

Role of Channel Complementarity Characteristics on the Risk Information Seeking and Processing Model a Systematic Literature Review

Shenghao Qi, Jen-Sern Tham, Moniza Waheed, Norliana Hashim

Department of Communication, Faculty of Modern Languages and Communication, University Putra Malaysia, Malaysia

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ABSTRACT

Over the past few decades, the application of the risk information seeking and processing (RISP) model has substantially increased within health and risk communication research. This model provides insights into how individuals respond to information scarcity through seeking, processing, or avoidance behaviors. In an era of burgeoning digital media, individuals often rely on multiple channels for health information; however, systematic reviews focusing on RISP within the digital media context remain limited. This study addresses that gap with a comprehensive analysis of existing literature using the preferred reporting items for systematic reviews and meta-analyses method, with papers ($n = 26$) included from Web of Science, Scopus, and Google Scholar. This review outlines study contexts, sample characteristics, and data collection modes, offering a critical assessment of the model's evolution, especially conceptualizing relevant channel beliefs. The analysis categorizes variables into exogenous, regulatory, mediation, control, and endogenous, constructing a comprehensive causality framework. Findings indicated future RISP research should emphasize multi-channel information seeking, reflecting the complexities of the current media environment, and advocating for mixed research methods to enhance the depth of risk communication studies.

Keywords: digital health, risk information seeking and processing model, channel complementarity characteristics, systematic literature review, multi-channel information seeking, COVID-19

INTRODUCTION

During the recent public health pandemic, individual patterns of seeking health and risk information have increased markedly. Public health emergencies, such as the SARS outbreak in 2003 [1], the H1N1 flu in 2009 [2], the Ebola outbreak in 2014 [3], and most recently, the COVID-19 pandemic in 2020 [4], have created widespread uncertainty among the public. This uncertainty encompasses concerns about the outbreak's severity, the virus's contagiousness, and uncertainty about when such outbreaks will end. Consequently, the urgent need for information drives individuals to seek knowledge to reduce their uncertainties during these times ([5], [6]). From theoretical and empirical perspectives, information is a key factor influencing individual decisions to adopt healthy lifestyles or preventive behaviors [7]. Information seeking involves actively and deliberately acquiring information from preferred channels to bridge specific health knowledge gaps [8]. Multi-channel information seeking, wherein individuals access information from various sources, has led to considerable health information processing. Evidence indicates that individuals use several sources to comprehend or

address health conditions ([9], [10]). Information from diverse sources, coupled with the rapid dissemination of health data, continuously reshapes how people access health information [10]. The effects of atypical circumstances caused by the pandemic, such as reduced access to healthcare professionals due to isolation and increased pressure on healthcare systems [11], heightened media focus [12], and unprecedented access to digital devices [13], have further influenced information-seeking behaviors [14].

The digital age, characterized by the rapid development of network technology and a substantial increase in internet users, has seen the Internet—particularly social media—become a prominent medium for accessing health information ([10], [15], [16]). As a widely used platform that offers accessible health resources, the Internet has emerged as an essential means for obtaining health information [10]. Research shows that one-third of adults in the United States and more than 100 million Internet users globally seek health information online to diagnose or better understand health conditions [17]. Internet use for accessing health information among individuals in the United Kingdom has notably increased from 18% in 2007 to 51% in 2016 [18]. Similarly, a 2016 survey of 10 Asian countries revealed that 85% of internet users in Indonesia pursued health information online, followed by 86% in Vietnam, and 80% in the Philippines, with China ranking next at 79% [19]. These statistics indicate a substantial proportion of Asian individuals seeking health information online.

Additionally, the COVID-19 pandemic data show that 78.7% of users used social media more often to access health information, demonstrating a notable increase over pre-epidemic levels [20]. As people relied more heavily on Internet resources during the COVID-19 pandemic to protect themselves and their families from potential health risks, online health information sources have gradually become a research area of interest [21]. Indeed, internet-based health information has substantially improved, maintained, and restored individual health [17].

RESEARCH GAPS AND OBJECTIVES

The risk information seeking and processing (RISP) model is a theoretical framework used to understand how individuals seek and process information during times of uncertainty, particularly in the context of risks and crises [22]. This model explores the influence of various sociological, psychological, and communication factors on individual behaviors in response to risk information ([23], [24]). Researchers have expressed great interest in studying risk information communication during public health crises ([4], [25]–[28]). The RISP model has been extensively applied to diverse risk domains, including environmental risks ([29], [30]), health risks ([31], [32]), natural disasters ([33], [34]), and public information-seeking behaviors in different risk situations [35].

Despite the extensive research on the communication of risk information using the RISP model and the ongoing efforts to enhance its utility, the evolving digital media landscape has added complexity to the information-seeking process. Individuals increasingly use multiple channels to obtain their health information needs ([9,10]), yet a systematic evaluation of the RISP model's applicability in this complex digital media environment is lacking. The RISP model encompasses the interrelation of multiple variables, including sociological, psychological, and communication factors ([23], [36]). Despite substantial progress in studying these variables, gaps remain in providing comprehensive theoretical explanations, particularly in a digital context. Thus, further expansion of systematic analyses is necessary for better guidance in future research.

Researchers are interested in health and risk communication during public health crises ([6], [32], [37], [38]). Despite abundant research on health and risk communication, systematic literature reviews that offer a holistic assessment of the RISP model in digital media remain scarce. Yang & Kahlor (2013) highlighted several

limitations in existing reviews [39]. They often lack comprehensiveness by focusing on a limited range of issues, and the reviewed studies undergo insufficient quality screening. This study aims to bridge these gaps by providing a systematic literature review that comprehensively examines the application of the RISP model in health and risk communication, specifically within the evolving digital landscape.

This study helps advance knowledge in the field by systematically reviewing prior research and informing emergent research in health and risk communication within an evolving media landscape. This paper makes significant contributions across several dimensions: it provides insights into the current state of health and risk communication research from a holistic perspective, thereby enabling a deeper understanding of how individuals obtain and process information during crises in the current media environment. The analysis primarily focuses on the internal and extended components of the RISP model, as discussed in the existing literature. This study is a valuable resource for researchers who want to understand the developmental status and emerging trends in health and risk communication research, providing a foundation for future inquiry.

METHOD

System Review Framework

This research is a systematic literature review approach characterized by its comprehensive, multi-level, and integrative nature. It adopted the preferred reporting items for systematic reviews and meta-analyses (PRISMA) research method, which entails a systematic review process divided into three stages: identification, screening, and inclusion [40]. PRISMA provides several advantages, including elaborating the research question, selecting screening indicators, and precisely timing the database search [41]. Consequently, PRISMA facilitates a rigorous search and identification of relevant content within the target database. The systematic review began by developing a protocol, specifying research questions, inclusion and exclusion criteria, data sources, and data extraction and analysis methods. This systematic approach ensured the transparency and replicability of the research process.

Design Search Strategy

This study aimed to encompass pertinent empirical studies grounded in the RISP model as the theoretical framework, serving as the foundation for a systematic literature review. The research methodology was a systematic review, adhering to the guidelines delineated in the PRISMA project. Google Scholar, Scopus, and Web of Science were chosen as the search databases to synthesize relevant research findings. These three authoritative databases ensured the comprehensiveness and integrity of the sample articles. The searches were conducted between September 2023 and October 2023, providing readers with a precise date range for the search activities. Fig. 1 illustrates the flow chart detailing the systematic search process. The method section of the study delineates four key elements: publication criteria, utilized resources, systematic literature review process, and data analysis strategies [42]. Each step of the search strategy ensured maximum relevance and completeness of the results.

Systematic Selection Process

Identifier: In September 2023, we initiated the first stage of the systematic review process, identifying research-specific keywords. The keyword searches for this study concerned synonym dictionaries, dictionaries, databases that proposed synonyms for keywords, and previous research. Consequently, we obtained a list of keywords related to the RISP model, the theory of channel complementary, and multi-channel information seeking (see TABLE I). The search keywords included: “risk information seeking processing model,” “risk information seeking processing,” “risk information seeking and processing model,” “risk information seeking

and processing,” “RISP Model,” “RISP,” “channel complementarity characteristics,” “channel complementarity theory,” “multi-channel information seeking,” and “information seeking.” The final sample size was determined after multiple searches across various entries in the three databases, as illustrated in Fig. 1. Before screening, the study manually removed duplicate documents, resulting in 990 valid files.

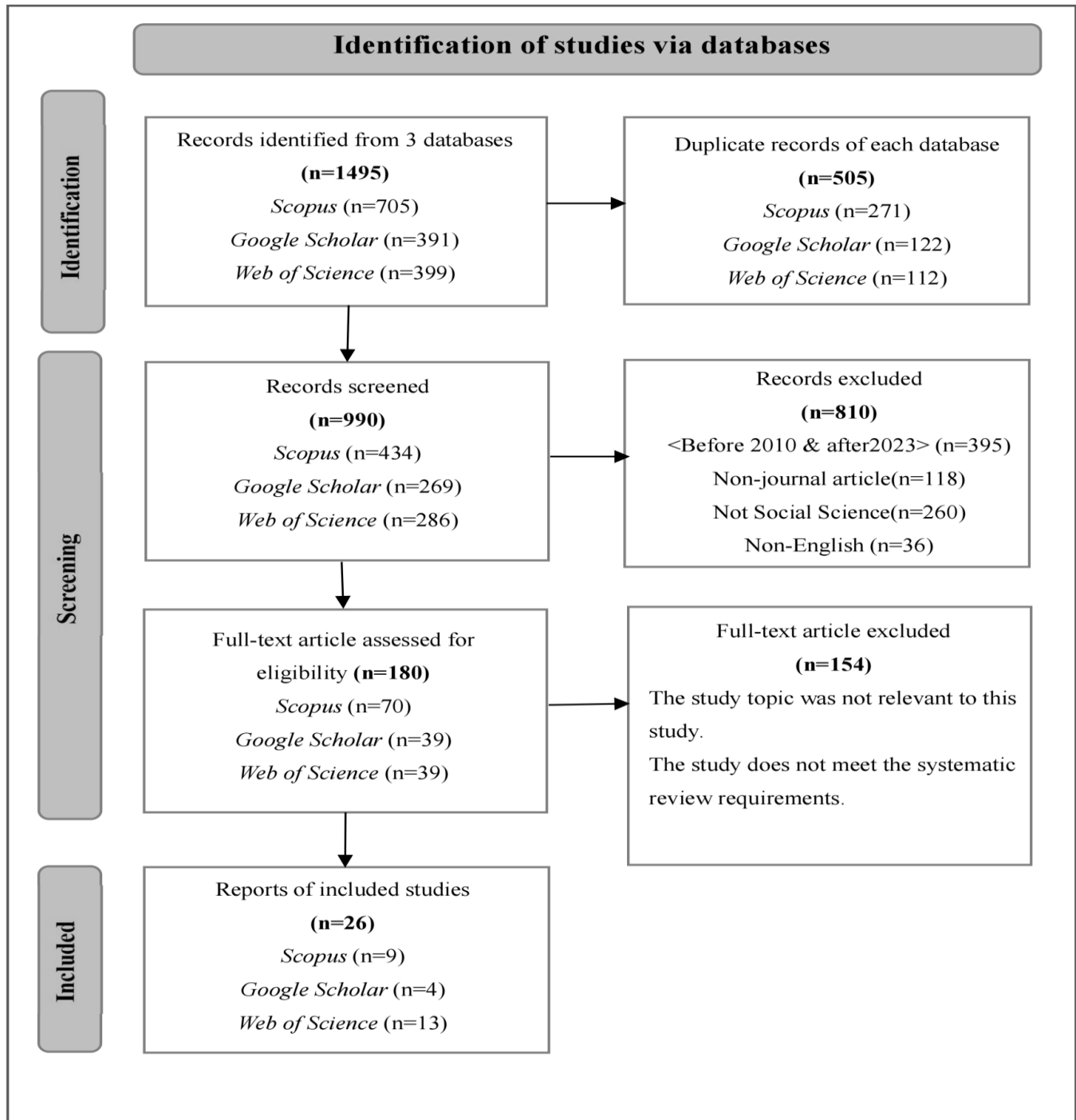


Fig. 1 Flow diagram of this systematic review process

Table I Papers Information Retrieval Strategies and Keywords

Database	Keywords and Search String
	Phase 1: TITLE-ABS-KEY (“risk information seeking processing model” OR “risk

Scopus	<p>information seeking processing” OR “risk information seeking and processing model” OR “risk information seeking and processing” OR “RISP Model” OR “RISP”)</p> <p>Phase 2: TITLE-ABS-KEY (“channel complementarity characteristics” OR “channel complementarity theory”) AND (“multi-channel information seeking” OR “information seeking”)</p>
Google Scholar	<p>Phase 1: allintitle: “risk information seeking and processing model” OR “risk information seeking processing model” OR “risk information seeking and processing” OR “risk information seeking processing” OR “RISP Model” OR “RISP”</p> <p>Phase 2: allintitle: ((“channel complementarity characteristics” OR “channel complementarity theory”) AND (“multi-channel information seeking” OR “information seeking”))</p>
Web of Science	<p>Phase 1: TS = (“risk information seeking processing model” OR “risk information seeking processing” OR “risk information seeking and processing model” OR “risk information seeking and processing” OR “RISP Model” OR “RISP”)</p> <p>Phase 2: TS = ((“channel complementarity characteristics” OR “channel complementarity theory”) AND (“multi-channel information seeking” OR “information seeking”))</p>

Filter: The screening phase was the second step in the systematic review procedure, encompassing article evaluation based on the predetermined inclusion and exclusion criteria (refer to TABLE II). The temporal scope of this study evaluation encompasses scholarly articles published from 2010 to 2023. Since 2010, the field of risk communication has witnessed numerous theoretical revisions and the emergence of new research perspectives. These theoretical advancements are crucial for deepening the understanding of the patterns and mechanisms of crisis communication. Consequently, focusing on studies published after 2010 better reflects the latest theoretical developments in the field. In practice, the social environment has undergone significant changes since 2010, marked by the frequent occurrence of natural disasters, public health emergencies and their rapid dissemination through new media platforms. These events have had profound and far-reaching impacts on society. Examining these new crisis events and communication practices can provide more targeted and practical strategies and methods for addressing real-world crises. Moreover, only research publications in peer-reviewed scholarly journals were included. Exclusions were made for books, review articles, and conference minutes. Only journals published in English were selected to avoid differences in content meaning caused by language barriers. Moreover, the study examined only journal papers that had reached the final publication stage. The categories of papers were restricted to social sciences, excluding those in fields such as medicine. Based on these inclusion and exclusion criteria, 810 articles were excluded, resulting in 180 articles that advanced to the next phase.

Table II Criteria for Inclusion and Exclusion

Exclusion criteria	Inclusion	Exclusion
Schedule	2010–2023	<2010 and >2023
Document Format	Academic journals	Journals (review articles), books, manuscripts, papers, series, and conference papers
Language	English	Other Language
Category	Social Science	Other Fields

Data collection and selection

The primary evaluation of this study encompassed the encoding of the topic and the examination of the subject matter. We analyzed the selected articles individually and discussed any inconsistencies, after which we generated themes and verified the correctness of the themes. Subsequently, we proposed and discussed several topics and formed standardized data, including the type of accreditation, study objectives, study design, study results, contributions, and limitations. Throughout this process, we ensured the impartiality of the review. At this stage, 154 articles that did not apply to the study purpose or were unsuitable for a systematic literature review were removed.

Quality assessment

This study employed a cross-sectional study assessment tool (AXIS tool) to assess the quality of the selected articles [43]—the AXIS tool subjected all 26 articles to quality standard inspection, ensuring each article met a certain level of quality and relevance before inclusion in the review. After this quality assessment, these 26 articles were used as the review benchmark.

Data analysis strategy

Data extracted from the 26 articles were reviewed and analyzed after the previous screening, review, and evaluation procedures. The selected articles were coded in a tabular manner, including the following information: (a) author, (b) year, (c) title, (d) theory, and (e) topic. Following this, further review steps were undertaken to evaluate the effectiveness of validity and credibility checks, ensuring that the article's rationality was verified twice. Finally, the study conducted a detailed content analysis of the entire dataset. Content analysis determined each article's research topic, theory/model, variables, etc ([44], [45]). The variables and the relationships between them in the literature were further organized to develop a causal framework for a comprehensive, multidimensional analysis of the concepts and models involved in previous research [46]. This detailed approach provided insights into the research gaps and helped conceptualize a clear path for further study in the field.

RESULTS

The review found that most authors used the RISP model in the context of crises. Of the 26 articles selected for review, 12 selected RISP model ([5], [22], [25]–[28], [30], [39], [47]–[50]), three articles focused on RISP model and Relevant Channel Belief (RCB) ([4], [38], [51]), one article focused on RISP model and multi-channel information seeking [52], four articles focused on RISP model, RCB and multi-channel information seeking ([32], [53]–[55]). Six articles focused on channel-complementary theory ([9], [10], [56]–[59]).

The review identified five major themes in the field of risk communication: 14 articles focused on health risks ([4], [5], [26]–[28], [32], [38], [47]–[52], [55]), two articles concentrated on the environmental crisis ([30], [39]), one article focused on the disaster crisis [54], and the other one concentrated on the product safety crisis [53]. One article covered environmental and health crises [25]. The remaining six articles focused on channel-complementary information seeking in the health context ([9], [10], [56]–[59]). (See TABLE III)

This study used the causal analysis method [46]. Articles with quantitative research methods were selected. Our research output includes a single article in 2011, another article in 2012, one article in 2013, two articles in 2014, one article in 2016, one article in 2017, one piece in 2018, seven articles in 2020, five articles in 2021,

three articles in 2022, and three papers in 2023.

Table III Research Category Information

References	Type	Theme
Yang, Z. J., Rickard, L. N., Harrison, T. M., & Seo, M. (2014, a) [30]	RISP model	Climate change, Environmental crisis
Zhang, D., Shi, Z., Hu, H., & Han, G. (2021) [55]	RISP model, RCB, Multi-channel information seeking	Health crisis
Li, J., & Zheng, H. (2022) [27]	RISP model	COVID-19, Health crisis
Lu, H., Chu, H. R., & Ma, Y (2021) [38]	RISP model, RCB	COVID-19, Health crisis
Yang, Z. J., & Kahlor, L. A. (2013) [39]	RISP model	Climate change, Environmental crisis
Yang, J. Z., & Liu, Z.L. (2021) [32]	RISP model, RCB, Multi-channel information seeking	Vaccine scandal, Health crisis
Hwang, H., & Jeong, S. H. (2020) [53]	RISP model, RCB,multi-channel information seeking	Toxic chemicals, Product safety crisis
Yang, Z. J., McComas, K., Gay, G., Leonard, J. P., Dannenberg, A. J., & Dillon, H. (2011) [52]	RISP model,Multi-channel information seeking	Health crisis
Shi, J., Hu, X., Guo, X., & Lian, C. (2020) [54]	RISP model, RCB, Multi-channel information seeking	Disaster Resettlement, Disaster crisis
Yang, Z. J., Aloe, A. M., & Feeley, T. H. (2014b) [22]	RISP model	Various crisis summary
Hwang, Y., & Jeong, S. H. (2023) [26]	RISP model	COVID-19Health crisis
Brinker, D. L., Zhou, Y., Acevedo Callejas, M. L., & MacGeorge, E. L. (2020) [48]	RISP model	Health crisis
Lin, J., & Dutta, M. J. (2017) [57]	Multi-channel information seeking	Health information
Ruppel, E. K., & Rains, S. A. (2012) [59]	Multi-channel information seeking	Health information
Moreno, Á., Fuentes Lara, C. M., & Navarro, C. (2020) [56]	Multi-channel information seeking	COVID-19, Health information
Zhang, L., Qin, Y., & Li, P. (2020) [10]	Multi-channel information seeking	HINTS, Health information
Rains, S., A. & Ruppel, E. K. (2016) [9]	Multi-channel information	Health information

	seeking	
Lee, S. T., Dutta, M. J., Lin, J., Luk, P., & Kaur-Gill, S. (2018) [58]	Multi-channel information seeking	Cancer prevention, Health information
Lu, H., APPC 2018–2019 ASK Group, Winneg, K., Jamieson, K. H., & Albarracín, D. (2020) [5]	RISP model	Influenza vaccine, Health crisis
Zhou, Y., Acevedo Callejas, M. L., & MacGeorge, E. L. (2020) [47]	RISP model	Antibiotic, Health crisis
Hovick, S. R., Bigsby, E., Wilson, S. R., & Thomas, S. (2021) [25]	RISP model	Environmental crisis, Health crisis
Choi, D. H., & Noh, G. Y. (2021) [49]	RISP model	Obesity crisis, Health crisis
Ford, J. L., Douglas, M., & Barrett, A. K. (2023) [50]	RISP model	COVID-19, Health crisis
Park, T., Ju, I., Ohs, J. E., Hinsley, A., & Muzumdar, J. (2023) [51]	RISP model, RCB	COVID-19, Health crisis
Jin, X., & Lane, D. (2022) [4]	RISP model, RCB	COVID-19, Health crisis
Zhou, X., & Roberto, A. J. (2022) [28]	RISP model	COVID-19, Health crisis

DISCUSSION

Theory and Model

The selected RISP research, mainly focusing on channel complementarity and multi-channel information seeking, uses the RISP model as the primary theoretical framework. These studies involve repeated validation, measurement, and innovation of the RISP model across various risk contexts, including health crises, environmental disasters, and information needs. Specifically, they emphasize the empirical verification of weak RCBs and categorize information-seeking variables into multi-channel information-seeking within the new media environment.

TABLE IV summarizes the theories or models used in the 26 reviewed articles. Specifically, twenty articles employed the RISP theory, while six used the channel complementarity theory. Additionally, seven articles attempted to validate the RCB variables. The findings indicate a clear direction for future research, emphasizing the need to address gaps within the RISP framework, particularly validating weak links and rectifying empirical shortcomings through quantitative testing of RCB variables. This direction includes fine-tuning specific RCB variables to enhance the model’s effectiveness.

Furthermore, 11 articles discussed multi-channel information seeking during crises, aligning with the contemporary media landscape where channels complement each other ([9,10,56,57]). This underscores the need to evolve the RISP model, particularly regarding information seeking, to better reflect the dynamics of today’s media environment. Previous research has applied numerous theories and models in investigating information seeking during critical situations, including the health information acquisition model [60], the comprehensive model of information seeking [61], health belief model [62], technology acceptance model [63], planned risk information seeking model [64], situational theory of problem-solving [65]. The RISP model, developed by Griffin et al. (2013), is widely acknowledged as a prominent theoretical framework, drawing

upon extensive prior research on risk perception and communication ([22], [24], [66]). It predicts risk information-seeking and processing behaviors and assesses the overall relevance of individual information-seeking behaviors in risk scenarios [67]. As one of the most successful attempts to integrate multiple communication theories into a unified model, the RISP model garnered substantial recognition [68].

Table IV Summary of Theories and Models Used In

Selected Analytical Articles

Theory/ Model	References	No. Item
RISP	Yang et al., 2014a [30], 2014b [22]; Zhang et al., 2021 [55]; Li & Zheng, 2022 [27]; Lu et al., 2021 [38]; Yang & Kahlor, 2013 [39]; Yang & Liu, 2021 [32]; Hwang & Jeong, 2020 [53]; Yang et al., 2011 [52]; Shi et al., 2020 [54]; Hwang & Jeong, 2023 [26]; Brinker et al., 2020 [48]; Lu et al., 2020 [5]; Zhou et al., 2020 [47]; Hovick et al., 2021 [25]; Choi & Noh, 2021 [49]; Ford et al., 2023 [50]; Park et al., 2023 [51]; Jin & Lane, 2022 [4]; Zhou & Roberto, 2022 [28].	20
Multi-channel Information Seeking	Yang et al., 2011 [52]; Yang & Liu, 2021 [32]; Zhang et al., 2021 [55]; Lin & Dutta, 2017 [57]; Shi et al., 2020 [54]; Hwang & Jeong, 2020 [53]; Ruppel & Rains, 2012 [59]; Moreno et al., 2020 [56]; Zhang et al., 2020 [10]; Rains & Ruppel, 2016 [9]; Lee et al., 2018 [58].	11
RCBs	Zhang et al., 2021 [55]; Yang & Liu, 2021 [32]; Hwang & Jeong, 2020 [53]; Shi et al., 2020 [54]; Lu et al., 2021 [38]; Jin & Lane, 2022 [4]; Park et al., 2023 [51].	7
Channel Complementary	Zhang et al., 2020 [10]; Rains & Ruppel, 2016 [9]; Moreno et al., 2020 [56]; Ruppel & Rains, 2012 [59]; Lin & Dutta, 2017 [57]; Lee et al., 2018 [58].	6

The RISP model is popular for health-related risk studies, such as those concerning H1N1 [69], Covid-19 ([32], [35], [50]), and environmental disasters ([34], [70]). Despite its extensive use, certain issues still persist. Notably, the field is relatively narrow, with many researchers primarily focusing on the original RISP model for extended research, making limited innovative adjustments to its variables ([22], [66]). According to Dutta-Bergman (2004), when motivated to obtain information on a topic, individuals use all available sources perceived to satisfy their information needs [71]. Tian and Robinson (2008) examined three primary communication channels—traditional media, face-to-face communication, and the Internet [72]. They concluded that consumers use multiple channels, including traditional media, online platforms, and interpersonal communication, to acquire desired health information. While some research addresses multi-channel information seeking and employs it as a research variable [52], scholars have generally paid limited attention to this aspect, with no comprehensive investigations thus far. Most studies discuss information-seeking behavior but fail to explore individual use of various media channels for information acquisition ([26], [27], [30], [48]). Given the current omni-media environment, understanding how individuals utilize different media is crucial. Some scholars advocate exploring diverse media for information gathering and conducting thorough investigations ([56], [73]).

Although the RISP model is a dominant framework in crisis communication research, scholars have highlighted considerable ambiguities concerning the specific beliefs constituting the RCB variable [22]. Research reveals that RCB testing is substantially less frequent than other RISP model components [74].

Moreover, empirical support for the importance of RCBs within the RISP model remains limited [75]. The RCB variable remains one of the least established and least understood aspects of the RISP frameworks. Additionally, there is ongoing uncertainty regarding appropriate methodologies for measuring the RCB variable ([22], [31]). Several studies have not established a statistically significant relationship between RCBs and risk information-seeking intentions [51]. Many investigations either overlooked this aspect of channel beliefs or found it misaligned with contemporary risk communication paradigms ([29], [31], [33]). Given the evolving nature of media and audience information-seeking behavior, scholars should revise and refine the RCB construct to reflect the current risk communication landscape accurately.

As information providers increasingly diverge from traditional mass media, recent research indicates that individuals actively select or avoid various information sources ([71], [76], [77]). Dutta-Bergman (2004) argues that newer channels do not necessarily replace existing ones; users tend to leverage multiple channels to complement each other, accessing information across diverse platforms to meet their needs [71]. Individuals interested in a specific topic or content area typically use all available media channels to gather the required information [78]. Evidence shows that individuals rely on multiple sources to understand or address health-related issues ([14], [79]). How people acquire health information is continuously evolving, driven by the proliferation of information sources and the rapid dissemination of health-related content [10].

Drawing from the relevant literature, we observed that channel complementarity theory and related channel beliefs are the attributes of information sources ([23], [24], [59]). Ruppel and Rains (2012) highlighted the empirical testing of channel complementarity theory [59]. Rains and Ruppel (2016) assert that the accessibility and quality of health information have improved substantially, enabling individuals to access a wide range of health-related content through various platforms, including print media, digital media, websites, and emerging media [9]. The growing body of scholarly literature emphasizes the complementary use of traditional media and the Internet as health-related information sources, as evidenced by studies cited in the present research ([57], [72]). Research also indicates that health communication channels exhibit complementarity across three distinct levels: between traditional media and the Internet within mass media, between interpersonal and mass media channels about disease severity, and between future interpersonal and mass media channels [80]. Ruppel and Rains (2012) further expand the concept of complementary characteristics within health information sources, identifying four key attributes that enhance their effectiveness: access to medical expertise, tailorability, anonymity, and convenience [59]. These complementary characteristics are essential for information-seeking behaviors, as individuals systematically employ sources aligning with each characteristic ([9], [81]).

Compared to media characteristics within RCBs, channel complementarity theory aligns more closely with contemporary media ecological and audience information-seeking behaviors, providing more precise descriptions of channel attributes. From this perspective, the RCBs within the RISP model could benefit from reconstruction to reflect these developments more accurately.

Conceptual framework

A causal framework provides a research-based, internally consistent logical structure with predictors, moderators, mediators, and outcomes. This framework integrates exogenous, moderator, mediating, and endogenous variables [82]. In particular, moderator and mediator variables influence the relationship between exogenous and endogenous factors [83].

In the context of multi-channel information seeking during crises, various impact factors and outcomes must be considered, along with multiple constructs contributing to advancing research in this field. This study employs a causal framework to systematically examine the multivariate effects of crises (e.g. Fig. 2). Given the

diverse nature of crisis topics, key variables often differ between researchers. While the RISP model encompasses numerous variables, scholars typically focus on those most relevant to their specific research topics and prioritize relationships among selected variables. Furthermore, variable categorization frequently varies across studies. Depending on the study’s context and objectives, they may be mediating or exogenous. Based on the selected articles, the classification is organized in TABLE V.

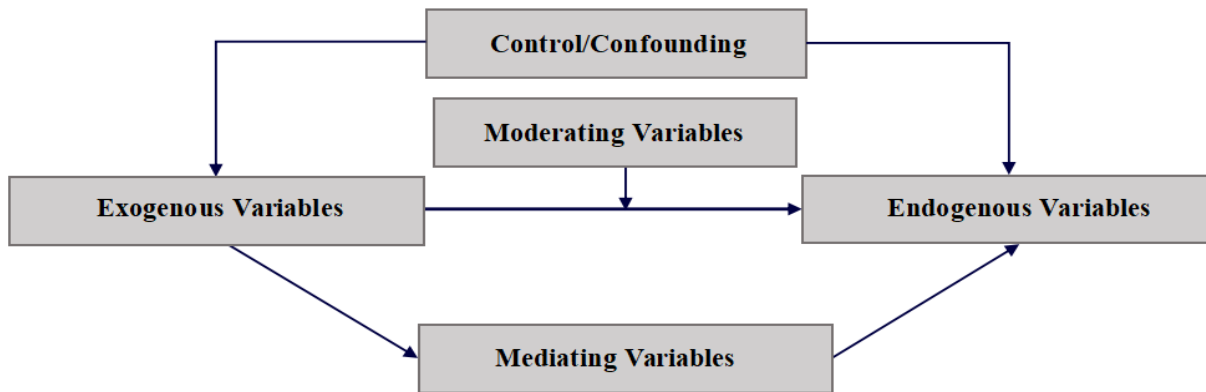


Fig. 2 Conceptual Framework.

Table V Classification of Variable Collection

Type of variable	Covering variables
Exogenous variables	Information Subjective Norms (ISN)
	Information Insufficiency
	Risk Perception
	Affective Response
	RCBs
	Perceived Information Gathering Capacity (PIGC)
	Individual Characteristics
Moderator variable	RCBs
	PIGC
	ISN
	Information Heuristic Processing
Mediating variable	Information Insufficiency
	Information Sufficiency
	ISN
	Negative Emotions
	Patient-centered Communication
	Demographic variables: age, gender, education level, family income, race, religious beliefs, employment, and marital status

Control/ variables	Health and Social factors variables: health conditions, physical health, chronic diseases, and health insurance of the participants; the frequency of diagnosis; political orientation; whether friends or family members were infected with COVID-19; the total number of sources of search; junior health provider; Internet use; and the number of sources used during the search process.
Endogenous Variables	Information Seeking
	Information Seeking and Processing
	Multi-channel Information Seeking
	Channel Complementarity

Exogenous variables: In the causal framework developed for this study, exogenous variables serve as predictors of outcome variables. Based on the analysis of 26 risk communication studies, exogenous variables comprise the following components:

1. ISN
2. Information Insufficiency
3. Risk Perception
4. Affective Response
5. RCBs
6. PIGC
7. Individual Characteristics

ISN plays a remarkable role as an exogenous variable in risk communication studies. ISN refers to the perception that certain information is important to individuals and that they expect others to understand relevant risk issues. This perception often motivates individuals to act upon these expectations and actively seek information [52]. Of the studies examined, twelve focused on ISN as an exogenous variable, investigating its influence on various aspects of information behavior. Several scholars examined the correlation between ISN and information insufficiency, highlighting how ISN shapes the perception of knowledge gaps and the need for further information ([5], [27], [28], [30], [39], [50], [51]). These studies suggest that when individuals feel socially compelled to understand a particular issue, they become more aware of knowledge gaps and seek additional information.

Additionally, researchers explored ISN’s direct impact on information-seeking behaviors. Studies show that ISN drives individuals to pursue risk-related information across various communication environments actively ([5], [26]–[28], [32], [39], [47], [50], [52], [53]). This relationship underscores how social expectations and norms regarding information importance influence the tendency to seek out information, particularly in risk-laden contexts. In addition to promoting information seeking, ISN also affects information avoidance in certain situations. Some researchers investigated how ISN may lead individuals to avoid risk information due to heightened social pressure or the overwhelming nature of risk communication ([39], [47], [50], [53]). Moreover, ISN is linked to information system processing, where individual perception of social norms regarding risk understanding motivates them to seek or avoid information ([26], [53]). The research indicates that ISN is crucial in shaping information-seeking and avoidance behaviors and influencing how individuals process risk information within different communication environments.

Information insufficiency is a critical exogenous variable in risk communication studies. It refers to the gap between an individual's current understanding and knowledge they perceive as necessary, also known as the “sufficiency threshold” [24]. Numerous studies have validated the direct correlation between information

insufficiency and active risk information seeking ([4], [5], [26]–[28], [39], [50], [51], [53]). Scholars have also examined how information insufficiency is linked to information avoidance ([26], [39], [50], [53]), system processing [53], and heuristic processing ([26], [53]). This concept plays a central role in determining how individuals engage with risk information and how they process it cognitively.

Risk perception, another exogenous variable, is crucial in shaping affective responses. Risk perception refers to individual judgments of risk characteristics and severity, indirectly influencing information insufficiency by eliciting emotional reactions [33]. These perceptions shape the extent to which individuals seek information and influence their emotional responses to perceived risks.

As an exogenous variable in risk communication, affective response refers to the positive or negative emotional reactions individuals experience in response to stimuli, particularly risks [84]. The RISP model integrates these emotional responses, recognizing their role in shaping individuals' engagement with risk-related information ([4], [37], [50]).

Researchers have demonstrated that risk perception and the affective responses it elicits substantially influence individuals' information-seeking behaviors. Risk perception—how individuals assess the severity or probability of a risk—triggers both positive and negative emotions, which in turn drive different information behaviors ([4], [22]). For example, heightened perceptions of risk evoke negative emotions, often motivating individuals to seek additional information to mitigate uncertainty or fear ([33], [39], [50]). Conversely, positive emotions like optimism may reduce individuals' perceived need for further information.

Studies in risk research have demonstrated a notable positive association between risk perception and negative emotional impact ([27,51]). At the same time, there is an inverse relationship between risk perception and positive emotional impact ([50], [85]). Moreover, affective responses are crucial in shaping individuals' perceptions of their knowledge deficits ([22], [23], [33]). Specifically, a stronger negative affective response is associated with an increased awareness of knowledge inadequacy, whereas a stronger positive affective response corresponds with a reduced perception of knowledge insufficiency ([27], [51], [86]). Negative affective states tend to motivate individuals to seek out information, while information avoidance is more frequently associated with adverse outcomes ([22], [39]). Conversely, a positive effect can hinder individuals' motivation to seek knowledge actively, as it is positively correlated with a propensity for information avoidance ([22], [39]).

Another critical exogenous variable in risk communication research is RCBs. They encapsulate cognitive and affective processes through which individuals evaluate information channels [74]. Conceptualized initially as beliefs regarding information channels—such as trustworthiness and availability—the updated definition of RCBs encompasses an individual's perceptions and assessments of the various channels they use to seek and process risk-related information [24].

The RISP model emphasizes that RCBs influence information-seeking intentions, either directly or indirectly [4]. Positive perceptions of relevant channels are associated with an increased likelihood of seeking risk information [54]. In contrast, negative beliefs about channels—such as perceptions of bias, inaccuracy, or incomplete information in the media—are linked to information-seeking behaviors that result in negative outcomes [87]. PIGC is another important exogenous variable in risk communication research. Studies show that a perceived ability to effectively gather information positively impacts the individual's risk information-seeking behavior ([26], [54]). Moreover, it positively correlates with systematic information processing, indicating that individuals more capable of acquiring information are more likely to engage in thorough and analytical processing of risk-related information ([26], [32]).

Individual characteristics, an essential set of exogenous variables, have been studied in the context of risk communication ([23], [24]). Research indicates that younger individuals are more likely to seek information through interpersonal sources, whereas older adults and those of white ethnicity are more inclined to seek information overall [52]. In contrast, minority groups and individuals from lower-income households tend to rely more heavily on media sources [52]. Furthermore, individuals with health issues are less likely to seek answers online, while women and older adults are likelier to have specific questions [52]. Individual characteristics—encompassing demographics, socioeconomic factors, and health conditions—substantially shape how people perceive and respond to the risks associated with crisis events [51].

Moderator variables: Moderator variables are crucial in shaping the relationship between exogenous and endogenous variables in risk communication research. Among the 26 studies examined in the context, several key variables are moderators, including:

1. RCBs
2. PIGC
3. ISN
4. Information Heuristic Processing

These moderator variables modulate the effect of exogenous on endogenous variables within the risk communication research framework. For instance, in the context of hazardous chemical communication in South Korea, RCBs play a pivotal role in moderating the influence of information insufficiency on individuals' intentions to seek information [53]. The central premise is that information insufficiency prompts increased information-seeking behavior only when individuals hold positive perceptions of a particular communication channel [53]. In other words, an individual's beliefs regarding the credibility and reliability of a specific channel significantly shape their likelihood of using that channel when confronted with an information deficit [53].

When individuals perceive information channels as highly credible and useful, their sense of information insufficiency intensifies, increasing their intention to seek additional information. Conversely, individuals with lower awareness of channel credibility and usefulness are less likely to seek information, even when they acknowledge insufficient knowledge [4]. Studies grounded in the RISP model have also demonstrated the moderating role of PIGC in the relationship between information insufficiency and intentions to seek information, particularly in the context of COVID-19 ([4], [51]). Additionally, PIGC moderates the relationship between RCBs and information-seeking behaviors. For instance, research found that Chinese parents who believed they had extensive knowledge of vaccine controversies were less likely to consult media sources if they perceived those channels as biased [32]. Moreover, the ISN's moderating role has been observed in the relationship between risk perception and vaccination intent [32].

Information heuristic processing modifies the relationship between misinformation exposure and misinformation acceptance. When individuals engage in cognitive processes involving higher-level heuristics, exposure to misinformation has a more pronounced effect on misinformation acceptance [26].

Mediating variable: In the conceptual framework, mediating variables clarify the relationship between exogenous and endogenous variables. This study's key mediating variables include information insufficiency, information sufficiency, ISN, negative emotions, and patient-centered communication.

The mediating role of information sufficiency is particularly evident in the relationship between perceived risk characteristics and information-seeking behavior, as well as between self-efficacy and information recognition behavior [54]. Both perceived risk characteristics and self-efficacy are influential factors that directly and

indirectly motivate individuals to seek risk information to achieve sufficient knowledge [54]. Additionally, core motivational factors shape perceived risk characteristics, such as information insufficiency and ISN. They indirectly affect the processes of information seeking and processing [32].

Moreover, information insufficiency is a mediating factor between the perceived benefits of influenza vaccination and the intentions of unvaccinated individuals to seek additional information. Information insufficiency also mediates the relationship between ISN and the intention to seek knowledge among unvaccinated individuals [5]. Previous research demonstrated that affective responses and ISN substantially drive information-seeking behavior in situations characterized by information insufficiency [52].

A clinical trial enrollment study found that risk perception primarily influences information-seeking by mediating negative emotions. This finding indicates that participation in clinical trials may evoke negative feelings among cancer patients and their caregivers, who perceive such trials as a risky treatment option [52]. Additionally, patient-centered communication, which occurs through various channels, including entertainment media, search engines, social media, and mobile health applications, mediates the effect of health information seeking behavior (HISB) on adopting healthy lifestyles [49].

Control variables and confounding variables: Research is often conducted within complex social environments, where multiple factors can interfere with examining exogenous and endogenous variables and their interrelationships [88]. Consequently, controlling for confounding variables is crucial to ensure the validity and reliability of study outcomes. The literature reviewed for this study identifies two primary categories of control and confounding variables: demographic, health, and social factors. These variables substantially influence study results. They must be carefully considered and controlled to maintain the integrity of the findings.

Demographic characteristics are frequently employed as control variables in surveys; researchers use them to account for the effects of other variables on risk information-seeking behavior. Commonly tested demographic variables include age, gender, education level, and family income [27].

Furthermore, health-related variables are common control variables to examine general media usage and account for health-related factors. These variables may include physical health status, chronic diseases, health insurance coverage, frequency of medical diagnoses, and other relevant health indicators [49].

When investigating HISB, studies often control for multiple variables, including age, education level, gender, general health status, the number of information sources used, availability of healthcare providers, and Internet usage [59]. These control measures help minimize the influence of confounding factors, leading to more accurate interpretations of the data.

Researchers also control the number of information sources used during information-seeking to explore differences between participants who actively seek or avoid health information when confronted with perceived health risks [9]. In addition to demographic and health-related variables, researchers often consider factors such as whether participants have ensured that all children in their care have completed mandatory childhood vaccinations [32]. For instance, in RISP studies, controlling for current knowledge is crucial, as it allows researchers to understand the relationship between information insufficiency and information-seeking behavior [39]. This control ensures that variations in information-seeking behavior are not solely due to differences in prior knowledge, thereby enhancing the validity of the findings.

Endogenous variables: Endogenous variables function as the outcome variables within a causal framework,

representing the result influenced by exogenous, moderator, and mediating variables. From our review of the selected articles, the key endogenous variables include information seeking, information processing, and channel complementarity. Within the category of information-seeking variables, several subcategories emerge, such as single-channel information seeking, multi-channel information seeking, and the combined dimension of information seeking and processing. These variables encapsulate the various dimensions of individual behaviors, preferences, and strategies in acquiring and processing relevant knowledge, highlighting the complexity of information-seeking activities across different channels.

During crises, individual perceptions of positive or negative affective responses can substantially shape their intentions to seek and share information ([22], [66]). Psychological factors, such as social norms, attitudes toward information seeking and sharing, and perception control over information seeking and sharing, play crucial roles in influencing these behaviors ([5], [25], [89]). Social standards and psychological factors, including attitudes and perceived control, are pivotal in determining how individuals approach information-seeking and sharing during times of crisis.

High-risk perceptions and negative emotional responses, such as anxiety, fear, or anger, tend to heighten information-seeking behaviors ([22], [30], [66]). When faced with potential threats, individuals are more likely to seek information to understand better and mitigate the perceived risks ([25], [89]). Furthermore, research has shown that positive attitudes toward seeking information about COVID-19 correlate with increased information-seeking behavior and inversely correlate with information avoidance. This finding underscores the critical role of individual attitudes in shaping information behavior during crises [50].

Information-seeking behavior is positively influenced by RCBs, indicating that the more trust individuals place in a particular information channel, the more likely they are to seek information from it [54]. Additionally, elevated perceived risk levels correlate with increased information-seeking tendencies, indicating that individuals are more motivated to pursue information when they perceive a higher degree of risk [54].

Trust in risk-related information disseminated by mass media further strengthens the likelihood of actively seeking relevant information, highlighting its critical role in shaping information-seeking behaviors [54]. Moreover, information insufficiency and ISN are reliable predictors of individuals' inclinations toward information-seeking behaviors ([22], [66]). Higher levels of perceived risk are also associated with heightened negative emotions and an increased demand for information, underscoring the complex interplay between risk perception, emotional responses, and information needs [34].

Studies conducted during the COVID-19 outbreak underscore the significance of risk perception and uncertainty as key predictors of information-seeking behavior. Emotional responses to risk situations are closely linked to information-seeking behaviors, highlighting the complex relationship between how individuals perceive risk, emotional states, and tendencies to seek information [86]. This connection suggests that heightened risk perception and emotional uncertainty can intensify individuals' motivation to seek information to reduce ambiguity and better understand potential threats.

Multi-channel information-seeking has been extensively studied, with some research dividing information-seeking channels in greater detail ([52], [53], [55]). In times of crisis, individuals use a more comprehensive range of channels to stay informed since the situation's urgency prompts them to seek out the latest updates from multiple sources ([52], [55]). Respondents commonly turn to media outlets, online social media platforms, family and friends, doctors, health professionals, school administrators, and public announcements to gather information [69]. Notably, there are substantial differences in individuals' intentions to seek information from various channels. In order of preference, the most frequently used channels include

news media, social media, government sources, and interpersonal communication [53]. Furthermore, studies have highlighted differences in each channel’s degree of influence on information-seeking behaviors [52].

Research also shows that individuals use a variety of platforms—including social media, mobile health applications, information-centered media, and entertainment-focused media—to seek and disseminate health information [10]. Scholars have identified complementary patterns in the use of different media channels. For example, individuals relying on search engines for health-related information are also likely to access similar content through social media platforms and mobile health apps, demonstrating an integrated approach to multi-channel information seeking [10].

Two studies have specifically explored the predominant online sources of health information in today’s media landscape. Zhang et al. (2021) investigated the selection and use of online multi-channel health information platforms, revealing varying platform usage among Chinese individuals [55]. Their findings indicate that while search engines are the most frequently used platform, social media platforms surpass other channels in terms of engagement [55]. Notably, when using search engines, individuals actively employ keywords to search for related topics [55]. Additionally, they frequently consult online encyclopedias and question-and-answer websites to address specific queries, which leads to complementary usage among search engines, online encyclopedias, and question-and-answer websites [55].

Channel complementarity theory proposes that individuals use multiple channels in a complementary manner to acquire health-related information. Beyond traditional sources such as newspapers and family members, the Internet has become a crucial source of health information [57]. This theory applies mainly to public health crises, such as the COVID-19 pandemic, when individuals diversify their information sources and rely on multiple channels to stay informed. For example, research conducted during the COVID-19 crisis in Spain demonstrates that media consumption patterns are more apparent through the lens of channel complementarity theory. Individuals engage with multiple media and channels simultaneously, underscoring the complementary nature of their information-seeking behaviors [56].

Individuals frequently rely on various sources of health information, including health providers, printed media, and online support groups. Each source offers distinct advantages catering to information seekers’ varying needs, such as access to medical expertise, the ability to customize information, anonymity, and convenience [9]. As information-seeking behaviors evolve in contemporary society, individuals can leverage multiple sources, each providing unique benefits. The concept of complementary channels has expanded beyond traditional media to include four critical characteristics of health information sources: access to professional medical expertise, the capacity for tailorability, the provision of anonymity, and ease of convenience [59].

Table VI The Relevant Channel Beliefs (Rcbs) In the Risp Model

<p>Current Situation</p>	<p>There is considerable ambiguity regarding the specific beliefs that constitute the RCB variable [22].</p> <p>The frequency of RCB testing is significantly lower than that of other components within the RISP model [74].</p> <p>Empirical support for the significance of RCB within the RISP model remains limited [75].</p> <p>Uncertainty persists regarding the appropriate methods for measuring the RCB variable ([22], [31]).</p>
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	<p>Several studies have yet to establish a statistically significant relationship between RCB and risk information-seeking intentions [51].</p> <p>Many studies either overlooked this aspect of channel beliefs or found it inconsistent with contemporary risk communication paradigms ([29], [31], [33]).</p>
<p>Improvements</p>	<p>Given the evolving nature of media and audience information-seeking behaviors, scholars should revise and refine the RCB construct to accurately reflect the current landscape of risk communication.</p> <p>From the relevant literature, we observe that channel complementarity theory and the relevant channel beliefs are both attributes of information sources ([23], [24], [59]).</p> <p>3. Ruppel and Rains (2012) expanded on the concept of complementary characteristics in health information sources, identifying four key attributes that enhance their effectiveness: access to medical expertise, tailorability, anonymity, and convenience [59]. These complementary characteristics are essential for information-seeking behaviors, as individuals systematically use sources aligned with each of these attributes ([9], [81]).</p> <p>4. Compared to the media characteristics within RCB, channel complementarity theory is more closely aligned with contemporary media ecosystems and individuals' information-seeking behaviors, offering a more precise description of channel attributes.</p> <p>5. From this perspective, RCBs in the RISP model could benefit from reconstruction to more accurately reflect these developments.</p>
<p>RCBs as Exogenous Variables</p>	<p>Initially conceptualized as beliefs about information channels—such as credibility and availability —RCB's updated definition includes individuals' perceptions and evaluations of the various channels they use to seek and process risk-related information [24].</p> <p>The RISP model emphasizes that RCBs directly or indirectly influence information-seeking intentions [4]. Positive perceptions of relevant channels are linked with an increased likelihood of seeking risk information [54].</p> <p>In contrast, negative beliefs about channels—such as perceptions of bias, inaccuracy, or incomplete information in the media—are associated with information-seeking behaviors that lead to negative outcomes [87].</p>
<p>RCBs as Moderator Variables</p>	<p>RCBs play a key role in moderating the impact of information insufficiency on individuals' intentions to seek information [53].</p> <p>2. The central premise is that information insufficiency prompts increased information-seeking behavior only when individuals have positive perceptions of a specific communication channel [53]. In other words, an individual's beliefs about the credibility and reliability of a specific channel significantly influence their likelihood of using that channel when confronted with an information deficit [53].</p>

	<p>3. When individuals perceive an information channel as highly credible and useful, their sense of information insufficiency is heightened, increasing their intention to seek additional information. In contrast, individuals with lower awareness of a channel's credibility and usefulness are less likely to seek information, even if they acknowledge knowledge gaps [4].</p>
<p>Improvements</p>	<p>Given the evolving nature of media and audience information-seeking behaviors, scholars should revise and refine the RCB construct to accurately reflect the current landscape of risk communication.</p> <p>From the relevant literature, we observe that channel complementarity theory and the RCBs are both attributes of information sources ([23], [24], [59]).</p> <p>3. Ruppel and Rains (2012) expanded on the concept of complementary characteristics in health information sources, identifying four key attributes that enhance their effectiveness: access to medical expertise, tailorability, anonymity, and convenience [59]. These complementary characteristics are essential for information-seeking behaviors, as individuals systematically use sources aligned with each of these attributes ([9], [81]).</p> <p>4. Compared to the media characteristics within RCB, channel complementarity theory is more closely aligned with contemporary media ecosystems and individuals' information-seeking behaviors, offering a more precise description of channel attributes.</p> <p>5. From this perspective, RCB in the RISP model could benefit from reconstruction to more accurately reflect these developments.</p>

Potential cross-cultural variations

Considering the RISP model's origins in the Western context, its constructs and measurements may more accurately capture the information-seeking and processing tendencies of Western populations (Kim et al., 2020). Most RISP research has been conducted in Western countries, for instance, in the United States (Hurricane Harvey, [34]; Antibiotic Risks, [47]; COVID-19, [4]; Cancer, [52]). However, a handful of scholars have explored this topic in research on Eastern countries, such as China (Vaccine scandals, [32]; COVID-19, [27]), Singapore (Transboundary air pollution, [70]), and South Korea (Toxic chemicals in consumer products, [53]). Successful validations of the model have been conducted in Eastern and Western cultural contexts.

However, related research has still identified directions worth exploring. Firstly, researchers stated that the behavior of people influenced by Western culture during the COVID-19 pandemic was influenced by social norms [51]. In particular, Chinese collective culture is strongly affected by social norms [51]. The results of the present study confirmed that the Chinese feel more information insufficiency due to the influence of social norms, the impact of social norms on individuals' perception and behaviors may differ according to social and cultural contexts [27]. However, comparative research on risk communication in Eastern and Western cultures can be further explored [51]. Secondly, Jin and Lane (2022) examined online information-seeking behaviors during the COVID-19 pandemic. They stated that Americans' information-seeking behavior was influenced by their personal experiences with risk and their perceptions of social norms regarding information. They revealed

that information insufficiency alone did not predict online information-seeking behaviors. Alternatively, individuals often overestimated their understanding of COVID-19, highlighting a common disconnect between perceived and actual knowledge. This warrants a deeper comparative exploration across different cultural contexts. Thirdly, a current study newly reported no moderating effect of channel beliefs in the relation between information insufficiency and information-seeking intentions in the US population [51]. This finding is not consistent with that of a previous study with a Chinese sample, which suggests the flexible applicability of the RISP model depending on study sample and cultural contexts [87]. While developing and refining theory, it is crucial to examine the validity of a theoretical prediction across various cultural contexts and populations. Future studies are required to investigate these potentialities within cross-cultural frameworks (Kim et al., 2020).

LIMITATIONS AND FUTURE DIRECTION

One limitation of this systematic literature review is the restriction to only three databases (Web of Science, Scopus, and Google Scholar) for article retrieval. This narrow focus may introduce potential biases in the sample selection process, as relevant studies published in non-English languages or indexed in other databases not included in the search could have been overlooked. Consequently, the findings of this review may only partially capture the breadth of research on the topic. Future researchers can utilize international academic databases, journal websites, and library resources to collect non-English literature on crisis communication, providing diverse cultural perspectives on cases, theories, and methods. Key non-English works can be translated professionally or via software and integrated with English-language reviews. Comparative analysis should address research priorities, methodologies, and conclusions across languages. Non-English findings can test the universality of crisis communication theories. If theories prove inapplicable in certain cultural or linguistic contexts, researchers should analyze factors such as cultural or structural differences to refine and enhance theoretical frameworks.

A second limitation is the focus on articles published after 2010, primarily centering on health crisis communication. While this focus is timely, particularly given the significant impact of the COVID-19 pandemic around 2020, future systematic literature reviews could benefit from broadening their scope to include a wider variety of crisis events beyond health risks. Additionally, comparative review studies that classify and analyze different crisis communication strategies are needed to provide a foundation for anticipating new research developments across diverse types of crises.

Third, the empirical studies included in this review mostly came from single sites, with limited exploration of cross-cultural applicability or comparative analyses across different locations within the same theoretical framework. This lack of cross-cultural examination may restrict the generalizability of the findings. Therefore, future research should prioritize investigating the cross-cultural effectiveness of crisis communication to address this gap and provide a more nuanced understanding of how crisis communication strategies perform in diverse contexts.

Lastly, this systematic literature review exclusively focused on empirical studies, omitting conceptual or qualitative research. The theoretical scope was also limited to the RISP model and channel complementarity characteristics theory. This narrow focus leaves a gap in providing a comprehensive review of the current state of crisis communication research. Future studies should address this limitation by incorporating a broader range of theoretical perspectives and methodologies, including conceptual and qualitative studies, to offer a more panoramic view of the field. This approach will help guide future research and build a more holistic knowledge system in crisis communication.

CONCLUSION

This systematic literature review examines comprehensively the RISP model within the context of health and risk communication, particularly in the evolving digital media landscape. By categorizing variables into exogenous, moderator, mediating, and endogenous components, this review highlights the intricate relationships influencing information-seeking behaviors during crises. Researchers can, based on research findings, recognize that information-seeking behavior during crises is influenced by complex relationships involving exogenous, moderating, mediating, and endogenous factors. This highlights the need to comprehensively consider multiple factors in both research and practice, accounting for how these factors collectively affect individuals' seeking, processing, and sharing of information. The study identifies multi-channel information seeking and channel complementarity as crucial elements in modern risk communication, emphasizing that individuals increasingly rely on diverse platforms to access, process, and share information in times of uncertainty. This complexity necessitates a deeper exploration of how these channels interact to shape information behaviors. The findings of this review underscore the importance of RCBs, PIGC, and ISN as significant factors that drive information-seeking behaviors. These variables are pivotal in determining how individuals perceive and respond to risk-related information, particularly when confronted with insufficient knowledge. Researchers in health and risk communication can focus on these key factors, analyzing how they can enhance public perception of risk information and foster appropriate responses. Particular attention can be given to strategies for strengthening these factors to facilitate the effective acquisition of risk information, especially in contexts where public knowledge is limited. The review also demonstrates the relevance of emotional responses, such as anxiety and hope, in shaping risk perception and information-seeking tendencies. Additionally, the influence of individual characteristics, such as age, education, and socioeconomic status, further complicates the information-seeking process. This suggests that researchers should consider individuals' emotional states and individual differences when developing communication strategies. For instance, tailoring the format and content of risk communication plans to different age groups and educational levels can enhance the effectiveness of information communication. Notably, the limited cross-cultural applicability and the restricted focus on health crises reveal opportunities for future studies to expand the scope of risk communication research. Risk communication researchers can conduct comparative analyses across various crises and cultural contexts to enhance the generalizability of research findings. Such studies can provide theoretical support for developing effective communication strategies tailored to different regions and types of crises.

Moreover, the review highlights the under-explored potential of multi-channel information-seeking behaviors and the complementary use of media in contemporary crisis communication. the integration of traditional and digital media. Researchers can investigate the interaction mechanisms among different media channels to explore ways to optimize and integrate media resources, better meeting public information needs during crises. For example, they can study how social media, mobile health applications, and search engines collaborate in disseminating risk information and leverage their respective strengths. In conclusion, while the RISP model remains a dominant theoretical framework in risk communication research, there is a growing necessity for more comprehensive and interdisciplinary approaches to better reflect the complexities of modern media environments. Future research should

actively incorporate interdisciplinary knowledge can enrich risk communication theories. Additionally, integrating qualitative methods into research approaches can provide deeper insights, and addressing the evolving dynamics of information-seeking behaviors across different crises and cultural settings. This broader perspective will contribute to a more holistic understanding of risk communication, ultimately guiding the development of more effective strategies to meet the information needs of diverse populations in times of crisis.

Conflicts Interest

The authors have no competing interests to declare that are relevant to the content of this article.

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SQ and JT conceptualized the study. SQ conducted data analysis and wrote the original draft. SQ and JT revised the manuscript. All authors reviewed and approved the final version of the manuscript.

ABBREVIATIONS

HISB: health information seeking behavior

ISN: Information Subjective Norms

PIGC: Perceived Information Gathering Capacity

PRISMA: preferred reporting items for systematic reviews and meta-analyses

RCB: Relevant Channel Belief

RISP: risk information seeking and processing

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