items.

Variables	Measurement items
Trustworthiness (Reimer & Benkenstein, 2016)	The initiator of this medical crowdfunding project is
	Honest
	Trustworthy
	Reliable
	Sincere
Willingness to donate (Baek & Reid, 2013)	I intend to sponsor the child;
	I will consider sponsoring the child in the future;
	I would recommend sponsoring the child to my friends or relatives;
	I am likely to make a charitable donation in order to help the child in need.

frame was significantly higher than that of loss frame ($M_{gain} = 3.61$, $M_{loss} = 2.87$, $t = -3.717$, $p < 0.001$). Therefore, the manipulation of message framing is successful.

Measurement validation The Cronbach's α values for trustworthiness and willingness to donate were 0.962 and 0.940 respectively, which indicated high reliability levels (Nunally, 1978). In addition, composite reliabilities of constructs were both above 0.928 (should exceed 0.80), the values for AVE ranged from 0.763 to 0.879 (should exceed 0.50) and the standard factor loadings exceeded 0.839 (should exceed 0.70). These results indicate good convergent validity (Fornell & Larcker, 1981; Zhang et al., 2018). Moreover, the square root of the AVE exceeded the corresponding inter-construct correlation, indicating adequate discriminant validity (Nunally, 1978).

4.3.6. Results of study 1

We utilized AMOS 22.0 to test the hypothesis H1. The results indicate that trustworthiness exerted a positive impact on willingness to donate ($\beta = 0.339$, $p = 0.001$), H1 was supported.

We conducted two-way analysis of variance (ANOVA) to test hypotheses regarding the impact of information quality and message frame on trustworthiness and willingness to donate, respectively. ANOVA is statistical technique for analyzing the difference between the means of more than two independent groups. ANOVA works by determining whether the groups created by the levels of the independent variable are statistically different. It does so by calculating whether the means of the treatment levels are different from the overall mean of the dependent variable. As shown in Table 3, the result indicated that high information quality had a greater impact on trustworthiness than low information quality ($M_{high} = 3.406$, $M_{low} = 2.926$, $F = 9.774$, $p = 0.002$), so H2a was supported. High information quality evoked higher level of willingness to donate than low information quality ($M_{high} = 3.455$, $M_{low} = 2.813$, $F = 17.976$, $p < 0.001$), so H2b was supported.

Similarly, results in Table 3 indicated that gain frame caused a higher level of trustworthiness than loss frame ($M_{gain} = 3.379$, $M_{loss} = 2.930$, $F = 8.620$, $p = 0.004$), thus H3a was supported. Gain frame had a greater effect on willingness to donate than loss frame ($M_{gain} = 3.606$, $M_{loss} = 2.623$, $F = 38.864$, $p < 0.001$), thus H3b was supported.

We also tested the mediation effect of trustworthiness via a bootstrapping procedure with PROCESS plug-in for SPSS developed by Hayes (2013). Bootstrapping is a non-parametric statistical procedure that allows mediation analysis without the normality assumption of the sample distribution. It can repeatedly sample a given dataset to generate a number of simulated samples. We computed the mediating model with 5000 bootstrapped samples, when information quality was an independent variable and willingness to donate was a dependent variable. The indirect effect of information quality on willingness to donate was 0.129, and its 95% confidence interval was [0.0119, 0.3018], excluding zero, indicating that the mediation effect was significant. In addition, when message framing was an independent variable and willingness to donate was a dependent variable, the indirect effect was 0.102, and its 95% confidence interval was [−0.0019, 0.2371], including zero, so the mediation effect was not significant.

4.4. Study 2: laboratory experiment

4.4.1. Research purpose and experiment design

Study 1 empirically confirmed the difference in the influences of gain and loss frame on trustworthiness and willingness to donate. In actual crowdfunding projects, medical crowdfunding charitable appeals often use both gain and loss frames. However, the literature considering the coexistence of these two frames is limited. Therefore, we designed Study 2 as an experiment to investigate whether two frames presenting together are stronger than a single frame. Furthermore, we examined whether two opposite presentation orders of gain and loss frames have unequal effects on willingness to donate.

Study 2 conducted a between-subject laboratory experiment with a 2 (information quality: high versus low) × 2 (presentation order of message framing: gain-first versus gain-last) factorial design to explore these issues.

4.4.2. Manipulation and measurement

Two factors were experimentally manipulated in Study 2: presentation order of message framing and information quality.

Manipulations of presentation order of message framing Similar to Study 1, the fictional medical crowdfunding appeals also began with a story about a child with congenital heart disease who needs money for treatment, but his parents cannot afford it. The

Table 3
ANOVA test results of Study 1.

Source	Dependent variable	Type III sum of squares	df	Mean square	*F*	P-value
Corrected model	*Trustworthiness*	14.032	3	4.677	5.902	0.001
	Willingness to donate	45.074	3	15.025	18.479	0.000
Information quality	*Trustworthiness*	7.746	1	7.746	9.774	0.002
	Willingness to donate	14.615	1	14.615	17.976	0.000
Massage framing	*Trustworthiness*	6.831	1	6.831	8.620	0.004
	Willingness to donate	31.599	1	31.599	38.864	0.000
Information quality * message framing	*Trustworthiness*	0.000	1	0.000	0.001	0.980
	Willingness to donate	0.410	1	0.410	0.504	0.479
Error	*Trustworthiness*	95.893	121	0.793		
	Willingness to donate	98.379	121	0.813		

difference is that each charitable appeal has both gain and loss message frames, but they appear in different orders. The gain-first appeal puts the gain frame before the loss frame (e.g., your help will save my poor child's life! Please don't let my child leave this world so early!), whereas the gain-last appeal has the opposite order of the two frames (e.g., please don't let my child leave this world so early! Your help will save my poor child's life!).

The manipulation of information quality, the measurement of trustworthiness, and willingness to donate is the same as that in Study 1.

4.4.3. Experimental procedure and measurement validation

The experimental procedure of Study 2 is the same as that of Study 1. The participants in Study 2 were 148 college students. After removing 25 invalid questionnaires, 123 valid samples were finally obtained, and women accounted for 68.3%. No significant differences were found among the subjects across the four experimental conditions in terms of gender ($p = 0.196$). Furthermore, the measurement validation of trustworthiness and willingness to donate indicated that both constructs were measured properly in Study 2.

4.4.4. Results of study 2

As in Study 1, we use AMOS 22.0 to test H1 and found trustworthiness exerted a positive effect on willingness to donate ($\beta = 0.589$, $p < 0.001$), so H1 was supported. We also conducted two-way analysis of variance (ANOVA) to test H2a and H2b. As shown in Table 4, the result demonstrated that high information quality promoted trustworthiness more than low information quality ($M_{high} = 3.454$, $M_{low} = 2.718$, $F = 17.254$, $p < 0.001$), which was the same as the result of Study 1, H2a was supported. High information quality exerted a greater effect on willingness to donate ($M_{high} = 3.183$, $M_{low} = 2.635$, $F = 11.286$, $p = 0.001$), thus H2b was supported as in Study 1.

In addition, the difference in trustworthiness between two kinds of presentation order was not significant ($M_{gain\text{-}last} = 3.147$, $M_{gain\text{-}first} = 3.004$, $F = 0.674$, $p = 0.413$), H4a was not supported. There was also no significant difference in the impact of message framing presentation order on willingness to donate ($M_{gain\text{-}last} = 2.929$, $M_{gain\text{-}first} = 2.875$, $F = 0.074$, $p = 0.786$), H4b was not supported.

To examine whether the coexistence of two message frames exerts greater effect than a single frame. We divided the samples of Study 1 and Study 2 into four groups: gain, loss, gain-first, and gain-last frames. The experimental procedure and stimulus materials in the two studies were identical, except the manipulation of the presentation order of message framing. Moreover, the variance analysis results showed that no significant difference exists among the subjects across the four groups in terms of gender ($F = 1.172$, $p = 0.321$). Therefore, four groups of subjects can be compared and analyzed. The analysis of variance showed significant differences in willingness to donate among these four groups ($M_{gain} = 3.606$, $M_{loss} = 2.623$, $M_{gain\text{-}first} = 2.875$, $M_{gain\text{-}last} = 2.929$, $F = 10.773$, $p < 0.001$). Furthermore, we conducted a posthoc test to perform a pairwise comparison among these four groups. The results indicate that the influence of gain frame group on willingness to donate is significantly stronger than the other groups, and no significant difference is observed between the other three groups. Therefore, the co-existence of gain and loss frames has no stronger joint effect than a single frame. Study 2 replicated and expanded the findings of Study 1 and provided supporting evidence for our hypotheses.

4.5. Study 3: field study

4.5.1. Research purpose and methods

Study 3 builds an econometric model to test the hypotheses by crawling real project data of the Qingsongchou platform, which is the largest medical crowdfunding platform in China. Study 3 expands the first two studies in three ways. First, Study 3 replicates the findings of Study 1 and Study 2 by moving into a real medical crowdfunding environment. The results from a real-world investigation have stronger external validity because data from representative samples of the general population can be collected. Second, we directly measure donation behavior rather than the willingness to donate. Finally, we complement the previous study by measuring information quality in three sub-dimensions (i.e., the text length, number of images, and number of health-related words) rather than measuring as one factor.

4.5.2. Data collection

Study 3 took Qingsongchou as the data source. Considering that the medical crowdfunding projects are not publicly listed on the

Table 4
ANOVA test results of Study 2.

Source	Dependent variable	Type III sum of squares	df	Mean square	*F*	P-value
Corrected model	*Trustworthiness*	25.317	3	8.439	8.399	0.000
	Willingness to donate	33.127	3	11.042	12.476	0.000
Information quality	*Trustworthiness*	17.337	1	17.337	17.254	0.000
	Willingness to donate	9.990	1	9.990	11.286	0.001
Massage framing order	*Trustworthiness*	0.677	1	0.677	0.674	0.413
	Willingness to donate	0.066	1	0.066	0.074	0.786
Information quality * message framing order	*Trustworthiness*	7.885	1	7.885	7.847	0.006
	Willingness to donate	23.748	1	23.748	26.830	0.000
Error	*Trustworthiness*	119.574	119	1.005		
	Willingness to donate	105.327	119	0.885		

Qingsongchou's website, obtaining the project information directly from its website is difficult. Nevertheless, the crowdfunding project initiators mainly seek help by posting project links to social media (e.g., WeChat and Weibo) for others to view the project. WeChat mainly utilizes the acquaintance communication circle, with a problem of selection bias, whereas Weibo covers users of diverse ages, regions, and interpersonal relationships. Hence, this study chooses Qingsongchou projects through Weibo. First, we searched on Weibo for topic links with the theme of "Qingsongchou," obtained the project information of Qingsongchou in each topic link, eliminated non-Qingsongchou and duplicate projects, and finally acquired 1645 data. The entire data crawling process was carried out from July 30 to August 2, 2019. We manually check the crowdfunding project for missing content, and if values are missing, we will visit the project link and supplement the missing value. Appendix B lists some screenshots of a Qingsongchou medical crowdfunding project.

4.5.3. Variables and research model

Study 3 adopted variables from Study 1 and Study 2 to verify their findings. However, we have only replaced some of the variables due to the limitations of the crawled data.

Dependent Variable The first two studies used willingness to donate as the dependent variable, and Study 3 used the raised amount of donation to represent the evaluation of donation behavior.

Rational Appeal In the first two studies, information quality was manipulated as a whole and used as a variable for rational appeal. In this study, we measure information quality in three sub-dimensions (i.e., the text length, number of images, and number of health-related words). The text length and number of images of charitable appeal can be obtained directly from the medical crowdfunding project description. The scores of health-related words can be measured by Linguistic Inquiry and Word Count (LIWC) software. This tool has been widely used in psychology, linguistics, and computer-mediated communication (Sosik & Bazarov, 2014; Tausczik & Pennebaker, 2010). Furthermore, its reliability and effectiveness have been verified by extensive studies (Pennebaker & Francis, 1996; Yin, Bond, & Zhang, 2014). We analyze health-related word frequencies in the charitable appeal by using the LIWC dictionary. The linguistic category of health in the LIWC software is chosen to measure the scores of health-related words.

Emotional Appeal In the first two studies, message framing was adopted for emotional appeal. Study 3 introduced a new construct for emotional appeal, that is emotional type (positive/negative emotion), because measuring gain and loss frames in the Qingsongchou medical crowdfunding project is difficult. The positive and negative emotions have been proved to affect the perception of message receivers, thereby affecting their information decision (Chua, Tee, Pang, & Lim, 2016; Garcia, Garas, & Schweitzer, 2014). Negative emotions contained in the charitable appeal may trigger donors' sympathy and promote donation, whereas positive emotions reflect the optimism of initiators and may encourage donors to give hope. The linguistic categories of positive and negative emotions in the LIWC software are chosen to measure the scores of positive and negative emotions.

Control Variables Other variables can affect the raised amount and were used as control variables, which are target amount, title length, number of real-name certification, project progress information update, and fund usage information update. In the medical crowdfunding project, high target amounts mean that project initiators may face serious difficulties. Donors will be inclined to sympathize with them and make large donations. On the contrary, the small target amount that is easier to achieve often sends a signal to potential donors that other donors can help the project initiator, resulting in generating the psychology of responsibility diffusion, that is, "even if I don't donate, there will be others to help them." This bystander effect often occurs in non-emergency situations (Latané & Nida, 1981). Hence, donors are willing to support projects with high target amounts. The project title is another variable influencing raised amount because it summarizes the most critical information of the project and will initially attract the attention of potential donors. A long title will provide detailed evidence, which is conducive to understand the text easily. The number of real-name certification refers to the number of real-name users who verify the authenticity of the project. The project progress information update indicates how frequently the crowdfunding project initiator will update information about the patient's treatment and fundraising

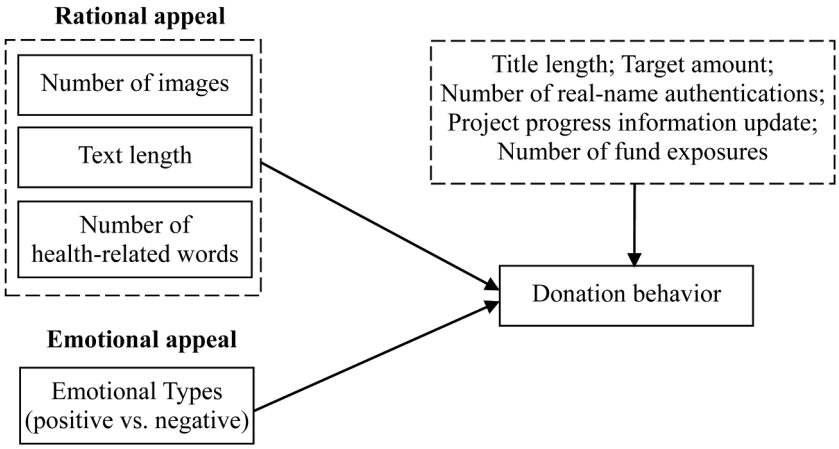


Fig. 2. Research model of Study 3.

status. The fund usage information update indicates how frequently the crowdfunding project initiator will update information about the use of funds. Initiators update the status and use of donations in a timely manner, which can increase the credibility of the project, thereby increasing the donation amount.

Fig. 2 shows the research model for Study 3.

4.5.4. Data analysis

We used LIWC 2015 and the default simplified Chinese dictionary to analyze the text of medical crowdfunding charitable appeal. Before using LIWC 2015 to analyze charitable appeal, we used Python to split the Chinese text and used the stop words list of Harbin Institute of Technology to filter stop words. Next, we imported the segmented text into LIWC 2015 and computed the score of health-related words, positive emotion, and negative emotion. Finally, we checked whether these words appear in the charitable appeal.

The target amount, raised amount, number of images, number of real-name authentications, project progress information update, and fund usage information updates can be directly obtained through data crawling. We used Excel to count the title length and text length of each charitable appeal. Table 5 shows the descriptive statistics of relevant variables.

The standard deviation of the target amount, raised amount, text length, and number of real-name certification is relatively large. Therefore, these four variables are logarithmically processed. Moreover, we run three different models to identify the effect of research variables. Model 1 includes the control variables only, and Model 2 considers the rational appeals (i.e., text length, number of images, and number of health-related words). Model 3 adds emotional appeal and explores how rational and emotional appeals influence donation behavior simultaneously.

Model 1 (Controls only model)0

$$ln(R\_amount+1) = \beta_0 + \beta_1 ln(Target+1) + \beta_2 ln(Title\_length) + \beta_3 Pro\_inf + \beta_4 Fund\_usage + \beta_5 ln(Num\_aut+1) + \epsilon$$

Model 2 (Presence of rational appeal)

$$\begin{aligned} ln(R\_amount+1) =& \beta_0 + \beta_1 ln(Target+1) + \beta_2 ln(Title\_length) + \beta_3 Pro\_inf + \beta_4 Fund\_usage + \beta_5 ln(Num\_aut+1) \\ &+ \beta_6 ln(Text\_length+1) + \beta_7 Num\_images + \beta_8 Health + \epsilon \end{aligned}$$

Model 3 (Presence of rational and emotional appeal)

$$\begin{aligned} ln(R\_amount+1) =& \beta_0 + \beta_1 ln(Target+1) + \beta_2 ln(Title\_length) + \beta_3 Pro\_inf + \beta_4 Fund\_usage + \beta_5 ln(Num\_aut+1) \\ &+ \beta_6 ln(Text\_length+1) + \beta_7 Num\_images + \beta_8 Health + \beta_9 Pos\_emo + \beta_{10} Neg\_emo + \epsilon \end{aligned}$$

4.5.5. Results of study 3

OLS regression is a statistical technique used for the analysis of the relationship between one or more explanatory variables and a response variable. In order to deal with the possible heteroscedasticity issue, the OLS regression with robust standard error was adopted. STATA14.0 was used for data analysis in Study 3. The regression results are shown in Table 6.

Test of control variables As shown in Table 6, target amount ($\beta = 0.292$, $p < 0.001$), number of real-name authentications ($\beta = 0.600$, $p < 0.001$) and project progress information update ($\beta = 0.011$, $p < 0.010$) significantly and positively affected donation behavior. While fund usage information updates ($\beta = -0.023, p < 0.050$) and title length ($\beta = -0.016, p < 0.001$) had negative impacts on donation behavior (i.e., raised amount).

Test of rational appeal Study 3 further verified the influence of three dimensions of information quality on donation behavior and reached following conclusions. First, text length ($\beta = 0.350, p < 0.001$) and the number of images ($\beta = 0.048, p < 0.001$) significantly facilitated donation behavior. By contrast, number of health-related words ($\beta = -0.027$, $p < 0.010$) exerted a negative effect on donation behavior.

Table 5
Descriptive statistics.

Variables	Min	Max	Mean	SD
Title length (Title_length)	3	44	11.16	5.637
Target amount (Target)	270	1,047,666	202,534.61	160,495.777
Raised amount (R_amount)	0	1,047,666	51,984.78	77,042.839
Text length (Text_length)	16	3797	554.67	356.522
Number of images (Num_images)	0	8	6.34	1.971
Number of real-name authentication (Num_aut)	0	535	53.86	48.129
Project progress information update (Pro_inf)	0	53	5.39	5.168
Fund usage information updates (Fund_usage)	0	60	1.16	2.232
Positive emotion (Pos_emo)	0	22.22	7.3542	2.94018
Negative emotion (Neg_emo)	0	27.59	6.0790	2.89558
Health-related words (Health)	0	16.67	3.3773	1.82797

Table 6
Regression results.

Variables		Model 1		Model 2		Model 3	
		Coefficient	Robust SE	Coefficient	Robust SE	Coefficient	Robust SE
Constant		4.385***	0.380	2.561***	0.462	2.506***	0.458
Control variables	Title_length	−0.012**	0.005	−0.015***	0.005	−0.016***	0.005
	ln(Target +1)	0.317***	0.035	0.295***	0.034	0.292***	0.034
	ln(Num_aut+1)	0.625***	0.059	0.596***	0.057	0.600***	0.057
	Pro_inf	0.012**	0.004	0.010**	0.004	0.011**	0.004
	Fund_usage	−0.033*	0.014	−0.023*	0.009	−0.023*	0.009
Rational appeal	ln(Text_length+1)			0.345***	0.050	0.350***	0.051
	Num_images			0.047***	0.014	0.048***	0.014
	Health			−0.027**	0.010	−0.027**	0.009
Emotional appeal	Pos_emo					0.017	0.010
	Neg_emo					−0.017	0.015
F		79.09		65.39		53.91	
R^2		0.389		0.426		0.428	

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Test of emotional appeal The results of econometric model demonstrated that positive emotion had a marginally significant effect on donation behavior ($\beta = 0.017, p = 0.084$), while negative emotion has no significant effect on donation behavior ($\beta = -0.017, p = 0.246$).

5. Discussion

Based on Aristotle's three modes of persuasion and message framing theory, this study explores the influence factors of medical crowdfunding donation from three aspects: rational, emotional, and credibility appeals. Several key findings can be derived from our three studies.

First, Study 1 demonstrates that high information quality (rational appeal) has a greater positive influence on trustworthiness and willingness to donate than low information quality. Study 2 further verifies this conclusion. This finding is consistent with previous studies in return-based crowdfunding (Allison et al., 2017; Bi et al., 2017). Additionally, results of Study 1 and Study 2 prove that trustworthiness plays a mediating role in the relationship between information quality and willingness to donate.

Second, Study 1 and Study 2 investigated the role of message framing (emotional appeal) in the context of medical crowdfunding. Previous findings on the persuasion effect of message framing are equivocal (Borah & Xiao, 2018; Majumdar & Bose, 2018; Yang, Solgaard, & Ren, 2018). Some scholars have argued that compared with the loss frame, the gain frame is more credible and can better promote users' behavior (Borah & Xiao, 2018; Yang et al., 2018b). On the contrary, other scholars have the opposite view that the loss frame is more persuasive than the gain counterpart (Majumdar & Bose, 2018). Study 1′s findings support the argument that the gain frame is stronger. Therefore, the gain frame can promote more trustworthiness and willingness to donate than the loss frame in the context of medical crowdfunding. Study 2 further explored whether the coexistence and presentation order of the message framing exert different effects. The results of Study 2 indicate that the coexistence of gain and loss frame has no stronger joint effect on willingness to donate than a single-gain frame because two frames with different valences can cause cognitive conflicts.

Finally, a field study (i.e., Study 3) validates some of the findings of the first two studies by measuring rational and emotional appeals in a real medical crowdfunding platform. In Study 3, information quality is further detailed into three sub-dimensions: the text length, number of images, and number of health-related words. Results show that the text length and number of images exert a significant positive effect on donation behavior, which verified conclusions of Study 1 and Study 2 to a certain extent. However, the number of health-related words exerts a negative effect on donation behavior. This finding differs from the findings of Majumdar and Bose (2018) that the presence of factual and money-related words promotes donation behavior on poverty charity platforms. One possible reason can be attributed to the unique characteristics of medical crowdfunding. Medical crowdfunding charity appeals contain a lot of specialized terminology about disease symptoms and pathological etiology, making viewers invest more cognitive efforts to process such specialized information. Therefore, excessive health-related words may cause a cognitive overload of viewers and negatively influence their reading of charitable appeal. We also replace message framing with an emotion attitude. Results indicate that positive emotion has a marginal effect on donation behavior, whereas a negative one has no effect, thereby supporting the positive effects of the gain frame.

6. Implications

6.1. Theoretical implications

This study is characterized by several theoretical implications. First, the present study provides novel insights that contribute to the emerging stream of research on crowdfunding. Prior research has focused on reward-based crowdfunding and has examined the persuasiveness of appeal mainly from a rational perspective (Bi et al., 2017; Wang & Yang, 2019). The present study provides us with a

much more nuanced understanding of the persuasive effects of appeals in the context of medical crowdfunding. By employing Aristotle's three modes of persuasion, we verify that the three appeals of logos (information quality), pathos (message framing), and ethos (trustworthiness) appeals all have significant effects on willingness to donate. Thus, unlike reward-based crowdfunding, which focuses on the rationality of the project, rationality and emotion in medical crowdfunding appeals impact willingness to donate.

Second, this study contributes and extends Aristotle's three modes of persuasion by investigating the relationship between logos, pathos, and ethos. Several previous studies have used Aristotle's three modes of persuasion to investigate the persuasive issues in different contexts, but these studies have rarely considered the relationship of these three components (Han, Shin, Chung, & Koo, 2019; Yang, Lee, Lee, & Koo, 2018a). We empirically demonstrate the significant mediating effect of credibility appeal (ethos) on the relationships between information quality (logos) and willingness to donate. This finding indicates that logos work through ethos in the context of medical crowdfunding.

Third, this study contributes to message framing literature by investigating the effects of gain and loss frames on trustworthiness and willingness to donate. Previous findings on the persuasive effect of gain and loss frames are equivocal (Chang & Lee, 2009; Chou & Murnighan, 2013; Reinhart et al., 2007; Borah & Xiao, 2018). Our findings support previous studies, which reported that the gain frame has more significant effects on trustworthiness and willingness to donate than the loss frame (Borah & Xiao, 2018; Reinhart et al., 2007). Furthermore, the coexistence of gain and loss frames has a negligible effect on willingness to donate than a single gain frame in the medical crowdfunding context. This study deepens our understanding that the impact of message framing may vary across contexts.

Finally, this study digs deeply into the characteristics of logos and pathos and how they influence donation behavior. Previous studies have explored several content characteristics of logos. For example, the text length and the number of factual and money-related words have positively influenced donation behavior (Bi et al., 2017; Larrimore et al., 2011; Majumdar & Bose, 2018). The current study differentiates three content characteristics related to logos (i.e., text length, number of images, and number of health-related words) and found the positive effects of text length and number of images on donation behavior. However, this study demonstrates the negative impact of the number of health-related words on donation behavior. We also explore the role of pathos and found that positive emotions expressed in charitable appeals positively influence donation behavior, which was not observed in the studies of other contexts.

6.2. *Practical implications*

Numerous medical crowdfunding projects on the Internet make appeals for donations to potential donors. This study has important insights into the role of charity appeal in increasing the likelihood of obtaining a donation for medical bills. We illustrate how medical crowdfunding project initiators can make their charitable appeal highly persuasive from three modes of persuasion (i.e., logos, pathos, and ethos). First, project initiators need to understand the importance of project information features. Second, they can improve the quality and richness of information by elaborating on their illnesses and financial difficulties and providing several proof images. However, this study concludes that number of health-related words exerts a significant negative effect on the donation amount. Excessive specialized medical terminologies can create a cognitive load on potential donors and thus affect their reading of charitable appeals. Thus, the number of health-related words in the appeal should be appropriate to avoid such problems. Second, the findings suggest that positively framed appeals in medical crowdfunding lead to trustworthiness and willingness to donate than negatively framed ones. Therefore, project initiators can choose appropriate message framing strategies and describe the positive outcomes to the beneficiaries to attract the attention and donations of others. Third, project initiators need to provide more evidence to increase the credibility of their medical crowdfunding projects. For example, they can use documents from hospitals and banks to show their actual medical expenses.

This study also has some implications for operators of medical crowdfunding platforms. First, medical crowdfunding platform operators should develop more features that contribute to the information richness of their websites, such as offering a more comprehensive range of information categories and the function to upload images and videos. They also could encourage beneficiaries to describe the project description in detail to reduce the information asymmetry between beneficiaries and potential donors. Second, some beneficiaries may exaggerate the severity of their illnesses and the costs of their treatment, leading to questionable credibility of certain projects. Therefore, medical crowdfunding platforms should pay additional attention to verifying the identity of the beneficiaries and the authenticity of the projects. Third, platform operators can create an atmosphere that promotes the positive attitudes and altruism of philanthropy.

7. Limitations and further research

This study still has some limitations. First, the two experiments of this study are conducted in China, and the empirical evidence of the field study is also from a Chinese medical crowdfunding platform. Our findings may not be generalizable to other countries and platforms. Future research could collect data from several countries and types of platforms to test the model. Second, we measured the information quality of the charitable appeal using only the text length, the number of images, and the number of health-related words. Other content-related features can be considered in future research, such as linguistic style. Third, this study simply divides emotional type into positive and negative emotions. In the future, we can further refine the types of emotions. For example, negative emotions including anger, anxiety, sadness, and so on may have different effects on donation behavior. Fourth, this study has not explored whether there are moderating variables that influence the effects of message quality and message framing on willingness to donate. Thus, the possible moderating variables must be explored in future studies to reveal the boundary conditions for applying Aristotle's

three modes of persuasion. Fifth, this study examined only two rational and emotional appeals, namely, information quality and message framing. Future research could explore more rational and emotional features medical crowdfunding charitable appeals.

Author statement

No conflict of interest exits in the submission of this manuscript. We would like to declare that the work described was original research that has not been published previously, and not under consideration for publication elsewhere, in whole or in part.

CRediT authorship contribution statement

You Wu: Conceptualization, Methodology, Data curation, Writing – original draft. **Xing Zhang:** Conceptualization, Methodology, Funding acquisition, Writing – review & editing. **Quan Xiao:** Software, Funding acquisition, Writing – review & editing.

Acknowledgements

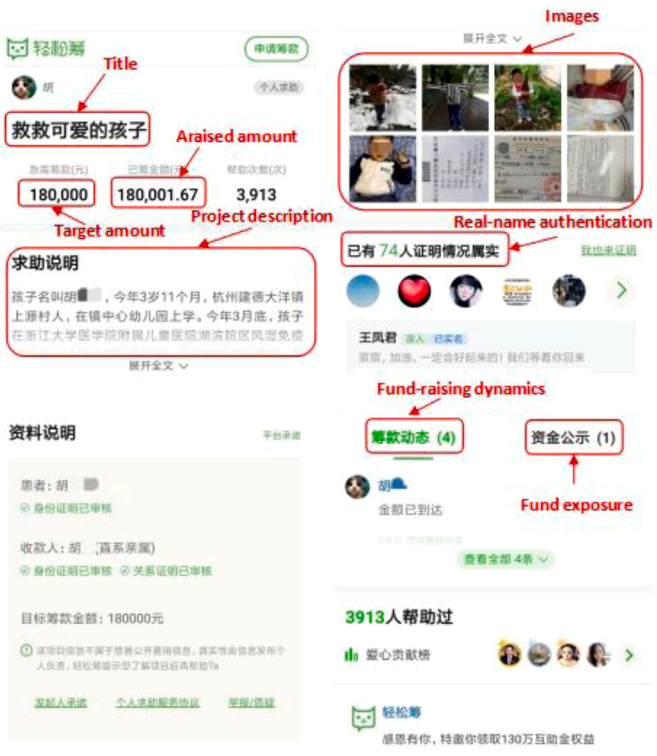
This work was supported by the National Natural Science Foundation (NSFC) Programs of China [71974152 and 71861014].

Appendix A. Scenario Design (examples).

High information quality×gain frame

Low information quality×loss frame

Appendix B. Screenshots of a Qingsongchou project.



References

Agrawal, A., Catalini, C., & Goldfarb, A. (2015). Crowdfunding: Geography, social networks, and the timing of investment decisions. *Journal of Economics & Management Strategy, 24*(2), 253–274.

Ahlers, G. K., Cumming, D., Günther, C., & Schweizer, D. (2015). Signaling in equity crowdfunding. *Entrepreneurship Theory and Practice, 39*(4), 955–980.

Aizenman, N. (2017). Health Care Costs Push A Staggering Number Of People Into Extreme Poverty. Retrieved Feb 20, 2021 from https://www.npr.org/sections/goatsandsoda/2017/12/14/569893722/hea_lth-care-costs-push-a-staggering-number-of-people-into-extreme-poverty.

Aknin, L. B., Van de Vondervoort, J. W., & Hamlin, J. K. (2018). Positive feelings reward and promote prosocial behavior. *Current Opinion in Psychology, 20*, 55–59.

Alkhirbash, A. (2016). A proposed framework for analysing Aristotle's three modes of persuasion. *International Journal of English and Education, 5*(4), 111–117.

Allison, T. H., Davis, B. C., Webb, J. W., & Short, J. C. (2017). Persuasion in crowdfunding: An elaboration likelihood model of crowdfunding performance. *Journal of Business Venturing, 32*(6), 707–725.

Appel, M., & Mara, M. (2013). The persuasive influence of a fictional character's trustworthiness. *Journal of Communication, 63*(5), 912–932.

Ba, Z. H., Zhao, Y. X., Song, S. J., & Zhu, Q. H. (2021). Understanding the determinants of online medical crowdfunding project success in China. *Information Processing & Management, 58*(2), Article 102465.

Ba, Z. H., Zhao, Y. X., Zhou, L. Q., & Song, S. J. (2020). Exploring the donation allocation of online charitable crowdfunding based on topical and spatial analysis: Evidence from the Tencent GongYi. *Information Processing & Management, 57*(62), Article 102322.

Baddeley, A. D., & Hitch, G. (1974). Working memory. *The psychology of learning and motivation* (pp. 47–89). New York: Academic Press.

Baek, T. H., & Reid, L. N. (2013). The interplay of mood and regulatory focus in influencing altruistic behavior. *Psychology & Marketing, 30*(8), 635–646.

Bagheri, A., Chitsazan, H., & Ebrahimi, A. (2019). Crowdfunding motivations: A focus on donors' perspectives. *Technological Forecasting and Social Change, 146*, 218–232.

Beres, D. (2018). 42% of new cancer patients lose their life savings. Retrieved Dec 20, 2020, from https://bigthink.com/health/how-much-does-cancer-cost/.

Bi, S., Liu, Z., & Usman, K. (2017). The influence of online information on investing decisions of reward-based crowdfunding. *Journal of Business Research, 71*, 10–18.

Borah, P., & Xiao, X. (2018). The importance of 'likes': The interplay of message framing, source, and social endorsement on credibility perceptions of health information on Facebook. *Journal of Health Communication, 23*(4), 399–411.

Buda, R., & Zhang, Y. (2000). Consumer product evaluation: The interactive effect of message framing, presentation order, and source credibility. *Journal of Product & Brand Management, 9*(4), 229–242.

Burtch, G., & Chan, J. (2019). Investigating the relationship between medical crowdfunding and personal bankruptcy in the united states: Evidence of a digital divide. *Management Information Systems Quarterly, 43*(1), 237–262.

Chakraborty, U. (2019). Perceived credibility of online hotel reviews and its impact on hotel booking intentions. *International Journal of Contemporary Hospitality Management, 31*(9), 3465–3483.

Chang, C. T., & Lee, Y. K. (2009). Framing charity advertising: influences of message framing, image valence, and temporal framing on a charitable appeal 1. *Journal of Applied Social Psychology, 39*(12), 2910–2935.

Cheng, Y. H., & Ho, H. Y. (2015). Social influence's impact on reader perceptions of online reviews. *Journal of Business Research, 68*(4), 883–887.

Chien, Y. H., & Chang, W. T. (2015). Effects of message framing and exemplars on promoting organ donation. *Psychological Reports, 117*(3), 692–702.

Chou, E. Y., & Murnighan, J. K. (2013). Life or death decisions: Framing the call for help. *PloS one, 8*(3), Article e57351.
Chua, A. Y., Tee, C. Y., Pang, A., & Lim, E. P. (2016). The retransmission of rumor-related tweets: Characteristics of source and message. In *Proceedings of the 7th 2016 International Conference on Social Media & Society* (pp. 1–10).
Cockcroft, R., & Cockcroft, S. (2005). *Persuading people: An introduction to rhetoric*. New York: Palgrave Macmillan.
Duncan, B. (2004). A theory of impact philanthropy. *Journal of Public Economics, 88*(9–10), 2159–2180.
Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.
Garcia, D., Garas, A., & Schweitzer, F. (2014). *Modeling collective emotions in online social systems. collective emotions* (pp. 389–406). Oxford: Oxford University Press.
Goldthorpe, J. H. (1998). Rational action theory for sociology. *British Journal of Sociology, 49*(2), 167–192.
Greenwood, M. (2016). Approving or improving research ethics in management journals. *Journal of Business Ethics, 137*(3), 507–520.
Han, H., Shin, S., Chung, N., & Koo, C. (2019). Which appeals (ethos, pathos, logos) are the most important for Airbnb users to booking? *International Journal of Contemporary Hospitality Management, 31*(3), 1205–1223.
Haugtvedt, C. P., & Wegener, D. T. (1994). Message order effects in persuasion: An attitude strength perspective. *Journal of Consumer Research, 21*(1), 205–218.
Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis. *Journal of Educational Measurement, 51*(3), 335–337.
Hogarth, R. M., & Einhorn, H. J. (1992). Order effects in belief updating: The belief-adjustment model. *Cognitive Psychology, 24*(1), 1–55.
Huang, A. H., Chen, K., Yen, D. C., & Tran, T. P. (2015). A study of factors that contribute to online review helpfulness. *Computers in Human Behavior, 48*, 17–27.
Jin, X. L., Yin, M., Zhou, Z., & Yu, X. (2021). The differential effects of trusting beliefs on social media users' willingness to adopt and share health knowledge. *Information Processing & Management, 58*(1), Article 102413.
Karimi, S., & Wang, F. (2017). Online review helpfulness: Impact of reviewer profile image. *Decision Support Systems, 96*, 39–48.
Kelton, K., Fleischmann, K. R., & Wallace, W. A. (2008). Trust in digital information. *Journal of the American Society for Information Science and Technology, 59*(3), 363–374.
Kim, T., Por, M. H., & Yang, S. B. (2017). Winning the crowd in online fundraising platforms: The roles of founder and project features. *Electronic Commerce Research and Applications, 25*, 86–94.
Kjeldskov, J., & Graham, C. (2003). A review of mobile HCI research methods. In *Proceedings of Mobile HCI 2003* (pp. 317–335). Berlin, Germany: Springer-Verlag.
Klobas, J. E. (1995). Beyond information quality: Fitness for purpose and electronic information resource use. *Journal of Information Science, 21*(2), 95–114.
Larrimore, L., Jiang, L., Larrimore, J., Markowitz, D., & Gorski, S. (2011). Peer to peer lending: The relationship between language features, trustworthiness, and persuasion success. *Journal of Applied Communication Research, 39*(1), 19–37.
Latané, B., & Nida, S. (1981). Ten years of research on group size and helping. *Psychological Bulletin, 89*(2), 308–324.
Li, M., Kankanhalli, A., & Kim, S. H. (2016). Which ideas are more likely to be implemented in online user innovation communities? An empirical analysis. *Decision Support Systems, 84*, 28–40.
Liang, T. P., Wu, S. P. J., & Huang, C. C. (2019). Why funders invest in crowdfunding projects: Role of trust from the dual-process perspective. *Information & Management, 56*(1), 70–84.
Lindauer, M., Mayorga, M., Greene, J. D., Slovic, P., Västfjäll, D., & Singer, P. (2020). Comparing the effect of rational and emotional appeals on donation behavior. *Judgment and Decision Making, 15*(3), 413–420.
Liu, L., Suh, A., & Wagner, C. (2018). Empathy or perceived credibility? An empirical study on individual donation behavior in charitable crowdfunding. *Internet Research, 28*(3), 623–651.
López, M., & Sicilia, M. (2014). eWOM as source of influence: The impact of participation in eWOM and perceived source trustworthiness on decision making. *Journal of Interactive Advertising, 14*(2), 86–97.
Lucassen, T., & Schraagen, J. M. (2010). Trust in wikipedia: How users trust information from an unknown source. In *Proceedings of the Fourth Workshop on Information Credibility (WICOW '10)* (pp. 19–26). New York: ACM Press.
Lucassen, T., & Schraagen, J. M. (2011). Factual accuracy and trust in information: The role of expertise. *Journal of the American Society for Information Science and Technology, 62*(7), 1232–1242.
Majumdar, A., & Bose, I. (2018). My words for your pizza: An analysis of persuasive narratives in online crowdfunding. *Information & Management, 55*(6), 781–794.
Makri, S., Blandford, A., & Cox, A. L. (2011). This is what I'm doing and why: Methodological reflections on a naturalistic think-aloud study of interactive information behaviour. *Information Processing & Management, 47*(3), 336–348.
Meirick, P. C., & Nisbett, G. S. (2011). I approve this message: Effects of sponsorship, ad tone, and reactance in 2008 presidential advertising. *Mass Communication and Society, 14*(5), 666–689.
Mollick, E. (2014). The dynamics of crowdfunding: An exploratory study. *Journal of Business Venturing, 29*(1), 1–16.
Mou, J., & Benyoucef, M. (2021). Consumer behavior in social commerce: Results from a meta-analysis. *Technological Forecasting and Social Change, 167*, Article 120734.
Nunally, J. C. (1978). *Psychometric theory*. New York, NY: McGraw-Hill (2 e edition.
Pan, L. Y., & Chiou, J. S. (2011). How much can you trust online information? Cues for perceived trustworthiness of consumer-generated online information. *Journal of Interactive Marketing, 25*(2), 67–74.
Pennebaker, J. W., & Francis, M. E. (1996). Cognitive, emotional, and language processes in disclosure. *Cognition & Emotion, 10*(6), 601–626.
Pornpitakpan, C. (2004). The persuasiveness of source credibility: A critical review of five decades' evidence. *Journal of Applied Social Psychology, 34*, 243–281.
Rand, D., Greene, J., & Nowak, M. (2012). Spontaneous giving and calculated greed. *Nature, 489*, 427–430.
Reimer, T., & Benkenstein, M. (2016). When good WOM hurts and bad WOM gains: The effect of untrustworthy online reviews. *Journal of Business Research, 69*(12), 5993–6001.
Reinhart, A. M., Marshall, H. M., Feeley, T. H., & Tutzauer, F. (2007). The persuasive effects of message framing in organ donation: The mediating role of psychological reactance. *Communication Monographs, 74*(2), 229–255.
Sargeant, A., & Woodliffe, L. (2007). Gift giving: An interdisciplinary review. *International Journal of Nonprofit and Voluntary Sector Marketing, 12*(4), 275–307.
Seo, B. G., & Park, D. H. (2019). The effect of message framing on security behavior in online services: Focusing on the shift of time orientation via psychological ownership. *Computers in Human Behavior, 93*, 357–369.
Shi, X., Zheng, X., & Yang, F. (2020). Exploring payment behavior for live courses in social Q&A communities: An information foraging perspective. *Information Processing & Management, 57*(4), Article 10224.
Smith, D., Menon, S., & Sivakumar, K. (2005). Online peer and editorial recommendations, trust, and choice in virtual markets. *Journal of Interactive Marketing, 19*(3), 15–37.
Snyder, J., Crooks, V. A., Mathers, A., & Chow-White, P. (2017). Appealing to the crowd: Ethical justifications in Canadian medical crowdfunding campaigns. *Journal of Medical Ethics, 43*(6), 364–367.
Sosik, V. S., & Bazarova, N. N. (2014). Relational maintenance on social network sites: How Facebook communication predicts relational escalation. *Computers in Human Behavior, 35*, 124–131.
Strausz, R. (2017). A Theory of Crowdfunding: A Mechanism Design Approachwith Demand Uncertainty and Moral Hazard. *American Economic Review, 107*(6), 1430–1476.
Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology, 29*(1), 24–54.
Tugrul, T. O., & Lee, E. M. (2018). Promoting charitable donation campaigns on social media. *The Service Industries Journal, 38*(3–4), 149–163.
Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science (New York, N.Y.), 211*(4481), 453–458.
Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly, 37*(1), 21–54.

Wang, X., & Wang, L. (2018). What makes charitable crowdfunding projects successful: A research based on data mining and social capital theory. In *International Conference on Parallel and Distributed Computing: Applications and Technologies* (pp. 250–260). Singapore: Springer.
Wang, Z. P., & Yang, X. (2019). Understanding backers' funding intention in reward crowdfunding: An elaboration likelihood perspective. *Technology in Society, 58*, Article 101149.
Xiao, Q. (2021). Understanding the asymmetric perceptions of smartphone security from security feature perspective: a comparative study. *Telematics and Informatics, 58*, Article 101535.
Yang, S. B., Lee, H., Lee, K., & Koo, C. (2018a). The application of aristotle's rhetorical theory to the sharing economy: An empirical study of airbnb. *Journal of Travel & Tourism Marketing*, 1–20.
Yang, Y., Solgaard, H. S., & Ren, J. (2018b). Does positive framing matter? An investigation of how framing affects consumers' willingness to buy green electricity in Denmark. *Energy Research & Social Science, 46*, 40–47.
Yi, M. Y., Yoon, J. J., Davis, J. M., & Lee, T. (2013). Untangling the antecedents of initial trust in web-based health information: The roles of argument quality, source expertise, and user perceptions of information quality and risk. *Decision Support Systems, 55*(1), 284–295.
Yin, C. X., & Zhang, X. F. (2020). Incorporating message format into user evaluation of microblog information credibility: A nonlinear perspective. *Information Processing & Management, 57*, Article 102345.
Yin, D., Bond, S. D., & Zhang, H. (2014). Anxious or angry? Effects of discrete emotions on the perceived helpfulness of online reviews. *MIS Quarterly, 38*(2), 539–560.
Zhang, D., & Adipat, B. (2005). Challenges, methodologies, and issues in the usability testing of mobile applications. *International Journal of Human-Computer Interaction, 18*(3), 293–308.
Zhang, X., Hu, W., & Xiao, Q. (2021). Influences of medical crowdfunding website design features on trust and intention to donate: Controlled laboratory experiment. *Journal of medical Internet research, 23*(5), Article e25554.
Zhang, X., Liu, S., Chen, X., Wang, L., Gao, B., & Zhu, Q. (2018). Health information privacy concerns, antecedents, and information disclosure intention in online health communities. *Information & Management, 55*(4), 482–493.
Zheng, H., Li, D., Wu, J., & Xu, Y. (2014). The role of multidimensional social capital in crowdfunding: A comparative study in China and US. *Information & Management, 51*(4), 488–496.
Zhong, Z. J., & Lin, S. (2018). The antecedents and consequences of charitable donation heterogeneity on social media. *International Journal of Nonprofit and Voluntary Sector Marketing, 23*(1), Article e1585.