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Health Misinformation on Social Media: A Literature Review

Completed Research Paper

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Abstract

Health misinformation on social media is considered as a major public concern. This study evaluates the current state of this issue by conducting a systematic literature review. Based on a stepwise literature search and selection procedure, we have identified 21 articles relevant to the topic of health misinformation on social media. We find that health misinformation on social media is a new and emerging topic in multiple disciplines. One very important insight of this review is that most studies are theoretical and exploratory in nature. There is only a small number of studies have solid theoretical foundations. Finally, we discuss the implication of the literature review for future research.

Keywords: Health misinformation, rumors, social media, literature analysis

Introduction

Health misinformation refers to a health-related claim of fact that is not supported by scientific evidence and expert opinions (Vraga and Bode 2017; Chou et al. 2018). In recent years, social media platforms (e.g., Facebook, Twitter, Weibo, and WeChat) have emerged as new channels for people to seek and exchange health information (Fichman et al. 2011; Zhao and Zhang 2017). It is reported that 46% of Facebook users look for health information on Facebook (Pew Research Center, 2013). While the first-hand experience shared by patients may be helpful for prevention and treatment, this kind of information is not accredited by medical authorities, resulting in a cacophony of true and false health information circulating on social media (Brady et al. 2017; Chou et al. 2018). Health misinformation is dangerous because it is related to an individual's health status and even life (Wiederhold 2017; Li et al. 2017). For example, the constant barrage of antivaccine information on social media like Twitter has caused the reluctance to vaccination and the occurrence of vaccine-preventable disease (Broniatowski et al. 2018). Consequently, the public, as well as the scientific community, grows increasingly concerned about health misinformation on social media.

An increasing number of articles on health misinformation on social media have been published in the fields of information systems (IS) (Chua and Banerjee 2018; Li et al. 2018), communication (Vraga and Bode 2017; 2018), and health care (Chua and Banerjee 2017; Albarracin et al. 2018). Despite growing maturity, our preliminary review indicates that research on health misinformation on social media is still in its early stages, with a large and fragmented research scope. Considering the importance and relevance of this issue to IS and related disciplines, it is necessary to review the knowledge accumulated on health misinformation on social media to guide future investigations. IS scholars have also called for the efforts to build a benchmark by consolidating existing knowledge in order to track the status of

an emerging discipline (Alavi and Carlson 1992; Webster and Watson 2002). From this perspective, a systematic review of prior studies can serve as a starting point for the development of new theories, and inspire IS scholars to further explore this virgin but fertile research field. In this regard, this study attempts to systematically review previous studies on health misinformation on social media to define the current research state, identify the potential research gaps and opportunities, and provide directions and guidelines for future research. We also believe that a synthesis of current knowledge on health misinformation on social media is timely and of practical relevance, contributing to prevention and intervention of the spread of health misinformation on social media.

This study proceeds as follows. First, we provide an introduction to health misinformation in the context of social media. Second, we describe the procedures of literature search and selection. Third, we analyze the identified articles and discuss the current state of research on health misinformation on social media, including publication timeline, research topics, research methods, and theoretical foundations. We conclude the paper by discussing the implications of our findings for future research.

Health Misinformation on Social Media

Misinformation has been widely investigated in social science, especially in the political and mass communication fields (e.g., Oh et al. 2013; Schaffner and Luks 2018). We are interested in health misinformation because it is one of the most frequently disseminated types of information on social media (Li et al. 2017). In addition, health misinformation has made some tragedies as reported in the literature (Spiteri Cornish and Moraes 2015), and this further reflects the practical significance of understanding health misinformation. IS researchers are also becoming increasingly interested in the spread of health information (Fichman et al. 2011; Adjerid et al. 2018). In prior research, terms such as misinformation, misleading information, rumors, fake information, false information, anecdotal information, and other variations coexisted, leading to conceptual ambiguity. For example, Sommariva et al. (2018) distinguished rumors as belonging to three categories: (1) misleading content, describing inaccurate information that attempts to frame an issue; (2) false content, describing partially true information; (3) fabricated content, describing completely fake information. In addition, Waszak et al. (2018) identified three categories of fake medical news: (1) fabricated news, which is completely fictitious information about medical facts; (2) manipulated news, which includes true basic information but has false conclusions; (3) advertisement news, which tells stories to criticize conventional therapies and advertise products. These similar concepts can be distinguished in terms of levels of facticity and deception (Tandoc Jr et al. 2018). During the article identification stage in this review, we notice that the misinformation terminology has been used most frequently, with 10 articles in the search results. Misinformation is defined as the factually incorrect information that is not backed up with evidence (Bode and Vraga 2015). This definition suggests that misinformation can serve as an umbrella concept to describe different types of incorrect information, regardless of the levels of facticity and deception. Therefore, this work focuses on misinformation and defines health misinformation as a health-related claim of fact that is not supported by scientific evidence and expert opinion (Vraga and Bode 2017; Chou et al. 2018).

While health misinformation has long been a concern to the public (Morahan-Martin and Anderson 2000; Zhang et al. 2015), it continues to evolve with the communication technologies. In the Web 2.0 era, social media has been considered responsible for the prevalence of health misinformation (Fernández-Luque and Bau 2015; Brady et al. 2017). First, people have a stronger desire to share their first-hand treatment experience—which may not be accurate—on social media communities than on general online platforms in order to make a social contribution and increase their social standing among their friends (Fichman et al. 2011). Moreover, people are more likely to rely on health information shared by their friends to make decisions than that from online search engines (Zhao and Zhang 2017). Thus, health misinformation on social media may have a stronger effect on patients than general Internet health misinformation. Second, compared with health information on websites, health information in social media posts tends to be oversimplified and potentially omits some small but important details (Brady et al. 2017). The third reason for the exacerbation of the spread of health misinformation on social media is the echo chamber effect (Brady et al. 2017; Chou et al. 2018). Social media connects like-minded people into a closed network, in which people share similar content, amplifying the risks caused by misinformation (Brady et al. 2017; Chou et al. 2018). Thus, unlike web-based health misinformation, which affects individual health, misinformation on social media may lead to

community-level problems (Pal et al. 2017). Given the prevalence of social media and the serious consequences caused by health misinformation on social media, we only target prior publications with health misinformation on social media as the focus in this review paper.

Literature Search and Identification

We followed the standard guidelines of systematic review to search and identify articles that investigate health misinformation on social media (Webster and Watson 2002). Figure 1 illustrates the literature search and selection procedures. First, we executed a systematic search in several index databases to identify the published articles related to health misinformation on social media. The databases being retrieved in this study include: Web of Science, EBSCOhost, ProQuest, SAGE, PubMed, Medline, and Scopus. These databases cover almost the major sources of literature in the areas of IS, social science, and health care. In order to reach a more complete list of the relevant literature, we combined a broad range of terms related to health misinformation on social media, and searched them in both abstract and keywords. The online database search generated a list of 544 articles. After removing duplicates, there were 244 articles.

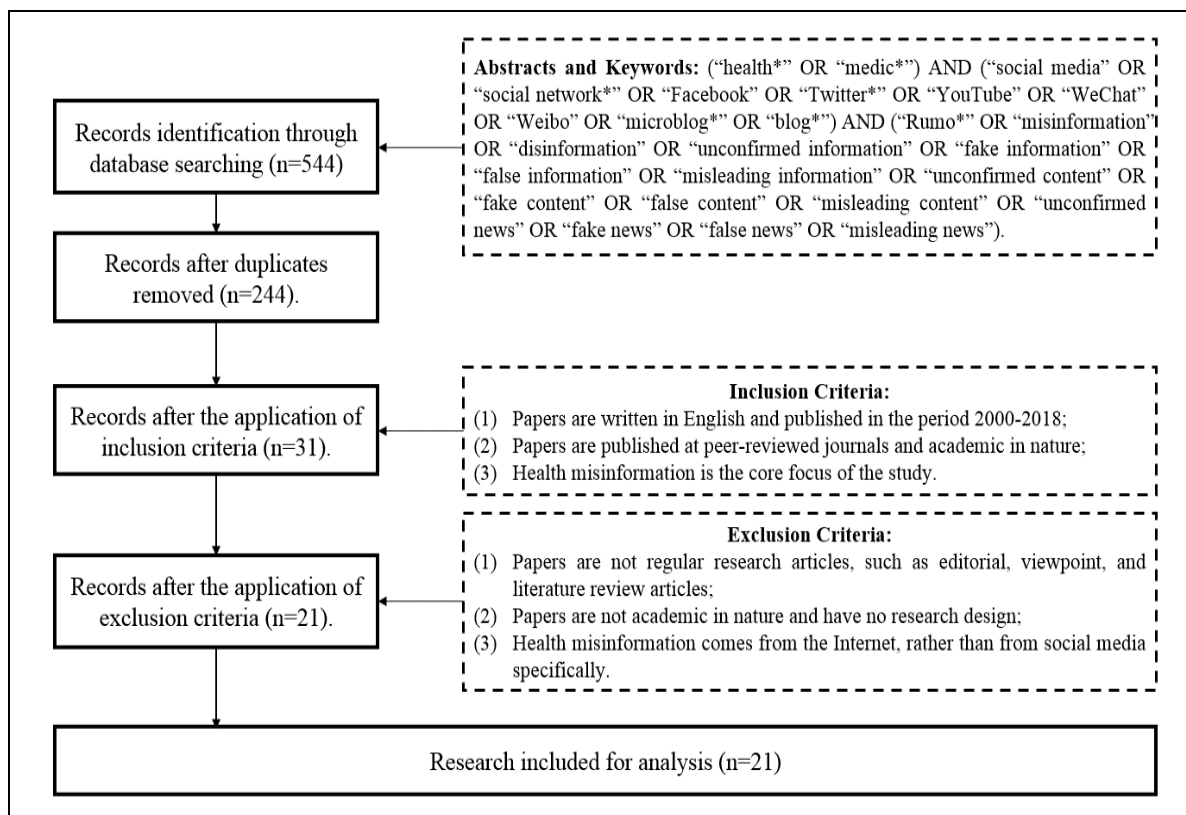


Figure 1. Literature Search and Identification Procedures

We then applied both inclusion and exclusion criteria to the 244 articles to ensure their relevance to further analysis. The inclusion criteria include: (1) papers are written in English and published in the period 2000-2018; (2) papers are published in peer-reviewed journals; and (3) health misinformation is the core focus of the study. The exclusion criteria are the following: (1) papers are not regular research articles, such as editorial, viewpoint, and literature review articles; (2) papers are not academic in nature and have no research design; and (3) health misinformation comes from the Internet, rather than from social media specifically. A total of 21 studies were included for further analysis.

Literature Analysis

Timeline of Publications (by Disciplines)

Figure 2 shows the timeline of publications regarding the topic of health misinformation on social media (by disciplines). While health misinformation on social media is a relatively new topic that debuted in the health care field in 2013, it has gained increasing attention in recent three years in the fields of health care, communication, and IS. We witnessed a significant increase in research on this topic in 2018, accounting for more than half of the published articles. Based on our review, there are 3 articles from IS journals, 6 articles from communication journals, and 12 articles from health care journals.

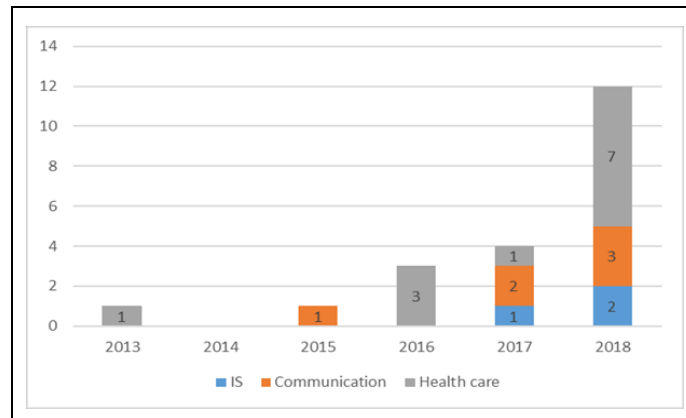


Figure 2. The Timeline of Articles

Overview of Research Topics

As shown in Table 1, we identify four most investigated themes around health misinformation on social media in the literature.

(1) Feature, focusing on characteristics of health misinformation on social media. This vein of research indicates that health misinformation on social media gains more popularity than true health information because health misinformation tends to be appealing in format. They also use exaggerated or emotional language (Syed-Abdul et al. 2013; Bail 2016; Chen et al. 2018; Waszak et al. 2018).

(2) Spread, focusing on the spread process of health misinformation on social media, such as characteristics of receivers, senders, and social media. For example, health misinformation receivers' characteristics include epistemic belief, initial misperceptions, conspiracy belief, personal involvement, quality of life, and health status (Chua and Banerjee 2017; 2018; Vraga and Bode 2018; Madathil and Greenstein 2018). Health misinformation can be easily spread on social media mainly because of marketing motivation and personal involvement (Trembath et al. 2016; Chua and Banerjee 2018). Some studies further pointed out the important roles of influencers and social media characteristics on the spread of health misinformation on social media (Brady et al. 2017; Lavorgna et al. 2018). Characteristics of health misinformation, including the types (true or false, textual or pictorial, and dread or wish) and the cues involved in the information, have also been found to influence the spread of health misinformation on social media (Chua and Banerjee 2017; Zhou et al. 2018).

(3) Impact, focusing on the influence of health misinformation on social media. While a lot of articles argued that health misinformation will result in undesirable consequences, such as causing unnecessary fear and anxiety (Chua and Banerjee 2017), leading to misperceptions about diseases (Chen et al. 2018), and impeding the physician-patient interactions (Lavorgna et al. 2018), there is only one paper, namely Albarracin et al. (2018) examining the impact of health misinformation on the social media context.

(4) Coping strategy, focusing on the strategies to intervene in health misinformation on social media. In this research avenue, Bode and Vraga have explored different strategies to correct health misinformation on social media, including social media algorithms, expert correction, and social correction (Bode and Vraga 2015; 2018; Vraga and Bode 2017; 2018). Some studies also indicated promoting individuals' health literacy, such as knowledge, expertise, and awareness, is also helpful for

dealing with issues related to health misinformation on social media (Syed-Abdul et al. 2013; Trembath et al. 2016). Other studies proposed coping strategies for health organizations by focusing on increasing social media presence, correcting misinformation transparently, and addressing individuals' emotional concerns (Brady et al. 2017; Gesser-Edelsburg et al. 2018).

Table 1. Summaries of Research Topics

Topic	Focus	References
Feature	The characteristics of health misinformation on social media.	Syed-Abdul et al. (2013); Bail (2016); Bessi et al. (2016); Li et al. (2017); Chen et al. (2018); Waszak et al. (2018); Zhou et al. (2018); Sommariva et al. (2018); Madathil and Greenstein (2018); Sicilia et al. (2018)
Spread	The spread process of health misinformation on social media.	Bail (2016); Chua and Banerjee (2017; 2018); Brady et al. (2017); Zhou et al. (2018); Madathil and Greenstein (2018); Lavorgna et al. (2018)
Impact	The impacts of exposure to health misinformation on social media.	Albarracin et al. (2018)
Coping Strategy	The strategies to correct and intervene in health misinformation on social media.	Bode and Vraga (2015; 2018); Trembath et al. (2016); Vraga and Bode (2017; 2018); Gesser-Edelsburg et al. (2018)

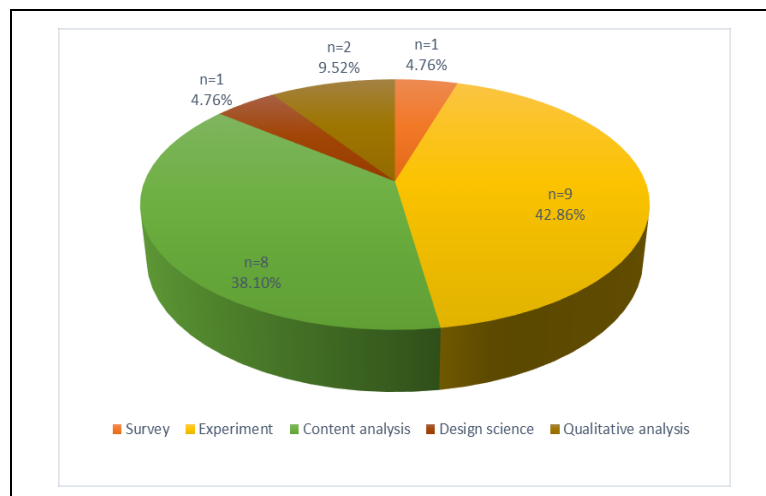


Figure 3. Research Methods among the Literature

Overview of Research Methods

As shown in Figure 3, prior studies have adopted a wide variety of research methods to investigate health misinformation on social media. Based on our analysis of the literature, experiment and content analysis are the two most employed research methods, with 9 articles using experiment and 8 articles using content analysis. The experimental design enables researchers to observe respondents' reactions in different scenarios by manipulating the types and the presence of health misinformation on social media (Chua and Banerjee 2017; Albarracin et al. 2018; Madathil and Greenstein 2018). Some researchers used the experiment method to examine the effects of coping strategies of health misinformation (Bode and Vraga 2015; 2018; Vraga and Bode 2017; 2018). Content analysis also has been widely used in the selected articles to identify informational and diffusion characteristics of health misinformation on social media (Bessi et al. 2016; Li et al. 2017; Waszak et al., 2018; Zhou et al. 2018). Further, there are 2 qualitative analysis articles, with one addressing the roles of parent and professional

attitudes on countering health misinformation (Trembath et al. 2016) and the other discussing the role of social media on the spread of health misinformation (Brady et al. 2017). The survey method was used in 1 article that attempted to identify influencers who can provide the most reliable life advice and the most useful health information in an online social networking-based patient community (Lavorgna et al. 2018). In addition, 1 paper in the design science paradigm designed a new rumor detection system by leveraging influence potential and network characteristics measures (Sicilia et al. 2018).

Overview of Theories

In the selected articles, we find that only 8 articles have theoretical foundations, as summarized in Table 2. For example, Li et al. (2017) drew upon the CARS List framework—the lack of credibility, the lack of accuracy, the lack of reasonableness, and the lack of support—and developed a checklist to help identify health misinformation on social media. Rumor theory has been used to explain the spread of health misinformation on social media (Chua and Banerjee 2018; Zhou et al. 2018). There are four key constructs involved in rumor theory, including anxiety, information ambiguity (source ambiguity and content ambiguity), personal involvement, and social ties (Oh et al. 2013). These constructs have also been discussed in other studies in this review (Bail 2016; Brady et al. 2017; Chen et al. 2018). Researchers adopted the theory of negativity bias to examine the emotional valence of health misinformation (Chua and Banerjee 2018). The theory basically argues that negative things generally exert a stronger effect on one’s attitudes and behaviors than positive things (Cacioppo and Berntson 1994). Theory of boomerang effect suggests that the attempts to change a behavior may lead to opposite results in the end (Byrne and Hart 2009), and this theory helps explain the failure of the correction of health misinformation (Chua and Banerjee 2018). Another challenge to the correction of health misinformation on social media is motivated reasoning, which suggests that people tend to accept confirmatory information to protect their pre-existing attitudes (Jerit and Barabas 2012). The data-frame theory suggests that people tend to rely on the initial frame to explain the new information they encounter (Klein et al. 2006). As such, researchers believe that health misinformation should be corrected as early as possible (Madathil and Greenstein 2018).

Table 2. Summaries of Theoretical Foundations

Theory	Description	Reference
CARS List framework	This framework is designed for evaluating the low quality of online information, including lack of credibility, lack of accuracy, lack of reasonableness and lack of support (Harris 1997).	Li et al. (2017)
Rumor theory	This theory is defined as “a collective and collaborative transaction in which community members offer, evaluate, and interpret information to reach a common understanding of uncertain situations, to alleviate social tension, and to solve collective crisis problems” (Oh et al. 2013, p. 409).	Chua and Banerjee (2018); Zhou et al. (2018)
Theory of negativity bias	This theory suggests that negative information is likely to exert a stronger effect on individuals’ attitudes and behaviors than information of neutral or positive nature (Cacioppo and Berntson 1994).	Chua and Banerjee (2018)
Theory of boomerang effect	This theory indicates that “messages designed to change a behavior can trigger a behavioral shift in a direction opposite to that of the intended outcome” (Chua and Banerjee 2018, p. 3).	Chua and Banerjee (2018)
Motivated reasoning theory	This theory suggests that people tend to accept confirmatory information to protect their pre-existing attitudes (Jerit and Barabas 2012).	Bode and Vraga (2015; 2018); Vraga and Bode (2017; 2018)
Data-frame theory	This theory indicates the initial data elements act as the anchors from which to develop the initial frame that is important to the sensemaking process (Klein et al. 2006).	Madathil and Greenstein (2018)

Discussion and Conclusion

Following the systematic guidelines of conducting a literature review, we collected and reviewed 21 published articles related to health misinformation on social media in 7 major databases. We further analyzed these 21 articles, with a focus on the timeline of publications (by disciplines), research topics, research methods, and theoretical foundations, as summarized in Table 3.

Table 3. Summaries of Reviewed Articles

Author (year)	Title	Discipline	Topic	Method	Theoretical background
Syed-Abdul et al. (2013)	Misleading Health-Related Information Promoted Through Video-Based Social Media: Anorexia on YouTube	Health care	Feature	Content analysis	Null
Bode and Vraga (2015)	In Related News, that was Wrong: The Correction of Misinformation through Related Stories Functionality in Social Media	Communication	Coping strategy	Experiment	Motivated reasoning theory
Bail (2016)	Emotional Feedback and the Viral Spread of Social Media Messages about Autism Spectrum Disorders	Health care	Feature and Spread	Content analysis	Null
Bessi et al. (2016)	Homophily and Polarization in the Age of Misinformation	Health care	Feature	Content analysis	Null
Trembath et al. (2016)	“Attention: Myth Follows!” Facilitated Communication, Parent and Professional Attitudes towards Evidence-Based Practice, and the Power of Misinformation	Health care	Coping strategy	Qualitative analysis	Null
Vraga and Bode (2017)	Using Expert Sources to Correct Health Misinformation in Social Media	Communication	Coping strategy	Experiment	Motivated reasoning theory
Li et al. (2017)	Fake vs. Real Health Information in Social Media in China	Information Systems	Feature	Content analysis	CARS List framework
Brady et al. (2017)	The Trump Effect: With No Peer Review, How Do We Know What to Really Believe on Social Media?	Communication	Spread	Qualitative analysis	Null
Chua and Banerjee (2017)	To Share or Not To Share: The Role of Epistemic Belief in Online Health Rumors	Health care	Spread	Experiment	Null
Bode and Vraga (2018)	See Something, Say Something: Correction of Global Health Misinformation on Social Media	Communication	Coping strategy	Experiment	Motivated reasoning theory
Gesser-Edelsburg et al. (2018)	Correcting Misinformation by Health Organizations during Measles Outbreaks: A Controlled Experiment	Communication	Coping strategy	Experiment	Null
Vraga and Bode (2018)	I Do Not Believe You: How Providing a Source Corrects Health Misperceptions across Social Media Platforms	Communication	Coping strategy	Experiment	Motivated reasoning theory
Albarracin et al. (2018)	Misleading Claims about Tobacco Products in YouTube Videos: Experimental Effects of Misinformation on Unhealthy Attitudes	Health care	Impact	Experiment	Null

Chen et al. (2018)	Nature and Diffusion of Gynecologic Cancer-Related Misinformation on Social Media: Analysis of Tweets	Health care	Feature	Content analysis	Null
Lavorgna et al. (2018)	Fake News, Influencers and Health-Related Professional Participation on the Web: A Pilot Study on a Social-Network of People with Multiple Sclerosis	Health care	Spread	Survey	Null
Sommariva et al. (2018)	Spreading the (Fake) News: Exploring Health Messages on Social Media and the Implications for Health Professionals Using a Case Study	Health care	Feature	Content analysis	Null
Waszak et al. (2018)	The Spread of Medical Fake News in Social Media-The Pilot Quantitative Study	Health care	Feature	Content analysis	Null
Chua and Banerjee (2018)	Intentions to Trust and Share Online Health Rumors: An Experiment with Medical Professionals	Information Systems	Spread	Experiment	Rumor theory; Theory of negativity bias; Theory of boomerang effect
Madathil and Greenstein (2018)	An Investigation of the Effect of Anecdotal Information on the Choice of a Healthcare Facility	Health care	Feature and Spread	Experiment	Data-frame theory
Zhou et al. (2018)	Understanding Health Food Messages on Twitter for Health Literacy Promotion	Health care	Feature and Spread	Content analysis	Rumor theory
Sicilia et al. (2018)	Twitter Rumour Detection in the Health Domain	Information Systems	Feature	Design science	Null

Based on the preliminary review analysis results, we can summarize the following findings which will hopefully yield instructive insights for future research.

First, research on health misinformation on social media has only recently appeared in peer-reviewed journals in the fields of health care, communication, and IS. However, the prevalence and the increasing trends of health misinformation on social media have potentials to promote further academic discourse on this topic. Therefore, we believe that health misinformation on social media is a young but promising research topic, which also provides rich opportunities for interdisciplinary research. Future research can integrate theories from health care (e.g., health belief model), communication (e.g., motivated reasoning theory), and IS (e.g., the artifacts of social media), to provide a holistic sociotechnical perspective—which is highly appreciated by IS researchers and practitioners—to understand health misinformation on social media.

Second, current research on health misinformation on social media is generally centered around four themes, i.e., feature, spread, impact, and coping strategy of health misinformation on social media. However, the majority of existing research focused on information characteristics and the spread of health misinformation on social media. Surprisingly, although the negative consequences of health misinformation on social media have been widely recognized by both research and practice, rarely effort has been devoted to evaluating the influence of health misinformation on social media on individuals' attitudes and subsequent behaviors. Thus, future research can follow this line of research and assess the potential impacts of health misinformation in the context of social media and further determine how to design social media artifacts to prevent such influence.

Third, experiment and content analysis are the mainstream research methods in current studies on health misinformation on social media. Experimental design empowers researchers to manipulate specific variables of interest and examine its effects on participants' reactions, advancing the behavioral research on health misinformation on social media. Content analysis helps to identify informational and diffusion characteristics of health misinformation on social media, providing some thumb rules to judge health misinformation on social media. However, an overview of theoretical foundations indicates that only a small number of studies are theory-driven, which makes it difficult to obtain meaningful conclusions from these studies. Thus, theory-driven empirical research—which is valued by the IS community—is highly recommended in future research.

This literature review also has some limitations. First, the literature analysis results basically depend on the inclusion and exclusion criteria applied to the database search results. It is possible that some important and relevant articles on this topic have been omitted because they may not satisfy the criteria. Second, the study provides a broad classification of research topics. It would be useful to dig deeper into each topic and propose a generic conceptual model to guide future research.

In summary, this study provides a systematic literature review on health misinformation on social media. Health misinformation on social media is becoming a growing danger to the public and attracts increasing attention from both scholars and policy makers. The literature analysis indicates that current studies regarding health misinformation on social media is still in its early stage but is emerging as a promising research area in the next few years. Despite suffering from some limitations, this literature review outlines the current state of research on this topic and provides directions for future research.

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