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Modelling users' trust in online health rumours: an experiment-based study in China

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Introduction. With the increasing availability of information on the Internet, online rumours have become prevalent, and it is not uncommon for search engines to return unverified rumours about health. However, false information in such domains may lead to serious consequences if it gains users' trust. An understanding of the characteristics of online health rumours that users' trust is important for fighting their spread.
Method. Using real-world online health rumour data from a Chinese database, the authors investigated the predictors of users' trust in online health rumours. An experiment (n = 30) and interviews (n = 10) were conducted to examine how users evaluate particular types of health rumours.
Analysis. The effects of rumours' manner of presentation and the perceived information quality on users' trust were tested using ANOVA (with SPSS software) for the quantitative data collected in the experiment. The qualitative component applied content analysis of the interview data to further explain the results produced by the quantitative analysis.
Results. The impact of pictures (one dimension of rumour presentation) on users' trust varies, depending on the perceived quality of the pictures displayed with the online health rumours, and informativeness (a dimension of information quality) is an influential predictor of trusting beliefs.
Conclusions. The paper serves the aim of highly effective prediction of users' trust in online health rumours, and it contributes new insights for proactively evaluating the hazard level of a particular online health-rumour item.

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Introduction

With its great popularity, the Internet has become an important resource for users seeking health-related information (Kim et al, 2011). For instance, Fox and Duggan (2013) reported that 59% of adults in the USA have sought health information online at some point, and 50.5% of UK breast cancer patients are reported to have searched for health information on the Internet in 2011

(Littlechild and Barr, 2013). Only a few years later, the China Internet Network Information Centre (2016) indicated that 22.1% of all Chinese Internet users had done so. Caregivers, patients, and survivors of diseases often rely on online resources for strategies, whether to inform self-diagnosis, treatment, or coping with illness (Walther et al., 2005). Importantly, online health information from non-medical sources is a crucial driver of patient-clinician information engagement (Moldovanjohnson et al., 2014).

Given that the Internet provides an environment in which people may post information freely, some of the statements can be exaggerated, misleading, or outright fabricated (Pearson, 2003). In addition, there are users who publish or spread rumours online, even if not originating them (Osterholm, 2000). Online rumours can be defined as online information for which reliable evidence is absent as it gets circulated among online communities (Zhang et al., 2015; Liu, 2014). Owing to a relative lack of quality control, information posted online has been reported to be less reliable than that in printed resources such as journals and magazines (Zhang et al., 2015), yet online rumours are often attractive because they provide a new perspective for addressing potential health problems, and they can have a strong appeal and be widely disseminated. Online health rumours can lead to decisions that may endanger the health of information-seekers or others (Zhang et al., 2015; Liu, 2014). This issue is rendered especially pressing by the fact that many health phenomena or problems have only recently emerged: it is often difficult to determine whether particular online health information is mere rumour. Therefore, individuals may well disseminate a rumour online without detecting that it is only rumour (Oravec, 2000; 2001).

For the reasons cited above, rumours' dissemination online is difficult to control and represents an emerging problem for society (Zhang et al., 2015; Liu, 2014). The Internet facilitates real-time information exchange among its users, increasing dissemination speeds to many times those of traditional print and broadcast media. Given the proliferation of online rumours and the attendant concerns, it is important to explore why people trust online rumours. Providing users with knowledge of how online rumours spread should help people proactively evaluate the likelihood of any given online information's falsity. For instance, when attention is drawn to the most dangerous rumours, it should be possible to curb their dissemination before they spread widely. We carried out work to examine, specifically, how particular characteristics of online health rumours affect users' trust in these rumours. On the basis of previous studies, we considered two sets of factors that may predict users' trust in online health rumours: perceived information quality (comprehensiveness, readability, and informativeness) and how the rumour is presented (with pictures, verification of the poster's identity, and/or inclusion of hyperlinks).

We begin the discussion below with a literature review that presents the factors influencing users' trust in online rumours. This is followed by description of the conceptual framework employed, after which the research methods are presented. Within the context thus provided, the results of our data analysis are discussed, and the paper concludes with discussion of the implications and highlights of both the limitations of our research and future directions.

The literature and research hypotheses

Factors in users' trust of online rumours

Trust has an important influence on individuals' decisions and behaviour in the digital era. Scholars have conceptualized trust in several ways. From a general perspective, the concept refers to a willingness to place one's faith in or be vulnerable to the actions of another party (Mayer et al., 1995). There are a set of specific beliefs or dimensions involved, such as integrity, competence, and

reliability (Gefen et al., 2003). As for users' trust in online information in particular, among the factors emphasised as affecting it are the perceived information quality, the source of information, and the channels used (Cheung and Thadani, 2012). In turn, one's level of trust in online information has been found to affect personal purchasing decisions in various research contexts, such as hotel bookings and choice of travel destination (Sparks and Browning, 2011; Abubakar and Ilkan, 2016). Moreover, trust has been found to mediate the effect of personality traits on information-sharing behaviour in a social media context (Deng et al., 2017).

On the Internet, health information usually spreads through online health communities. Here and beyond, the mechanism of online rumours' dissemination is similar to network viruses' (Kwon and Cha, 2014). Specifically, users infected by online rumours may well disseminate them, thereby infecting others in their social networks, because they do not question the authenticity of the rumours. In other words, users who put trust in online health rumours may compound the problem by also spreading them (Liu, 2014). Under information manipulation theory, purveyors of false information may deceive others more readily by increasing the amount of material on the relevant Web page; the rumour looks more trustworthy when additional information is presented (Steven and McCornack, 1992). Therefore, people spreading rumours, whom we will refer to as rumour-mongers, may increase the quantity of information on a Web page to make the rumours there more convincing or present further evidence to support these assertions (Hancock et al., 2005). Prior literature shows that perceptions of a given information source's worthiness of trust, known as trusting beliefs, are affected by various characteristics of online rumours (Chua and Banerjee, 2016; Chua et al., 2016; Zhang et al., 2015).

Researchers have investigated the connections between people's trust in online information and such factors as perceived information usefulness and information quality, although their work often treats trust in online information and information credibility as equivalent (Johnson et al., 2015). Where a distinction is drawn, individuals' evaluations are usually considered to be influenced primarily by perceived credibility rather than by the actual information quality (Lee, 2018), and indeed perceived credibility has been identified as an important factor related to online health information's quality. In the work of Yeap et al. (2014), 'information quality' refers not to trustworthiness but to reinforcement of the content embedded in messages, such that the information seems to offer value to other users. Information quality is closely related to the perceived comprehensiveness, informativeness, readability, interpretability, accuracy, and relevance of the information (Nicolaou and McKnight, 2006). Johnson et al. (2015) have suggested that both content and style may affect the perceived credibility and usefulness of information, which, in turn, influence trusting beliefs. For health information specifically, Corritore et al. (2012) found that trust in information can be explained by user perceptions as to credibility, ease of use, and risk, and Harris and colleagues (2011) developed and tested a predictive model of trust in online health information that features credible design, high information quality, impartiality, and personalization as the antecedents to trust. Cunningham et al. (2016) found that perceived credibility and usefulness of online information seem to influence people's trust in that information, which, in turn, determines their intentions to use the information.

The literature indicates that, in addition, the manner of presentation of online rumours affects users' level of trust in them. Chua et al. (2016) noted a significant connection of the sentiment expressed with the rumours, the presence of pictures, and the amount of text with users' corresponding trusting beliefs. For instance, individuals may trust online rumours if there is more text and if pictures are present with that text (Zhou et al., 2004). Zhang et al. (2015) have reported that rumours are more likely to be considered true when the material contains elements such as

hyperlinks, pointers to sources, and numbers, whereas reality demonstrates that information presented with pictures and with longer statements (including long headlines) is actually more likely to be false. However, there is still little knowledge of how the presentation and information-quality elements of online rumours affect people's trust in the rumours (Cunningham and Johnson, 2016; Johnson et al., 2015; Rowley et al., 2015). Research into users' trust in these rumours has employed primarily quantitative methods, accordingly there have been calls for studies that afford in-depth insights into users' trust in online health rumours via a synthesis of qualitative and quantitative research methods aimed at nuanced explanation of the complex phenomena involved (Rowley et al., 2015).

To address this research gap, we modelled users' trust in online rumours by considering two core aspects of rumours: their presentation and information quality. After developing the model, we tested it empirically in the context of online health rumours, specifically as encountered in microblogging. For purposes of this study, rumour presentation refers to the format of the presentation of rumours in an online multimedia environment (Xie, 2011). In light of the research findings of Zhang et al. (2015), we proposed that rumour presentation can be captured in terms of hyperlinks, verification of who posted the information, and pictures. We adopted a definition of information quality consistent with the work of Yeap et al. (2014), considering it in terms of reinforcement of the content embedded in the items. Our key premise here was that three concepts, comprehensiveness, informativeness, and readability of the information together capture the information quality of online rumours (Banerjee and Chua, 2014; Berland et al., 2001; Doll and Torkzadeh, 1988; Eysenbach et al., 2002; Ferster and Hu, 2017; Grewal and Alagaratnam, 2013; Lee and Hong, 2016; Sordi et al., 2014; Seidman et al., 2003; Walsh and Volsko, 2008). The definitions of the concepts used in the study are presented below (See Table 1).

Table 1: The main concepts in the research

Concept	**Definition**	**Reference**
Comprehensiveness	The extent to which the information content of a microblog item shows sufficient breadth and depth.	Yeap et al. (2014)
Readability	The extent to which a given microblog item seems easy to understand.	Chua and Banerjee (2016)
Informativeness	The extent to which a given microblog item provides users with necessary information.	Ducoffe (1966)
Trust	Users' willingness to believe the information provided by a microblog item.	Mayer et al. (1995)
Rumour presentation	The format in which rumours are displayed in a multimedia environment	Xie (2011)
Information quality	The amount of information-related strengthening of the content embedded in a microblog item.	Yeap et al. (2014)

The impact of the manner of presentation on users' trust

How information is presented is an important factor in trusting beliefs (Corritore et al., 2012). Online rumour can be presented in numerous forms; for example by SMS or in plain text; in a video; and/or accompanied by details such as the poster's profile photo or level of membership in the relevant forum, the time of posting, and the quantity of upvotes,sharing and responses (Chua and Banerjee, 2016; Chua et al., 2016; Cunningham and Johnson, 2016; Corritore et al., 2012; Harris et al., 2011; Johnson et al., 2015; Zhou et al., 2004; Zhang et al., 2015). In our study design, the presentation of a rumour is measured by the following indicators: i) whether or not the rumour-monger is a verified user within the community in question, ii) whether or not the rumour is accompanied by a hyperlink, and iii) whether or not any pictures are included.

Studies indicate that the manner of a rumour's presentation does influence trusting beliefs. For instance, hyperlinks in an online rumour point users to another Website, for additional information (Kim, 2000). When users are sceptical as to, for instance, whether the event described truly took place, they may use the embedded links to verify the information by checking other sources, even if the original information source may be rumour-based itself. It has beeen found that users trust tweets that contain more hyperlinks, and similar results were obtained for online health rumours in particular: users trusted the ones with hyperlinks (Castillo et al., 2013; Zhang et al., 2015). Indeed, Hargittai et al. (2010) found hyperlinks to be among the most important elements influencing trust formation. Proceeding from the foregoing discussion, we present our first hypothesis:

H1. The presence of hyperlinks in the context of online health rumours has a positive association with users' trust in the online rumours.

Pictures are normally thought to represent reality, because pictures can express what words alone cannot describe (Ball and Smith, 1992). Images may provide convincing proof by attesting to the existence of the posited phenomenon. Users often put faith in clich⁾ such as every picture tells a story, seeing is believing, zcameras don't lie, and a picture is worth a thousand words (Zhang et al., 2015). Several studies have indicated that rumours with pictures are more likely to be trusted than those without (Chua et al., 2016; Zhang et al., 2015). Accordingly, we hypothesized as follows:

H2. The presence of pictures with online health rumours correlates positively with users' trust in the rumours.

In some online social media services, users may choose to verify their identity. This is done by sending personal information to a platform provider, such as Sina Weibo (https://weibo.com/). A company that offers a Twitter-like microblogging service, Sina Weibo estimates its number of active users at more than 300 million (Sina Weibo, 2021). Once this information is connected with the online platform, a symbol is displayed alongside the user profile for differentiation from unverified users. In the case of Sina Weibo, verification for a personal account requires a set of documents including at least two of: proof of employment, a business card, a copy of official identification such as a driver's licence or passport, and evidence of professional certification. Verifying an enterprise account in Sina Weibo involves other documents instead: company registration documents, a letter of application, and a third-party authorization letter. Once the account has been verified by Sina Weibo, the user's profile is considered real. Since numerous studies have provided evidence that the reputation of an information provider, such as a publisher, search engine, or Web site, influences users' trusting beliefs (Cunningham and Johnson, 2016; Johnson et al., 2015), one could expect verified users to be perceived as more trustworthy than unverified ones. It is possible that information posted by the former is more likely to be trusted; the information provider's verification status may have an influence on trust.linked belief in the truth of online health rumours. We posit the following:

H3. Online health rumours posted by verified users are perceived as more trustworthy than those posted by unverified users.

The impact of information quality on users' trust

Information quality is a key precursor to users' trust in information (Bisdikian, 2012; Chopra and Wallace, 2003; Fletcher, 2004; Johnson et al. 2015; Rowley et al., 2015; Nicolaou and McKnight, 2006). Johnson et al. (2015) have noted an influence of information quality on users' judgements of trustworthiness. Furthermore, Chopra and Wallace (2003), who defined users' trust in information as a social attitude, stated that this trust is formed on the basis of the user's assessment of various indicators of information quality. Examining information exchange, Nicolaou and McKnight (2006) have suggested that a relationship exists between perceived information quality and trusting beliefs. Therefore, perceived information quality can be regarded as a key determinant of users' trusting beliefs with regard to online rumours. Specifically looking at health contexts, Seidman et al. (2003) found a sense of comprehensiveness to be an important dimension of information quality, and Rowley et al. (2015) have suggested that readability is a fundamental dimension for evaluating health information quality. Finally, Doll et al. (1988) concluded that informativeness is an important predictor of information quality. On the basis of the findings described above, we chose comprehensiveness, readability, and informativeness to be the three key dimensions of information quality in our model.

Comprehensiveness refers to the extent to which the rumour material appears sufficient, broad, and balanced. For example, this increases with the amount of detail: background information on the case, event times and places, and the people referred to (Fletcher, 2004). Comprehensiveness has already been found to be an important dimension of information quality (Sordi et al., 2014; Seidman et al., 2003). This is true in the health context also: McNally et al. (2012) reported that the comprehensiveness of online health information plays a vital role in building users' trusting beliefs. In the work of Shen et al. (2013), information quality (encompassing comprehensiveness and format) was found to influence the formation of trust indirectly through the mediator information usefulness. Considering users who seek out health information, Rowley et al. (2015) indicated that comprehensiveness, as a sub-dimension of information content, influences users' trust formation during this process. On these grounds, it is reasonable to argue that comprehensiveness influences users' trust in online health rumours. We formed the following hypothesis:

H4. Comprehensiveness correlates positively with users' trust in online health rumours.

Readability refers to the extent to which material is easy to understand (Chua and Banerjee, 2016). Several studies have highlighted readability as an important dimension of health information quality (Berland et al., 2001; Ferster and Hu, 2017; Grewal and Alagaratnam, 2013; Rowley et al., 2015; Walsh and Volsko, 2008), and various scholars have suggested that users put greater trust in information that is more readable (Banerjee and Chua, 2014; Ghose and Ipeirotis, 2012; Yoo and Gretzel, 2009). For instance, Ghose and Ipeirotis (2012) found readability to affect both the usefulness of online information and users' trust in that information. As for rumours, Yoo and Gretzel (2009) found deceptive information to be less readable than information from a legitimate source and that people usually trusted the latter. From this evidence, we hypothesized that people are more likely to trust such online health information as can be easily understood; that is, they would be expected to trust online health information with high readability:

H5. Readability correlates positively with users' trust in online health rumours.

In our model, informativeness is the degree to which the users of information regard it as useful. The concept refers to the information's knowledge content, which can be measured with regard to, for instance, depth and complexity. Informativeness has been identified as a key dimension of information quality (Doll and Torkzadeh, 1988) and as having an impact on trusting beliefs (Banerjee and Chua, 2014; Newman et al., 2003; Ott et al., 2011; Vrij et al., 2000). Often, those wishing a rumour to spread will add stories to the rumour material; such fabrications makes the rumour appear more informative and convincing (Newman et al., 2003). There is good reason for this, for Vrij et al. (2000) have argued that the features of the text used in online information exert an effect on users' trusting beliefs. Informativeness has been argued to be vital in formation of trust in information in an online environment (Johnson et al., 2015; Lucassen and Schraagen, 2011), with Sillence et al. (2007) indicating that informativeness contributes to users' trust in health information in particular. We posited, against this background, that informativeness has a positive impact on users' trust in online health rumours, thus:

H6. Informativeness correlates positively with users' trust in online health rumours.

Figure 1, below, presents the model applied in our research. Incorporated into the research design are two sets of factors for modelling users' trust in online health rumours: the mode of presentation of the rumours (pictures, verification of poster identity, and hyperlinks) and information quality (comprehensiveness, readability, and informativeness).

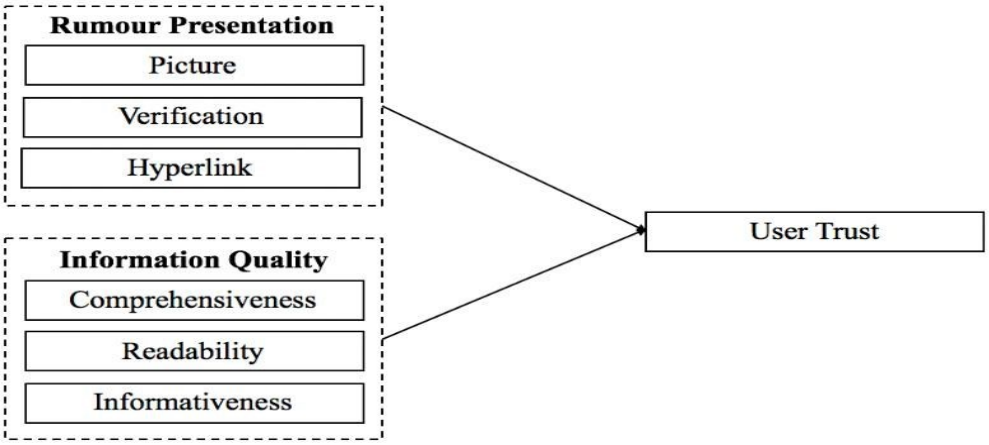


Figure 1: The proposed research model.

Methods

For validation of the proposed research model, we collected data by conducting both an experiment and interviews. Below, we describe our research design in greater depth, addressing the experiment and the interview process, alongside the relevant instruments, the data-collection procedure, and the analysis methods.

The experiment design

Examples of online rumours were obtained from a Chinese rumour database maintained by Tsinghua University Natural Language Group to provide researchers with convenient inquiry services related to rumours and data support for academic study of online rumours (but no longer available as open access). Various sorts of rumours could be retrieved from this database, which encompassed several online channels and numerous spheres: politics, the economy, fraud, social life, etc.

There are two main sources for the rumour items in the database. Some are submitted by end users online. Database administrators who are experienced in the field of online rumours review the user-

submitted rumours, and only those accepted by the administrators are included in the database. The other rumours in the database are collected by the Sina Weibo rumour-processing centre in China, an official agency that identifies rumours. For this research, we restricted ourselves to the latter source, selecting only those microblog entries (short messages such as tweets, as opposed to full articles) in the database that were detected by Sina Weibo's rumour-processing centre as containing online rumours. Hence, the microblog items we presented to the experiment participants are guaranteed to be real rumours that were spread via social media. To filter for rumours related to health, we used *health* as the key in the interface's subject search field. We randomly selected some material that included the additional elements of rumour presentation envisioned for our research design (pictures, identity verification, and hyperlinks).

We conducted a within-subjects experiment with a 2 × 2 × 2 design involving these three factors (pictures, verified identity, and hyperlinks). We divided the online health-rumour items into eight categories on the basis of the presence or absence of each of these factors in the corresponding condition. Table 2 shows the eight categories of online health-rumour items in this research. For each category, we selected three distinct online health-rumour items from the database with material that displayed that category's features. Thereby, we obtained a final sample containing 24 individual rumour items (3 rumour items × 8 categories) for testing. Figure 2 provides an example of the pictures that we showed to the participants in the experiment.

Table 2: The categories of online health rumours in the experiment

Category of rumour	**The presentation design of the online health rumours.**
1	picture + verification of identity + hyperlink
2	picture + verification of identity + no hyperlink
3	picture + no verification of identity + no hyperlink
4	picture + no verification of identity + hyperlink
5	no picture + verification of identity + hyperlink
6	no picture + no verification of identity + hyperlink
7	no picture + verification of identity + no hyperlink
8	no picture + no verification of identity + no hyperlink

Figure 2: A sample picture from the experiment

Also, we interviewed several of the people who took part in the experiment. For more informative interviews, we based this stage on the responses in the experiment. That is, the design of the interview questions was informed by the experiment's results, and the sample of users answering those questions was chosen to be representative. Participants were selected in a manner that provided a balanced sample: we randomly selected one or two participants each who had indicated a high, medium, or low level of trust in a rumour presented with hyperlinks, pictures, or verification of poster identity, and we asked why they had this level of trust in the microblog item (i.e., rumour). We controlled for sex, to reduce its impact on our findings from the interviews.

Collection of data

Recruitment for participation in the experiment was performed through snowball sampling at a university. Thirty people with a Weibo account and social-media use experience were invited to participate. According to Jakob (2006), testing with more than twenty users typically provides reasonably tight confidence intervals in collection of usability measurements. Our choice is consistent with prior literature on health information, for which the number of experiment subjects is 7-29 (Bolgva et al., 2017; Jean et al., 2015; Mazur et al., 2016; Wu and Li, 2016). All of the subjects in our experiment had searched for health information online before.

The experiment, carried out between April 10 and May 2, 2017, took place in a computer lab, where the subjects were able to complete the tasks without any disruption. So that the participants were guaranteed to understand the concepts involved in this study, we explained the relevant ideas to them before the experiment began. Also, a sample picture of an online health-rumour item was visible on the computer screen before the participant began the experiment. The participants were requested to read the material on the screen and then evaluate its apparent comprehensiveness,

readability, and informativeness, along with their level of trust in this particular online health information. After doing this, a participant needed only to click with the mouse to see a new picture. A normal microblog-reading environment was created by inviting the subjects to read the selected health-rumour items without informing them that the microblog items they would read are rumours. Hence, they read the health-rumour materials presented as if they were part of normal microblogs. To make the participants understand the concepts included in this study, we explained the relevant concepts to the participants before doing the experiment. The participants completed the experiment in the computer lab without any disruption.

Eight groups of rumour items, for twenty-four items in total, were presented to the participants, with the order of the conditions randomized in order to improve the internal validity of the experiment. Besides addressing the potential for ordering effects, this approach helps to avoid the possibility of bias caused by the experiment processing sequence (Fowler, 2000; McDaniel, 2004). In addition, a time gap was enforced between successive images of rumour items. This break of about three minutes diminished any possible effect that viewing a given picture might have in relation to the next one. In other words, after reviewing each image and answering the related questions, the participant had to wait three minutes before moving on to the next item.

All the participants were requested to report their evaluation for all twenty-four items shown, using a seven-point Likert scale, from 1 (indicating extremely low levels) to 7 (for high ones) to assess the perceived comprehensiveness, readability, and informativeness of each health-related microblog item, along with their trust in its information.

Table 3 presents the participants' demographics. The age of experiment subjects ranged from 23 to 27 years. In this study, we controlled for participants' age, so that the results would be representative of users of Sina Weibo (most of China's Sina Weibo users belong to the so-called post-'90s generation, according to the Sina Weibo data centre (2016). The sample consisted of 15 males and 15 females. Most of the participants were master's students (73.33%), and the rest were doctoral students (26.67%). The breakdown of their fields of study was as follows: 13.33% were in the engineering field, 16.67% were studying humanities subjects, 23.33% were in natural sciences, and 46.67% were the social sciences students.

Table 3: The socio-demographic characteristics of the participants in the experiment

User characteristic		**No. of participants (n = 30)**	**Percentage (%)**
Age	23	8	26.67
	24	9	30
	25	6	20
	26	5	16.67
	27	2	6.66
Sex	Male	15	50
	Female	15	50
Education	Master's student	22	73.33

	Ph.D. student	8	26.67
	Humanities	5	16.67
	Social science	14	46.67
Academic discaipline	Engineering	4	13.33
	Sciences	7	23.33

After examining the results of the experiment, we applied the method above to select ten of the subjects for interviews, to help enrich our understanding of the findings from the experiment from the user perspective. Figure 3 describes the interview process. To improve the credibility and dependability of the study, we utilized semi-structured interviews, which facilitates expanding the discussion to potential topics of interest related to the pre-selected questions (Patton, 2002; Spradley, 1979). The semi-structured format allows the researchers to ask additional questions and thereby brings richer coverage of the subject at hand (Beaudoin, 2016). All interviewees were asked to answer questions about the importance of presentation and information quality in relation to their trust in the online health rumours. All conversation in the interviews was recorded, and we coded the interview material from transcripts in our qualitative data analysis.

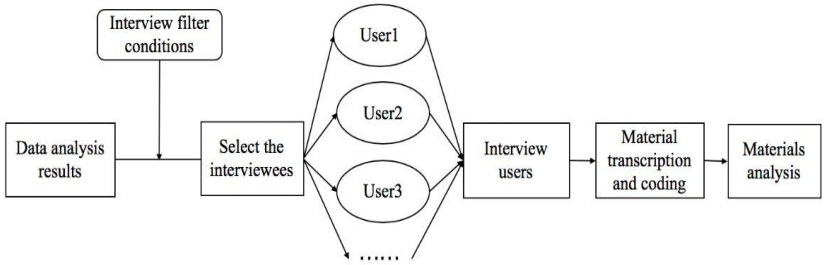


Figure 3: A diagram of the interview process

On the basis of the chronological order of the interviews, the interviewees were assigned individual-specific codes to aid in the analysis. These codes, which are cited in connection with the interview extracts below, are shown in Table 4, which presents the demographic characteristics of each person invited for an interview. The final stage in the process involved content analysis of the interview data. With this qualitative material, we were able to explain the results from the quantitative data analysis more fully.

Table 4: The socio-demographic characteristics of the interviewees

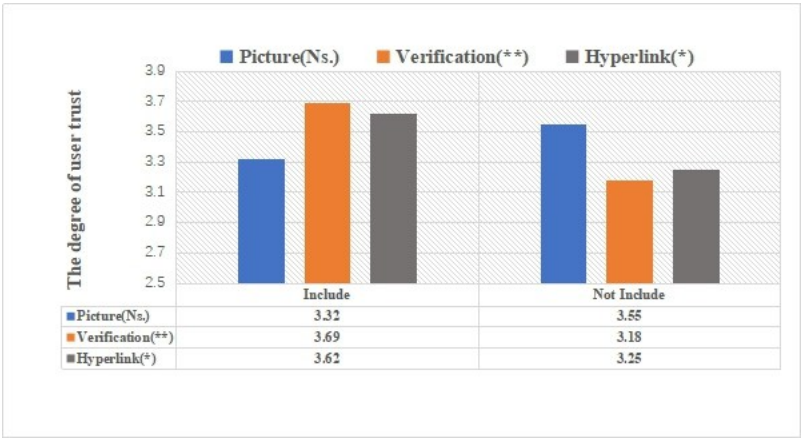
Participant code	**Sex**	**Age**	**Education level**	**Academic discipline**
1	Male	23	Master's student	Natural sciences
3	Male	27	Ph.D. student	Social sciences
4	Female	24	Master's student	Social sciences
7	Male	25	Master's student	Engineering
9	Male	24	Master's student	Natural sciences

11	Female	26	Ph.D. student	Humanities
15	Female	23	Master's student	Social sciences
20	Female	24	Master's student	Humanities
22	Male	25	Ph.D. student	Social sciences
25	Female	24	Master's student	Natural sciences

Results

Analysis of the presentation-related results

Analysis of variance (ANOVA) was carried out with the software SPSS 22.0 to examine the precursors to users' trust with regard to rumour presentation (pictures, verification of the source, and hyperlinks) and information quality (comprehensiveness, readability, and informativeness). Figure 4 shows the average scores for users' trusting beliefs related to each of the three aspects of presentation. The average mean value for trusting beliefs for those items without pictures is 3.55 (SD = 1.04), which is higher than the mean value for the ones including pictures, 3.32 (SD = 1.26). However, pictures (F = 2.413, p = 0.122, not significant) were found to have no significant impact on users' trusting beliefs. People appear to have a higher level of trusting belief with online health rumours conveyed by verified users than those presented by users whose identity was not verified (Mverification = 3.69, with SD of 1.06; Mno-verification = 3.18, with SD of 1.19; p = 0.001**). Finally, the average mean value of trusting beliefs is higher for online health rumours with hyperlinks than for those without (Mhyperlink = 3.62, SD = 1.10; Mno-hyperlink = 3.26, SD = 1.40; p = 0.014*).



(* = p<0.05; ** = p<0.01; *** = <0.001; Ns. = not significant)

Figure 4: The average scores for users' trust in relation to the presentation of rumours.

A series of ANOVAs was performed to distinguish the effect of pictures, identity verification, and hyperlinks. Verification of poster (F = 12.441, p = 0.001**) and the presence of hyperlinks (F = 6.070, p = 0.014*) were found to have significant impacts on users' trust, while inclusion of pictures (F = 2.413, p = 0.122, not significant) did not show a significant impact on it. Hence, the results indicate that users put greater trust in online health rumours from verified-identity rumour-mongers or that feature hyperlinks. To measure the magnitude of differences by rumour presentation, we calculated the size of the effect of the manner of presentation in terms of eta squared (η2). According to Cohen (1988), the variable is responsible for a small effect when $0.02 \leq \eta 2 < 0.13$, a medium-sized effect

when $0.13 \leq \eta 2 < 0.26$, and a large one when $0.26 \leq \eta 2$. Small effect sizes were observed for identity verification and hyperlinks ($\eta 2 = 0.05$ and $\eta 2 = 0.025$, respectively).

Our qualitatively oriented further analysis of the data highlighted that six of the 10 interviewees explicitly stated that they would have put less confidence or trust in the item if there had been no "verified" status or hyperlinks. Regarding pictures, in contrast, four interviewees stated that they would trust online health information containing pictures less. Such responses are discussed in more detail below, where the extracts have been translated into English from the original Chinese conversation.

At this point, it is worth noting that the interviewees indicated that some factors may be more influential than others. For example, P5 appeared to give more weight to pictures than other factors, while P3 put emphasis on verification of the source.

Verification indicates that the identity stated by the rumour-monger [at this point, the participants were aware that they had been presented with rumours] is authentic. The information he or she provides will naturally be perceived to be more authoritative. I will be more inclined to trust information he or she publishes. (P3)

When asked why the presence of pictures had little or no impact on their levels of trust, P5 and P8 explained,

The pictures attached to information differ; some pictures are highly relevant to the information content of the text, but some are not. (P5)

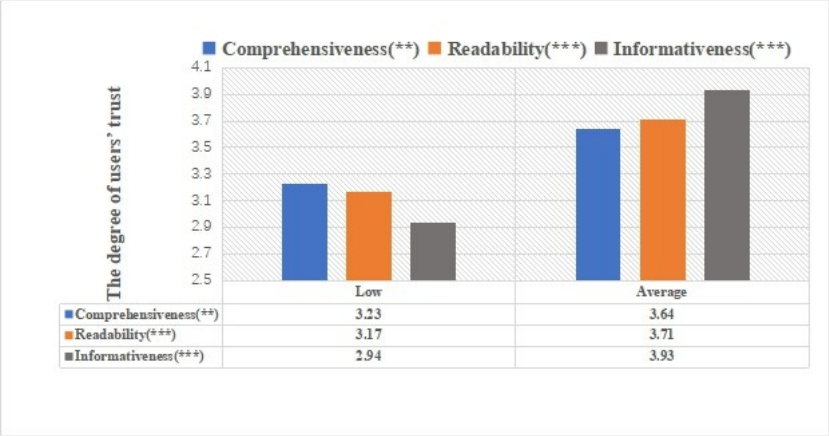
Information suggested by the pictures [in the items] has a great impact on users' trusting beliefs; some picture content is over-exaggerated, while some pictures seem to be 'true'. (P8)

Asked about the reason for the small effects observed for hyperlinks, P1, P2, P4, P7, and P8 all gave the same explanation. This extract is typical:

I think hyperlinks can provide additional information. [A hyperlink] can supplement the information content, which helps to enhance trust. (P1)

Analysis of the results related to information quality

We used Microsoft Excel to sort the rumour items by the scores each was given for comprehensiveness, readability, and informativeness. Accordingly, we divided the items into two subgroups to reflect high vs. low perceived comprehensiveness, and we then did the same for the readability and informativeness constructs. For each of the various subgroups, we calculated the corresponding average value for trusting beliefs. The statistics characterizing users' trust connected with different levels of comprehensiveness, readability, and informativeness are shown in Figure 5. Specifically, an average level of trust was found for online health rumours that seemed to have higher comprehensiveness ($M_{high\text{-}comprehensiveness} = 3.64$, $SD = 1.25$; $M_{low\text{-}comprehensiveness} = 3.23$, $SD = 1.02$; $p < 0.01$**), higher readability ($M_{high\text{-}readability} = 3.71$, $SD = 1.24$; $M_{low\text{-}readability} = 3.17$, $SD = 0.99$; $p < 0.001$***), and higher informativeness ($M_{high\text{-}informativeness} = 3.93$, $SD = 1.13$; $M_{low\text{-}informativeness} = 2.94$, $SD = 0.95$; $p < 0.001$***).



(* = p<0.05; ** = p<0.01; *** = p<0.001; Ns. = not significant)

Figure 5: Descriptive statistics for the degree of users' trust in relation to information quality

The ANOVA results reveal a significant impact of these three dimensions of information quality on the subjects' trusting beliefs - comprehensiveness ($F = 2.472$, $p < 0.01$**), readability ($F = 4.354$, $p < 0.001$***), and informativeness ($F = 8.148$, $p < 0.001$***). Medium-sized effect sizes were found for comprehensiveness ($\eta 2 = 0.142$) and readability ($\eta 2 = 0.200$), whereas a large effect was observed for informativeness ($\eta 2 = 0.353$).

Unsurprisingly, in the qualitative part of the study, all 10 interviewees indicated that high information quality is an important influence on their trusting beliefs with regard to online health information. Some of them stated that if the information quality is low, they will hesitate to accept the information, as in this example:

I think the most important part of health information is the quality of the information. Health information of low quality will have a negative effect on our health. (P10)

The interviewees varied in their comments related to the medium-sized effect of comprehensiveness on trust beliefs, with P2 and P9 indicating that they would not trust online health information on the basis of its comprehensiveness alone while the other eight interviewees stated that they would readily trust online health information with high comprehensiveness. For example, in the view of P6,

[m]aybe a higher level of comprehensiveness means more information. I think this can reduce uncertainty when [one is] searching for health-related information on complex scenarios.

With regard to readability, seven interviewees stated that, although it may not directly affect their trust in online health information, it can influence their understanding of the information presented. In essence, low readability increases the difficulty of understanding an online health rumour, and this, in turn, affects users' trust in the rumour. The following interview extracts illustrate this:

It is easier to understand online health information that has a high level of readability. Therefore, the possibility of trusting the information is greater. (P3)

If the health information has unorganized content and its readability is too low, it is normal that I don't trust information that I can't understand. (P4)

Finally, in their comments on informativeness, eight of the interviewees indicated that the level of informativeness affects their trust in particular online health information. These remarks are typical:

The more informative the online health information, the more knowledge I obtain on the subject, so it is more likely that I will trust the information in question. (P8)

The greater the informativeness of the online health information, the better I can understand the content of that information. [Informativeness] is useful for me in evaluating whether the information is true and strengthens my confidence in the information. (P7)

Discussion of findings and implications

Discussion of the results

The Internet is becoming an increasingly complex environment. It provides great volumes of health information, from various sources, which varies in information quality, with much of the material actually consisting of rumours. Online health rumours can affect people's understanding of illness and their health strategies, thereby misleading users and perhaps delaying treatment. Hence, by examining the determiners of trust in online health rumours, our study contributes new insights for proactively evaluating the hazard level of a particular online health rumour.

In our work on rumours' manner of presentation, our discovery of a positive correlation between hyperlinks' presence and the likelihood of a rumour being trusted, corroborating H1, stands in contrast to the findings of Rowley et al. (2015), who reported that hyperlinking to Web pages and other online material is of low importance in formation of trust in health information. We can point to two possible mechanisms that may explain our results. Firstly, one can change users' trusting beliefs related to unconfirmed information by manipulating the presentation of information (Steven and McCornack, 1992). Hyperlinks can direct the user to information that supplements the item presented, thereby enhancing trust. The information linked to may serve as third-party endorsement or an external referral (Wathen and Burkell, 2002). Secondly, it seems easy to verify that the content linked to is as described. Some users may feel a greater need to verify the authenticity of health-related online information as compared to other information found on the Internet. Therefore, rumours that seem to facilitate this by providing hyperlinks may win the user's trust more easily.

It is interesting that we found an insignificant relationship between the presence of pictures and trusting beliefs in relation to health rumours, even though pictures are usually regarded as beneficial complements to bare factual information (Ball and Smith, 1992; Kennedy et al., 2008). While scholars have reported that pictures have a significant impact on trusting beliefs and that online health rumours presented with pictures were more likely to be trusted (Chua et al., 2016; Zhang et al., 2015), we did not find support for H2. The situation may be more complex. Our findings could provide seeds for generating new insights into users' trust in online health rumours in three respects. Firstly, because pictures can attract attention more readily than pure text, users might well ignore the details offered in the text and focus instead on evaluating the pictures' authenticity (Rey and Dugelay, 2002) or perceived value. An additional factor, pointed to by the interviews, is that some pictures are regarded as highly relevant to the content of the matters of health while others are not. Users articulate that certain image content represents exaggeration and some pictures instead reflect the truth. This reveals that, at least in the case of online health rumours, users consciously consider the pictures in the course of the trust-formation process. Choosing the right, high-quality pictures could influence users' level of trust in online health information, whether rumour or fact. When researchers study only the existence of pictures, without considering the angle of picture quality, it is difficult to evaluate the true effect of pictures on trusting beliefs. Furthermore, our findings point to user-specific variables that may be relevant: all respondents in our small sample were graduate students, who might be more likely to be critical thinkers.

Of the three factors we tested in this category, verification of poster identity proved to have the strongest influence on trusting beliefs. This lends support to H3. Obviously, rumour-mongers having a verified identity will increase the sense of credibility of the information and render the rumours seemingly trustworthy (Metzger and Flanagin, 2010). This finding is in line with previous studies, which indicate that a provider of health information is more likely to be trusted if "verified" and that verification of identity has significant influence in the formation of trusting beliefs (Johnson et al., 2015; Cunningham and Johnson, 2016). The results from the interview stage indicate that verification is linked to good reputation and that information published by users with a known identity is seen as more authentic.

With regard to information quality, we found that online health rumours that seem comprehensive in nature are more likely to be trusted. Therefore, H4 is supported. This is consistent with prior studies (Thoroddsen et al., 2013; Rowley et al., 2015). High comprehensiveness may reduce uncertainty in today's complex Internet environment when a user is searching for health information. Previous findings indicate that fabricated messages tend to have lower specificity, such as relatively little temporal or spatial information (Bond and Lee, 2005; DePaulo et al., 2003; Watson and Ragsdale, 1981). Since common wisdom too holds that specificity is a good indicator of information's authenticity, information-seekers may readily believe an online health rumour that seems to display comprehensiveness. In addition, comprehensiveness indicates precision, which is associated with solid information (Viswanathan, 1992). Liars usually offer fewer details than truth-tellers (DePaulo et al., 2003); therefore, such information-seekers as caregivers and patients may accord greater weight to information sources that present abundant detail in their content (Kennedy et al., 2008; Paling, 2003). For these reasons, online health rumours with a high level of comprehensiveness are more likely to be trusted.

Readability, in turn, was found to have a positive correlation with users' trust in online health rumours. Our results support H5 and suggest that rumours that are more readable are more likely to be trusted (Banerjee and Chua, 2014; Ghose and Ipeirotis, 2012; Rowley et al., 2015; Yoo and Gretzel, 2009). As was highlighted in the interviews, low readability leaves information-seekers unable to understand the material, and people do not trust what they cannot understand. Accordingly, a rumour that is more readable is more likely to be believed and also disseminated among users.

Of the three dimensions of information quality we tested, informativeness was the most influential factor in trusting beliefs and showed a large effect size. Thus, H6 is supported. There are several possible reasons behind this finding. According to the interviews, informativeness is proportional to the level of the users' understanding of the information as they obtain more information from rumours with a high level of informativeness. In addition, in this era of rapid information dissemination, rumour-mongers may fabricate or disseminate rumours for their own purposes via increasing informativeness of rumours (Osterholm, 2000). In line with information manipulation theory (Steven and McCornack, 1992), they may attempt to increase the rumours' perceived informativeness so as to convince people. According to the uncertainty reduction theory (Berger and Calabrese, 1975), high informativeness enhances the perceived credibility of a message and decreases the associated uncertainty, thereby encouraging trust. Individuals would seem to have a universal preference for more information, since the sense of personal control rises and the potential for health-related risks seems to decline (Miles and Frewer, 2003).

Implications

While studies on online rumours abound, the determinants of trusting beliefs related to them have received relatively limited attention. At the same time, online health rumours are rife and may have serious consequences in the realms of disease prevention and detection (Zhang et al., 2015). Therefore, the study reported upon here contributes important insights by applying an integrated perspective - involving both rumour presentation and information quality - for understanding users' trust in online health rumours.

The findings contribute to research into online rumours on two counts. On the theoretical front, the study explored the determinants of users' trust in online health rumours from both of the aforementioned standpoints. With grounding in real-world data about rumours, several interesting findings can be reported. Significantly, several of these are inconsistent with prior studies. This may suggest that the phenomenon of health rumours is complex and that more research on the topic is warranted. Therefore, the paper may serve as a useful reference for future efforts in this stream of research. In addition, it provides evidence of how the hyperlink and source-verification aspects of rumour presentation affect users' trust and how the three dimensions of information quality (comprehensiveness, informativeness, and readability) tested influence users' trust in the context of health rumours.

On the practical front, our research provides important insights for managers wishing to combat the spread of online health rumours, by offering criteria by which one can evaluate the hazard level represented by particular manifestations of rumours. Specifically, a hyperlink-featuring item from a verified community member that seems to offer high information quality is more likely to be trusted, and the information provided is likely to spread further. Since new online rumours are emerging constantly, it is impossible to manage each one individually. In light of this issue, our findings provide a valuable starting point for proactively identifying the features of the most "dangerous" forms of rumour and for instituting effective rumour management. The paper also provides some guidelines to users of online information, such as researchers, educators and librarians, as to how one may pinpoint false information / rumours online in one's work.

The study's limitations and some future directions

While the study makes several contributions, it has a number of limitations also. Firstly, we considered only two sets of factors when modelling the trusting beliefs of users. Interesting findings might be obtained by including factors additional to rumour presentation and information quality in the analysis. Secondly, the study was limited to the context of online health rumours, so its results may not apply to other classes of rumour or to rumours in general. Further research should be conducted on online rumours in other settings, such as political or business rumours. Thirdly, the study was conducted with a relatively small sample of university students in China, so caution should be employed in generalizing the results to users with other cultural backgrounds. In addition, further research, with a larger and broader sample, could prove illuminating and might yield more reliable or even different results. Fourthly, the research design in this study used real-world online health rumours without controlling for the level of social-media use experience, experience with the Internet in general, or participants' education background. Control of the participant group in terms of such factors should aid in examining whether groups that differ on this basis show differences in trust beliefs with regard to online health rumours. Scholars conducting future research could control for these user-level factors, in addition to which they could take full control of the online rumour content. For instance, the research design could provide exactly the same rumour content to separate groups in studies of how rumour presentation and information quality affect users' trust.

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Appendix

English-language version of the questionnaire used in the experiment

This experiment is for a piece of research on microblogs in Sina Weibo. The study's questionnaire is completely anonymous and only for academic research. Thanks for your support and cooperation!

Some concepts used in the experiment:

Comprehensiveness refers to the extent to which the information content of the microblog item has sufficient breadth and depth.

Readability refers to how easy the microblog item is to understand.

Informativeness refers to the extent to which the microblog item provides necessary information to users.

users' trust refers to users' willingness to be vulnerable to the information provided by the microblog item.

1. Sex: A) Female B) Male

2. Year of birth: _____

3. Your education level: _____

4. Your academic discipline: _____

Please answer the following questions after you read each microblog item shown to you on the computer. There will be 8 microblog entries for you to read in total. We use a 1-7 scale. 1 means a very low level, 4 is neutral, and 7 refers to very high level.

What do you think about the comprehensiveness of this microblog item?

1 2 3 4 5 6 7

How high do you consider the readability of this microblog item to be?

1 2 3 4 5 6 7

How informative do you think this microblog item is?

1 2 3 4 5 6 7

To what degree do you trust this microblog item?

1 2 3 4 5 6 7

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