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Models and components in disaster risk communication: A systematic literature review

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Abstract:

BACKGROUND AND AIM: Risk communication is considered a major factor in disaster risk management by the concerned policymakers and researchers. However, the incoherence of variables affecting risk communication in various studies makes it difficult to plan for disaster risk communication. This study aims to identify and classify the influential components in disaster risk communication.

MATERIALS AND METHODS: This systematic review was conducted in 2020. Databases included PubMed, Scopus, and Web of Science. In searching for articles, there was no limit on the date of publication and the language of the article. The research addressed both natural and man-made disasters. The Preferred reporting items for systematic review and meta-analysis protocols (PRISMA) checklist was followed throughout the research, and the quality of the papers was assessed using the mixed methods evaluation tool (MMAT).

RESULTS: In searching the articles, 3956 documents were obtained, of which 1025 duplicated articles were excluded. The titles and abstracts of the remaining documents (2931) were examined, of which 2822 were deleted, and the full text of 109 documents was studied for further assessment. Finally, after applying the inclusion and exclusion criteria and reviewing the full texts, 32 documents were considered to extract the data and for quality assessment. On studying the full text of the obtained documents, 115 components were found, which were classified into five groups (message, message sender, message receiver, message environment, message process) and 13 subgroups. In addition, the obtained components were classified as those proposed by the authors of the article and those obtained from disaster risk communication models.

CONCLUSION: Identifying the effective components in the disaster risk communication gives a more comprehensive view of risk communication to the disaster managers and executives and provides the decision-makers with an important platform to be able to use the components of risk communication and increase the impact of messages and ultimately increase people's preparedness for disasters in planning operations for the risk communication.

Keywords:

Disasters, emergency communication, risk communication, systematic review

Introduction

Risk communication includes any type of two-way communication among different stakeholders, during which it is possible to assess the risk and make decisions as to take appropriate measures in disasters.[1] In other words, interactive communication decreases uncertainty,[2] creates mutual trust, and increases awareness and motivation among various stakeholders.[3] These forms of communications educate the public, allowing them to take precautions and avoid possible damage.[4]

Considering the role of risk communication in the disaster management cycle,[5]

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the need for effective communication among all stakeholders is quite clear.[6] Furthermore, the effectiveness of information exchange among different stakeholders is influenced by the elements and components of risk communication, including trust among stakeholders[7-9] and coordination among the organizations.[10-12] Despite these results, some studies showed that many risk communication strategies have been less successful to prepare people for disasters in terms of the lack of motivational and persuasive skills.[13] As a result, the efficacy of risk communication is determined not only by the appropriate selection of risk communication tactics, but also by the capacity of communication resources to encourage the audience and community to engage in disaster preparedness programs.[14] These are just some of the elements that are effective in risk communication. Besides, there are many components which affect the exchange of information, and so far, different models and frameworks have been devised in the field of risk communication with one or more risk approaches at different levels and in various phases of the disaster cycle.[14-16] Some risk communication approaches are found based on the idea that providing the public more information makes preparation for the catastrophe easier.[17] However, although giving information to increase public awareness is important, other risk communication models place a greater focus on the role of motivating factors in translating risk awareness into disaster preparation.[14] Therefore, each of these models has its strengths and weaknesses, and the presence of different models in the field of risk communication shows that there is no consensus on the models and their essential elements. This shows the need for a comprehensive risk communication model, for which it is necessary to identify the components and variables that affect risk communication.

We identified and categorized risk communication components because there have been no systematic reviews in this field so far.

Materials and Methods

Study design and setting

We conducted a systematic review of the components affecting disaster risk communication in each methodological article that extracted the indicators/factors needed to improve risk communication in natural and man-made disasters. There are no restrictions in selecting the study documents in terms of the type and research method of the studies performed, date of publication, or the language of the documents obtained. Selected studies are related to risk communication in natural or man-made disasters or simulated environments and exercises.

Information sources and the search strategy

Databases such as PubMed, Web of Science, and Scopus were searched for the articles published from 1980 to 2020, and no restrictions were placed on the type of document. This study was conducted to answer the research question, «What components affect disaster risk communication?" To do this, we first used the keywords used in related articles. Then, using Mesh in PubMed, the relevant keywords in the entry terms were extracted. Experts' opinions were used to find related keywords. Finally, the syntax was formulated using the keywords obtained and the (AND) and (OR) operators in PubMed. After performing the initial search in PubMed as a pilot search, the syntax was also used in the Scopus and Web of Science.

PubMed syntax

("Risk communication" [Title/Abstract] OR "emergency communication" [Title/Abstract]) AND (disaster* [Title/Abstract] OR Emergence* [Title/Abstract] OR incident [Title/Abstract]).

Scopus syntax

(TITLE-ABS-KEY ["risk communication"] OR TITLE-ABS-KEY ["emergency communication"] AND TITLE-ABS-KEY [disaster*] OR TITLE-ABS-KEY [Emergence*] OR TITLE-ABS-KEY [incident]).

Web of Science syntax

(TS = ["Risk Communication"] OR TS = ["emergency communication "]) AND (TS = [disaster*] OR TS = [Emergence*] OR TS = [incident]).

Study participants and sampling

The studies found were first entered into the Endnote software, and duplicate studies were removed. Then, the titles and abstracts of the articles were reviewed, and the relevant items were selected based thereupon. Then, two researchers (AF and IS) studied the full text of the remaining articles and related articles were selected. Disagreements between the two researchers were resolved through group discussion and obtaining consensus. In case of any disagreement about a study, a third researcher was consulted. To look for other related articles which could be suitable for the systematic review, references to selected articles were also analyzed. Then, using the Scopus database, major journals related to the research title were examined in order to find possibly related articles, but none of them reached the final circle of articles selected and no documents were added. After selecting the articles, the opinions of other authors were taken, and all approved the articles selected by them.

Data collection tool and technique

This study examined the components of disaster risk communication in studies and models. First, the

studies providing models were identified, and after a thorough review, the components affecting disaster risk communication were extracted from the models. Other selected studies were then reviewed, and the components suggested by the authors were extracted. All extracted components were entered into Excel, and each article was assigned a code. Then, all extracted factors were categorized by thematic analysis. The collected components were, therefore, grouped into category and subcategories in a group discussion with the study's authors. The same components were combined, and related components were grouped together as a subcategory. Group discussions were used to settle any disagreements over the name and categorization of variables.

Critical evaluation of the quality of articles is a key step in a systematic review, and various tools are used for this purpose. However, these tools are usually specific to each research project (e.g., clinical trial or observational studies). This limitation still creates challenges in evaluating the quality of systematic reviews, where the relevant articles are analyzed using various methodologies.[18] Considering the lack of limitations in (free inclusion of) the methodologies of the studies in the present study, and based on the deep analyses, a tool was needed to simultaneously evaluate studies that have used different methods. In this study, the mixed methods assessment tool (MMAT) developed at McGill University was used to simultaneously evaluate quantitative, qualitative, and combined studies.[19]

Ethical consideration

This paper was derived from a Ph.D. research project at Shahid Sadoughi University of Medical Sciences with the ethics code IR.SSU.SPH.REC.1399.110 as approved by the Ethics Committee in Human Research at this university on August 20, 2020.

Results

Study selection

A total of 3956 documents were extracted from the three databases, PubMed, Scopus, and Web of Science. Of these, 1025 duplicated articles were excluded. Among the remaining 2931 articles, 2822 articles were removed after the titles and abstracts of the articles were read. Finally, 109 studies were selected, and their full texts were read, 31 of which were included in the study [Figure 1]. By reviewing the resources section of the selected articles, another article was identified and added to the selected documents. Therefore, a total of 32 articles were analyzed [Figure 1].

Descriptive analysis

A review of studies showed that among the studies selected for the identification of components influencing risk communication, 29 were articles and three were conference papers published between 2005 and 2020.

In terms of the research method, among the selected studies, qualitative method was included in eight cases,[17,20-26] mixed methods in four,[27-30] model development in seven,[15,16,31-35] cross sectional in three,[36-38] experimental in two,[28,39] a case study in two,[40,41] a case report in two,[42,43] clinical trial in one,[44] and survey in three.[45,46] The most common type of disaster among the selected studies was related to floods with 13 cases,[15,16,22,23,28-31,36,38,46-48] earthquake with two cases,[21,24] tornadoes with one case,[27] epidemics with three cases,[26,42,43] tsunamis with one case,[17] and nuclear accidents with one case.[22] In other studies, the type of incident was not specified. Out of the 32 articles, 27 were related to the response phase and five to the preparedness phase [Table 1].

Qualitative analysis

One hundred and fifteen components were discovered after obtaining and examining the full text of the research, which were extracted based on the authors' proposals as well as the risk communication models. Then, these components were divided into five groups (message, message sender, message receiver, message environment, message process) and 13 subgroups. The subgroups included general message characteristics, content of message, message dissemination, communication channels, individual characteristics, message receiver characteristics, motivational factors, cognitive factors, psychological reactions, natural environment, social environment, communication (internal and external), and participation and feedback [Table 2].

Discussion

To develop a disaster risk communication model, the components affecting disaster risk communication must first be examined. Since risk communication automatically improves disaster risk management,[50,51] various disaster risk communication models were designed to determine the factors affecting risk communication. Besides, in several other studies, the authors have tried to discover these variables as the components affecting risk communication, so that they could help create an effective communication process in disasters. Therefore, to identify these components from various studies, a systematic review was required to summarize the results of these studies. In the literature review, no systematic review was found to identify the components and models of disaster risk communication. Based on this study's results, 115 components were identified in five groups (message, message sender, message receiver, message environment, and message process). Some of these components were identified

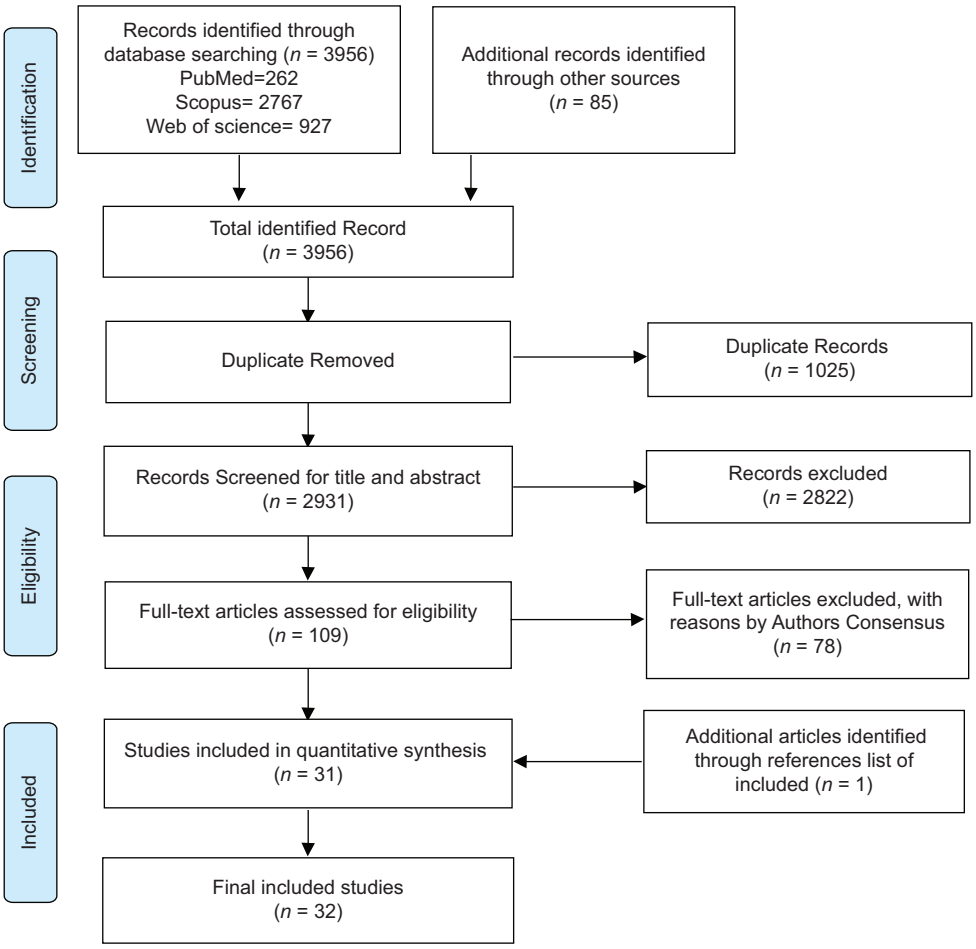

Figure 1: PRISMA flowchart diagram of the searched and selection of papers

from the risk communication models and some were suggested by the authors of the articles [Table 2].

Eighteen articles had been published from 2015, and this shows that the number of studies in this area is increasing and the importance of risk communication in disaster management and fatality reduction is well known to experts and planners.

Among the selected studies which had addressed risk communication in specific events, the highest number of cases (n = 13) was related to floods. In other words, flood risk communication received the highest attention. In 2018, floods accounted for 35% of the world's natural disaster victims, compared to 14% in 1980[52] This seems to be due to climate change-related floods,[53] population growth, and urbanization.[54]

Regarding the unexpected nature of disasters and limitations in controlling variables, disaster-related studies often use a qualitative or case series design, and typically, researchers have analyzed descriptive data and gained empirical generalizability.[55] More than half of the studies selected are qualitative and provide valuable information about disaster risk communication.

To better understand the factors affecting risk communication and explain the relationships among components, a number of these studies were designed as a conceptual framework or model.[15-17,27,31,33-40,42] The approach of most of these models is message based, in a way that they had taken into account the message transmission process from the sender to the receiver and its influential factors such as transparency of messages, communication among stakeholders, risk communication environment, the role of trust in communication channels, source of messages in risk communication, and the like, so that they could prepare people for disasters by raising awareness. In the meantime, one study takes a step forward and points to the participation of the community as a mediator in the process of disseminating information and preparing people for disasters.[37]

Message

The message is one of the main categories of risk communication and plays a major role in the formation

Table 1: Studies' characteristics and appraisal

Authors	Literature type (score)	Study method (score)	Multidisciplinary approach (score)	Model development (score)	Disaster phase	Incident type (score)	MMAT score	Country
Samuel, *et al*.[27]	Article	Mixed method	Disaster	Yes	Response	Tornadoes	****	USA
Christopher *et al*.[41]	Article	Case studies	Disaster	No	Preparedness	Not specified	***	USA
McLaughlin *et al*.[34]	Article	Model development	Non-disaster	Yes	Preparedness	Not specified	***	USA
Intrieri *et al*.[15]	Article	Model development	Disaster	Yes	Preparedness	Flood	*****	Italy
Hu *et al*.[31]	Article	Model development	Disaster	Yes	Preparedness	Flood	****	Taiwan
Abunyewah *et al*.[38]	Article	Cross sectional	Disaster	Yes	Preparedness	Flood	****	Ghana
Wong *et al*.[25]	Article	Qualitative	Disaster	No	Preparedness	Not specified	**	England
Perko *et al*.[39]	Article	Empirical	Disaster	Yes	Preparedness	Nuclear	****	Belgium
Reynolds *et al*.[32]	Article	Model development	Disaster	Yes	Preparedness	Not specified	***	USA
Samaddar *et al*.[30]	Conference paper	Mixed method	Disaster	No	Preparedness	Flood	****	India
Xiang *et al*.[35]	Article	Model development	Disaster	Yes	Preparedness	Not specified	***	China
Zhang *et al*.[42]	Article	Case report	Disaster	Yes	Response	Epidemic	****	China
Seeger *et al*.[33]	Article	Model development	Disaster	Yes	Preparedness	Not specified	****	USA
Holroyd *et al*.[20]	Article	Qualitative	Disaster	No	Preparedness	Not specified	***	USA
Selamet[24]	Article	Qualitative	Disaster	No	Preparedness	Earthquake Tsunami	***	Indonesia
Suzuki *et al*.[16]	Article	Model development	Disaster	No	Preparedness	Flood	****	Japan
Abunyewah *et al*.[37]	Article	Cross sectional	Disaster	Yes	Preparedness	Not specified	****	Ghana
Sjoraida *et al*.[23]	Conference paper	Qualitative	Disaster	No	Preparedness	Flood	****	Indonesia
Seebauer *et al*.[36]	Article	Cross sectional	Disaster	Yes	Preparedness	Flood	****	Austria
Ping *et al*.[28]	Article	Empirical	Disaster	No	Preparedness	Flood	*****	England
Weber *et al*.[29]	Article	Mixed method	Disaster	No	Preparedness	Flood	***	Austria
Maidl *et al*.[46]	Article	Survey	Disaster	No	Preparedness	Flood	***	Switzerland
Rahman *et al*.[17]	Article	Qualitative	Disaster	Yes	Response	Tsunami	****	Indonesia
Gesser-Edelsburg *et al*.[26]	Article	Qualitative	Disaster	No	Response	Epidemic	***	Israel
Susilowardhani *et al*.[22]	Conference paper	Qualitative	Disaster	No	Preparedness	Flood	**	Indonesia
Mondino *et al*.[48]	Article	Mixed method	Disaster	No	Response	Flood	***	Italy
Herovic *et al*.[21]	Article	Qualitative	Disaster	No	Preparedness	Earthquake	****	USA
Kievik *et al*.[44]	Article	Nonrandomized, controlled trials	Non-disaster	No	Preparedness	Not specified	****	The Netherlands
Shi *et al*.[40]	Article	Case study	Disaster	Yes	Recovery	Not specified	****	China
Sumo *et al*.[43]	Article	Case report	Disaster	No	Response	Epidemic	***	Liberia
Song *et al*.[47]	Article	Survey	Disaster	No	Response	Flood	****	USA
Kim, *et al*.[45]	Article	Survey	Disaster	No	Preparedness	Not specified	***	South Korea

of communication. This approach provides the best practices to establish mutually beneficial relationships with risk stakeholders, helping the stakeholders to identify risk uncertainty, establish continuity in communication, and respond to the communication and information needs of diverse and changing audiences.[56] This issue was also emphasized in various studies. Xiang *et al*. proposed a general framework for disaster risk communication, of which message was a key element.[35] Abunyewah *et al*. also showed that comprehensive risk messages tailored to people's needs had a significant effect on public disaster preparedness.[37] Therefore, to make a communication, the message content and general characteristics should be considered.

Message sender

According to this study results, another major category affecting risk communication was the message sender, which included the dissemination of messages and communication channels. Numerous studies were conducted on message transmission and types of communication channels for message transmission. The results of various studies showed that the transmission of educational messages is necessary to increase public awareness of public health after natural disasters and reduce their vulnerability.[57-59] This is also underscored in the current research, which examined the risk of communication channels and their features in the majority of communication models.[17,33,40] Today, there are several means of contact between individuals and

Table 2: Classification of extracted criteria

Category	Subcategory	Criteria	Model versus author
Message	General characteristics of the message	1. Consistency of message[20,27,33,42]	Model extracted and author suggested
		2. Uncertainty[24,26,27,32,33,35,42]	Model extracted and author suggested
		3. Public receptivity[27]	Author suggested
		10. Transferability[35]	Model extracted
		5. Competing messages[21]	Author suggested
		8. Message construction[24]	Author suggested
		9. Message repetition[25,44]	Author suggested
		11. Information source credibility and authenticity[15,25,33,38,41]	Model extracted and author suggested
		12. Timeliness[20,26,29,35,42]	Model extracted and author suggested
		13. Adequate and accurate information[15,26,28,29,31,33,37,42]	Model extracted and author suggested
	Content of message	1. Accessibility of risk message[23,28,33,42]	Model extracted and author suggested
		2. Perceived hazard characteristics[40]	Model extracted
		3. Clarity[20,22,28,33,49]	Model extracted and author suggested
		4. Understandable[22,31,35]	Model extracted
		5. Logical[22]	Author suggested
		6. Style of message[25]	Author suggested
		7. Believability[25,30,35]	Model extracted and author suggested
		8. Completeness[20,28,35]	Model extracted and author suggested
		9. Actionable message[33]	Model extracted
		10. Messages tailored to the needs of the audience[15,21,31,33,43]	Model extracted
		11. Open and transparent messages[33,42]	Model extracted and author suggested
		12. Trustworthy message[28]	Model extracted and author suggested
		13. Information sufficiency[33,35,37,38,40]	Model extracted and author suggested
Sender	Message dissemination	1. Message sender characteristics[15,17]	Model extracted
		2.The use of same terminology, info graphics, or hashtags for disaster notification[15]	Model extracted
		3.The hierarchization of communication media[15]	Model extracted
		4. Identifying the person responsible for transmitting alerts[15]	Model extracted
		5.Timely dissemination of messages[15,33]	Model extracted
		6. Information publisher skills, honesty and integrity, knowledge[30,42]	Author suggested
		7. Concern and care about the community's interest[30]	Author suggested
		8. Transparency in the dissemination of information[20,42]	Author suggested
		9. Using education and training campaigns[21,47]	Author suggested
	Technology and communication channels	1. Availability of communication channels[27,37]	Model extracted
		2. Accessibility of communication channels[31]	Model extracted
		3. Technological difficulties (system getting hacked or missing the text alert)[25]	Author suggested
		4. Preparing a battery-powered communication device[23]	Author suggested
		5. Use of different communication channels[16,17,23,24,29-31,33,35,41,43,45]	Model extracted and author suggested
Receiver	Individual characteristics	1. Income[24,30,31,48]	Model extracted and author suggested
		2. Demographic variables[23,30,31,39-41,46,48]	Model extracted and author suggested
		3. Level education[15,27,30,31,39,48]	Model extracted and author suggested
	Motivational factors	1. Response efficacy[44]	Author suggested
		2. Awareness[16,24,33,39,46,48]	Model extracted and author suggested
		3. Self-efficacy[31-34,40,44]	Model extracted and author suggested
		4. Risk perception[24,25,29-31,33,36,42,44,46]	Model extracted and author suggested
	Receiver characteristics	1. Understanding of risk[16,32,33]	Model extracted
		2. Trust the source of information[15,20,25,30,31]	Model extracted and author suggested
		3. Trust of communication channels[30,40]	Model extracted and author suggested
		4. Risk experience[23,29-31,34,36,40,41,46,48]	Model extracted and author suggested
		5. Person's beliefs, feelings, or opinions about risk[17,23,31,41,45]	Author suggested
		6. Adaptive behavior[31,44,46]	Model extracted and author suggested
		7. Intention to prepare[24,30,36-38,46]	Model extracted and author suggested
		8. Intentions to comply with advice gain[25]	Model extracted
		9. Knowledge[27,29,33,34,37,39,46,48,49]	Model extracted and author suggested

Contd...

Table 2: Contd...

Category	Subcategory	Criteria	Model versus author
		10. Predispositions[39]	Model extracted
		11. Acceptance and reception of information[30,31,35,39,46]	Model extracted and author suggested
		12. Understanding public health authorities[20]	Author suggested
		13. Communication skills and abilities[23,34,35]	Author suggested
		14. Confidence, enactment, satisfaction with the proposed solution[16]	Model extracted and author suggested
		15. Digital literacy[45]	Author suggested
		16. Attachment to property and city[46]	Author suggested
		17. Perceived responsibility of property owners and citizens[46]	Author suggested
		18. Information-seeking behavior[33,40,46]	Model extracted and author suggested
		19. Value similarity stakeholders[36]	Model extracted
		20. Decision-making and behavior change[26,31,33,37]	Model extracted and author suggested
		21. Competence and honesty[35,36]	Model extracted
	Cognition factors	1. Cognition of disaster prevention and response plan[31]	Model extracted
		2. Attitude toward risks[23,25,34,39,46]	Model extracted and author suggested
		3. Cognition disaster risk[30-32]	Model extracted and author suggested
		4. Risk propensity[31]	Model extracted
		5. Cognitive and perceptual changes[34]	Model extracted
		6. Risk aversion[31]	Model extracted and author suggested
	Psychology reaction	1. Worry[25,31,46]	Model extracted
		2. Fatalism, fear[31,36]	Model extracted
		3. Compliance[25,34,41]	Model extracted
		4. Panic, reassurance[25]	Author suggested
		5. Denial, resilience[36]	Model extracted
		6. Optimism bias[31]	Model extracted
		7. Responsibility perception[31]	Model extracted
Environment	Natural environment	1. Observe natural phenomenon[31]	Model extracted
		2. Context of communication[31,35]	Model extracted
		3. Cultural and religious beliefs[21,23,24,35]	Author suggested
		4. Habits of society[35,44]	Author suggested
	Social environment	1. Behaviors of friends and neighbors[31]	Model extracted
		2. Connection intensity with community[31]	Model extracted
		3. Social assistance and societal safety culture[31]	Model extracted
		4. Psychometric risk characteristics[39]	Model extracted
		5. Social attributes of stakeholders[35]	Model extracted
		6. Interpersonal communication and social dynamics[23,43]	Author suggested
Process	Communication (internal and external)	1. Funding-financing feasibility and local economic analysis[24]	Author suggested
		2. Setting the schedule[17,22]	Author suggested
		3. Determining Objectives and Analysis the Audience [22]	Author suggested
		4. Identify the right way to create communication messages[22]	Author suggested
		5. Sharing information[16,23,33,35,37,47]	Model extracted and author suggested
		6. Communication with organizations and groups[16,26,32,42]	Author suggested
		7. Cooperating with participants[23]	Author suggested
		8. Empathy-based communication[23]	Author suggested
		9. Developing and implementing public education[23]	Author suggested
		10. Transparency in communication[20]	Author suggested
		11. Partnership with the media and rumor management[43]	Author suggested
		12. Active monitoring of community risk perceptions and compliance[43]	Author suggested
		13. Evacuation planning and transportation procedure[24]	Author suggested
		14. Infuse risk communication into policy decisions[42]	Author suggested
		15. Identification of at-risk groups and empowerment of the public[26]	Author suggested
		16. Evaluate the risk communication effort[22]	Author suggested
		17. Communication from non-experts[21]	Author suggested
		18. Provision information[26,33,35,47]	Model extracted and author suggested
		19. Trust among stakeholders[20,26,35,36,39,45,46]	Model extracted and author suggested

Contd...

Table 2: Contd...

Category	Subcategory	Criteria	Model versus author
	Participation and feedback	1. Extent of participation[24,31]	Model extracted
		2. Feedback[25,31,42]	Model extracted and author suggested
		3. Community participation[24,26,37,43,45,47]	Model extracted and author suggested
		4. Emotional involvement[23]	Author suggested

aid groups through which the essential information may be published.[60]

Message receiver

The study results show the importance of the message receiver in disaster risk communication. The message receiver includes demographic characteristics, cognitive factors, psychological reactions, motivational factors, and characteristics of the message receiver. Numerous studies have highlighted the impact of message recipient characteristics on risk communication. However, there is debate on some features of the message receiver. For example, Perko *et al*.[39] found that individuals with specific knowledge were identified as having a special ability to receive risk communication messages, but their knowledge did not affect the direct acceptance of information. Despite the fact that trust in relief groups is one of the primary obstacles of risk communication,[61] Mehta *et al*. found that public trust in the information shared through social media leads to the correct choice after a disaster.[62] Besides, various other factors such as risk perception and risk experience can affect the acceptance of risk messages by the recipients of the message.[63-65] Therefore, the message receiver is one of the main factors affecting risk communication.

Message environment

The selected articles referred to the role of the social environment and cultural contexts in creating effective communication between organizations and people. The study results indicate that the environment in which communication is formed should be fully considered. This finding is consistent with the results of a study by Holmgaard *et al*.[66] The findings of the Eiser research also showed that people's risk perceptions are shaped by their experiences, emotions, values, cultural beliefs, and interpersonal and social dynamics.[67] To improve communication with the people and spread suitable educational information, it is vital to understand their communication settings, including their cultural and religious beliefs and social conventions.

Message process

Another main category of the present study is the communication process, which refers to communication among organizations, groups, message exchange among them, and public participation in the message transmission process. Bahadori *et al*.[68] showed in a study in Iran that providing and developing health-related education, sharing resources and information, paying attention to public participation, and having a systematic and national vision were among the important dimensions of inter-organizational communication. Opdycke *et al*. also showed that message exchange is an important factor to establish communication among relief organizations.[69] The results of these studies are consistent with the findings of the present study. The results of several other studies also indicate that citizens should participate in disaster risk management policies and programs and share their expectations and opinions with relief organizations to play an active role in the implementation of this program.[47,70,71]

According to studies, the awareness of people about the hazards of their environment is not merely enough to prepare for disasters, and it is necessary to motivate people to do so. According to Paton, risk communication policies and strategies should include motivational components to turn risk awareness into prepared behaviors.[67] Moreover, risk perception, self-efficacy, critical awareness, and response effectiveness are the motivational factors that encourage message recipients to take recommended measures.[14] Critical awareness and the effectiveness of response are the components which seem to have received low attention in studies and need to be further studied in the future to determine their effectiveness in disaster risk communication.

Limitations

Although disasters in developing countries are very fatal and destructive,[72] most studies have been performed in developed countries and only a few studies have been conducted in developing countries.

Conclusion

A systematic review methodology was used to investigate the components affecting risk communication. An attempt was made to provide a complete picture of the components affecting disaster risk communication. The obtained components were divided into five groups (message, message sender, message receiver, message environment, message process), which included a broad variety of risk communication factors. To build a complete model of risk communication in various disasters, it is required to identify distinct models of risk communication and extract their key components and aspects. This may bring about effective changes

in planning for risk communication and providing an important platform for decision-makers and administrators to consider all the components of risk communication in operational risk planning to deliver the risk-related messages in a timely manner, which may help people prepare for disasters and make timely decisions.

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Conflicts of interest

There are no conflicts of interest.

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