

**World Health Organization
Department of Communications**

Evidence Syntheses to Support the Guideline on Emergency Risk Communication

Q12: What elements and timing of messages are best at influencing public/ community levels of concern to motivate relevant actions to protect health?

Final Report

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1.0 INTRODUCTION

1.1 Background

The World Health Organization (WHO), as an agency of the United Nations (UN), commissioned systematic reviews and syntheses of existing evidence to support the development of new emergency risk communication guidelines. The systematic reviews were required to focus on emergency risk communication to inform the development of recommendations for the WHO Risk Communication Guideline on Emergency Risk Communication, which refers to any risk communication done before, during, and after health emergencies.

As defined by the WHO, risk communication refers to the real-time exchange of information, advice, and opinions between experts and/or officials and/or the publics who face a threat (hazard) to their survival, health, or economic or social wellbeing.

The purpose of the proposed guidelines is to assist the WHO as it communicates with multiple stakeholders, exchanging information that will enable everyone at risk to make informed decisions about protective and preventive actions that will mitigate the effects of a threat (hazard).

As noted by the WHO, emergency health risk communication is distinguished from non-emergency health risk communication exchanges by a combination of the following characteristics: The existence of a perceived public health threat; a dramatically increased demand for information to protect health that often outstrips the ability of health authorities to provide it; a need to communicate with potentially at-risk populations before recommendations are certain; a rapidly evolving situation in which information about the health threat and how to prevent its continuation or spread is incomplete and changing as public health investigation proceeds.

A public health emergency event, such as an earthquake, wildfire, flood, and emergent infectious disease, is usually characterized as having four major phases: Preparation; onset; containment, which includes the peak of the emergency event; and recovery. Another characterization, also with four phases, but conceptualized slightly differently, includes: prevention; readiness/preparedness; response; and recovery. A fifth phase, evaluation, generally follows the recovery phase although it commonly occurs along with the earlier four phases as well.

The WHO sought systematic reviews and syntheses of existing evidence regarding twelve questions of interest related to emergency risk communication. Of these, the Wayne State University team was responsible for six questions, and this report presents the findings for one of them.

1.2 Rationale

Communication with the public during mass emergencies is a complex process involving multiple stakeholders. The messages from authorities to the general public, and to specific communities, must be carefully designed to successfully influence health protection behaviors. In particular, message content and message timing must be thoughtfully calibrated to achieve maximum impact. Emergent health emergency events tend to be both global and local problems; thus, successful communication related to such situations must also take into account the political and cultural context in which the messages will be received and understood.

1.3 Objective

1.3.1 Question

The objective was to conduct a systematic review of the extant literature on the best practices for message design for emergency health risk communication and present an evidence synthesis. Specifically, the purpose of the systematic review is to address the following question:

What elements and timing of messages are best at influencing public/ community levels of concern to motivate relevant actions to protect health?

1.3.2 SPICE Framework Question Explication

As provided by the WHO, the question is explicated using the SPICE (Setting, Perspective, Phenomena of Interest, Comparison, Time Scope) framework as follows:

Setting: In the context of preparing for and responding to national and international events/ emergencies with public health implications in high, low, middle income, and fragile states.

Perspective: National governments and relevant subnational authorities (e.g., local/ district health departments); journalists; responding partners; communities.

Phenomenon of Interest: Timing and content of emergency risk communication messages designed to raise/ lower public and community concerns about threats.

Comparison: Different phases of event/ emergency, different sources of information (level of authority, local communities, national government authorities), consistency and frequency of messages, different types of appeals. Variations in timing and content of messages related to equity considerations such as local contextual and population characteristics.

Evaluation: Impact on public acceptance of health protection information, level of motivation to act on health recommendations, level of compliance with health recommendations.

Time Scope: 2003 to present.

1.3.3 Review Question and Rapid Knowledge Map

To ascertain the availability of existing reviews and primary studies relevant to the question, we conducted a preliminary literature search and created a Rapid Knowledge Map. The map showed existing reviews were available as were sufficient number of primary studies with a wide coverage of type, phase, and country of emergency public health events. The Rapid Map also allowed us to refine the objective of and the approach to the present review as noted below.

1.3.4 *Phenomena of Interest and Outcomes/ Effects Associated with Review Question*

The phenomena of interest are timing and content of emergency health risk communication messages designed to raise/ lower public and community concerns about threats.

To foreground the phenomena of interest that could potentially be measured, observed, or described in affected populations (communities/ publics, stakeholders, etc.), we parsed the phenomena of interest and review question to focus on elements/ contents and timing of messages that were effective or in the absence of evidence of effect appeared to work best as follows:

Elements/ contents and timing of messages

→ Increase/ decrease in concern.

→ Increase/ decrease in motivation for action.

1.3.5 *Phenomena of Interest and Comparison Category for Outcomes/ Effects/ Impacts and Best Practices*

Given the corpus of research studies relevant to the objective for this systematic review, the SPICE framework descriptions (as noted above) of the setting, perspective, phenomena of interest, and time scope categories do not require any clarification.

However, the description of the comparison category requires additional interpretation for studies that do not include a comparison group. For such studies, we have interpreted the comparison descriptors not as comparison conditions/ groups in a research study, but as concepts/ variables that may have an association with the concepts/ variables contained in the questions. The SPICE description for the comparison category includes concepts/ variables such as different sources of information, consistency, and frequency of messages, and different types of appeals. Instead of seeing these terms as comparison groups, as may be the case in a randomized trial, we took these concepts/ variables to be potentially associated with level of concern and motivation to identify what works and for whom and in what contexts.

As such, when we extracted data from individual studies that were not group comparisons (randomized or nonrandomized), we did not compare (or contrast) the key concepts/ variables in a question with the concepts/ variables in the comparison category; instead, we checked for associations between the question concepts/ variables and comparison category concepts/ variables and focused on identifying best practices as directed by the review objective.

1.3.6 *Data and Population of Interest*

The primary data of interest were from field studies of populations that were *directly* affected by a relevant public health emergency event. Of interest were also data from studies of populations who may be likely to be affected by a relevant public health emergency event, particularly studies that focused on questions promoting individual preparedness for such events. Also of some interest were data from studies that addressed how organizations, predominantly government organizations or individuals employed by governments, respond to or work to develop risk communication messages.

2.0 EXISTING SYSTEMATIC REVIEWS

2.1 Approach to Existing Systematic Reviews

We did not conduct a structured review of the existing reviews and did not extract detailed findings from this literature. We appraised the quality of these reviews, and then identified key relevant findings from the reviews that were judged as high and moderate quality.

2.2 Quality Rating and Relevant Findings

The literature search for the present review revealed 12 existing systematic reviews that were relevant to the review objective. All were narrative reviews and none were quantitative meta-analyses.

The relevancy was assessed using the criteria in Noyes et al. (in press) that provides four categories, direct, indirect, partial, and uncertain. Two coders assessed the relevancy independently and there was very little agreement between them for the indirect, partial, and uncertain categories. As such, we combined indirect, partial, and uncertain assessments and labeled them as indirect; thus, we ended with two categories for relevance, direct and indirect.

The quality of the reviews was rated using a modified Assessment of Multiple Systematic Reviews (AMSTAR) quality appraisal checklist (Shea et al., 2007). AMSTAR consists of 11 elements that address the reviews' design (i.e., a priori), data extraction, details of the literature search, inclusion of grey literature, characteristics, methods, and scientific quality of included studies, publication bias, and acknowledgement of conflict of interest(s). Each area in AMSTAR is assessed using "yes," "no," "can't answer," or "not applicable." Studies received a final rating of "high" (no significant flaws), "moderate" (minor flaws impacting credibility/validity), or "low" (some flaws likely to impact credibility/validity). Two coders did the coding independently with high agreement. The final quality assessment was judged after the coders resolved any differences.

Reviews that were rated as low quality were "unpacked" for their data-based primary studies, which were added to the literature for the present review. Existing reviews that were appraised as high or moderate quality were read for key relevant findings. The quality ratings and key findings are noted in Section 2.2.1.

2.2.1 Existing Reviews Ratings and Relevant Findings

Notes for Table

- . All reviews were narrative synthesis.
- . Relevancy judged as only direct and indirect (see above).

<i>Review Citation (first author) and Review Purpose</i>	<i>Modified AMSTAR Quality Rating</i>	<i>Relevancy</i>	<i>Key Relevant Findings</i>
Bean (2015)	Low	---	---
Burnett (2013). How do patients and the general public understand the risk associated with clostridium difficile, a bacterial infection of the gastrointestinal track.	Moderate	Indirect	. The mass media play a significant role in informing the public about health care concerns.
Cairns (2013).	Moderate	Indirect	. Risk communication that neglects to take

How does the public perceive the trustworthiness of health and risk communication messages that promote health protective behaviors regarding communicable diseases.			into account psychosocially mediated perceptions is ineffective. . Risk communication is successful when it maintains an interactive exchange of information with stakeholders about emergent concerns. . The public is not homogenous and its levels of engagement with an issue may change throughout the communication process. . Risk communication needs to convey negative developments as openly and transparently as possible.
Fitzpatrick-Lewis (2010). What communication (mass media) channels are most effective in conveying risk information to the public. What individual factors influence public perception of these messages.	High	Direct	. Multiple media approach is more effective than any single media approach. . When a warning method is for seldom occurring real life events (e.g., chemical spill siren), the public should receive regular information about the meaning of the warning. . Communication should come from a trusted source; tailor communication for the audience; build the content of messages with the strongest scientific evidence available; Incorporate text with visuals (pictures, diagrams) with qualitative and quantitative data; disseminate information in the media through multiple sources.
GesserEdelsburg (2015). How does the literature of risk communication--specifically which communication channels and strategies--explain public compliance and engagement with information about the emerging infectious disease, H1N1.	Moderate	Indirect	. Different populations have distinctive and diverse attitudes and risk perceptions regarding compliance with the H1N1 vaccination, which influences communication between the government and the public. . Public health agencies responsible for EID communication need to collaborate with the media to ensure that coverage is profound and evidence-based while scientific information remains accessible through online open access to key resources.
Gurabardhi (2005). What are the trends in the risk communication literature as it focuses on environmental and technological risk between 1988 and 2000.	Moderate	Indirect	. Two-way risk communication flow is important.
Lin (2014). How do social determinants such as age, education and income (SES) influence public perception and understanding of risk communication messages about H1N1. When such determinants correlate with information inequality, how should public health campaigns take this problem into account.	Moderate	Direct	. Open communication with clear and honest information associated with better informed public who is more likely to take recommended action. . Trust in public officials and source of information, worry, and levels of knowledge about the disease, and routine media exposure as well as information-seeking behaviors, were related to greater

			likelihood of adoption of recommended practices. Non-traditional channels of communication (e.g., partnership with community leaders or organizations) should be used to reach out to the most vulnerable and those in need of a better understanding of the risks and actions needed to be able to protect themselves.
McCaffrey (2015). How does the public respond to communication about and prepare for the risks associated with wildfires.	Moderate	Indirect	Interactive learning is both the preferred and the most effective means of providing information Rather than focusing on risk alone, the most effective means of increasing preparedness may be to provide clear information on the potential benefits of a desired action.
McComas (2006)	Low	---	---
Ruggiero (2013). How does the literature on crisis management contribute to understanding communication about terrorism.	Moderate	Indirect	Speaking with multiple voices in comparison to 'speaking with one voice' may be the most appropriate strategy for risk communication where heterogeneity of the target groups is combined with high technical uncertainty about the issue being communicated. Honest, accurate, and timely communication is effective. Role of communication is broader than just issuing instructions; communication should focus on empathy, facilitate sense-making, and enhance resilience.
Vaughan (2009)	Low	---	---
Visschers (2009). How does the presentation format and context in which the format is used influence public perception and understanding of probabilistic estimates of risk.	Moderate	Direct	Verbal/linguistic information combined with numeric expressions is the most effective in promoting audience understanding.

2.3 Summary of Relevant Findings from Existing Systematic Reviews

The existing nine high or moderate quality reviews focused on a variety of public health emergency events, including natural hazards, terrorist attacks, and flu pandemics. The reviews draw predominantly (and in some cases exclusively) on studies in the developed world nations with developed public health care/emergency infrastructure and largely democratic political systems. The reviews also approach risk communication as a multi-disciplinary project. Six reviews were directly related and three were indirectly related to the phenomenon of interest. With this context in mind, the following findings span the reviews:

- Risk communication messages should be developed with specific audiences in mind and, whenever possible, in conjunction with and including input from the target audience(s). Risk communication should be thought of as a process and be iterative in nature.

- Most risk communication messages will be mediated, primarily through the mass media although messages in the form of brochures or through interpersonal communication with friends, neighbors, health care professionals, and in some cases government authorities, will be added to that mix. Effective risk communication is multi-modal and includes visual information. The role of social media in risk communication remains ill-understood.
- Public responses to specific risk communication messages will not be monolithic. Single risk communication messages can increase knowledge; under many circumstances, people will ignore messages or misinterpret them. This is particularly true when the message asks for a dramatic response, such as evacuation.
- Risk communication messages should be jargon free, and messages that focus on the probabilities of certain risks occurring appear to be less well understood and less effective than messages that focus on specific, desired behavioral outcomes.
- Risk communication messages need to emerge from trusted, credible sources. In many cases, these sources are public health professionals. Messages that emanate from government authorities, that are not evidence based, that appear to be manipulative, and/or that are not transparent, are more likely to be rejected or ignored. Long-term, risk communication messages need to foster trust and be open to refinement and change as events dictate. Local authorities such as public health practitioners are essential to effective risk communication.
- Members of health organizations should receive training specific to working with the media, including the ability to respond to questions accurately and transparently, including negative developments.

2.4 Summary of Research Gaps Identified by Existing Systematic Reviews

The existing reviews show the following gaps in the literature:

- Evaluation studies that focus on risk communication campaigns throughout the course of an entire emergency event.
- Evidence based strategies for contingency planning, needs assessments, and public education.
- Empirical literature that considers the comparative impact of risk communication campaigns in non-democratic and low-income nations.

2.5 Use of Existing Systematic Reviews

The findings from the existing reviews were used to contextualize the present systematic review. Where appropriate, the findings from the high or moderate quality existing reviews were mapped against the findings from the present review in the discussion section and were used to underpin the Evidence to Decision (DECIDE) frameworks (Alonso-Coello et al., 2016).

3.0 METHOD

3.1 Protocol and Process Design for Evidence Synthesis

A detailed protocol for the review was developed. It is available on request from the contact persons for the report.

The process design for the evidence synthesis for the review is presented in Section 3.3. Findings were extracted only from data-based primary studies. The design shows that the findings were grouped and processed within the type of study methodology stream and then brought together in an overarching synthesis of the findings across the methodology streams. Details of the process are presented below in Sections 3.9 to 3.15.

3.2 Determining Study Methodology of Data-based Primary Studies

The WHO Minimum Methodological Expectations document in Section 2.2 required production of a knowledge map and noted the following categories for data-based primary studies: Quantitative randomized control trials; qualitative (ethnographic research, case studies, process evaluations, and mixed-methods designs); mixed-method studies (combining different types of designs to explore a phenomenon of interest); observational and cross-sectional surveys; and grey literature reports.

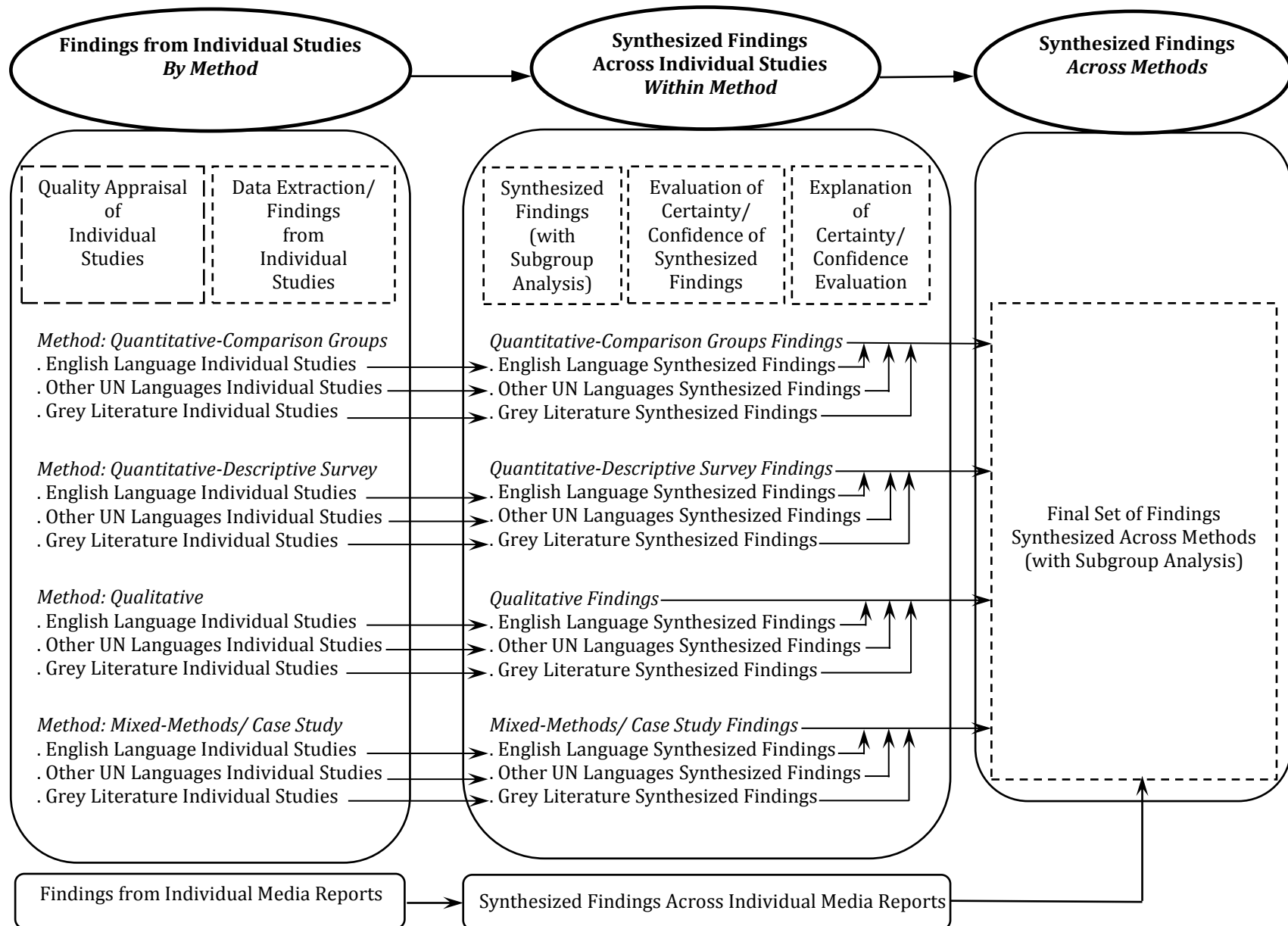
Using the above methodological groupings as a starting point, in the initial Rapid Knowledge Map we identified five methodological streams that best covered the method types found in the primary studies selected for the review:

- Quantitative – randomized group comparison and non-randomized group comparison.
- Quantitative – descriptive survey and similar designs.
- Qualitative – open-ended questionnaire survey, interview, focus group, ethnography/ participant observation, and textual analysis.
- Mixed-method – use of both quantitative and qualitative methods, where the different methods usually address different hypotheses and/ or research questions.
- Case study – use of several methods, where usually all methods address the same research question and focus on one particular event/person/location.

After a more in-depth perusal of the mixed-method and case study article/ reports, we did not find any appreciable methodological differences as both types utilized quantitative and qualitative methods with similar procedures. In consultation with the WHO methodologist consultant, we combined these two methodological streams. Thus, we ended up with four methodological streams:

- Quantitative-Comparison Groups (QN-CG)
- Quantitative-Descriptive Survey (QN-DS)
- Qualitative (QL)
- Mixed-Method and Case Study (MM, CS).

3.3 Process Design of Synthesis of Evidence from Data-based Primary Studies



3.4 Existing Reviews, Guidelines, Media Reports, and Grey Literature

As noted in Section 2.1, we did not conduct a systematic review of the existing reviews. We identified key findings and used them to contextualize the findings of the present review.

We did not include guidelines, recommendations, and other such literature in the present review. Only data-based primary studies were selected for data extraction and synthesis of evidence.

English language media reports that included some type of risk communication relevant “data,” such as direct quotations or detailed descriptions of events, from populations affected by an emergency event were included. As shown in Section 3.3, the findings from media reports served as a separate input for the final synthesized set of findings.

Grey literature non-academic reports were included only if they were data-based primary studies. Academic unpublished data-based primary study masters theses and doctoral dissertations were treated as grey literature. As shown in Section 3.3, these grey literature studies were treated similar to the academic primary studies.

3.5 English and Other UN Languages

3.5.1 Languages Included in Review

The primary search was for literature in the English language. Additionally, we conducted searches for studies published in the other UN languages as well, which included Arabic, Chinese, French, Russian, and Spanish.

3.5.2 Review Process for Other UN Languages

As seen from Section 3.3, we followed the same process for both English and other UN languages articles/reports for data extraction from individual studies and synthesis of findings within methodological streams. That is, the individual studies from Arabic, Chinese, French, Russian, and Spanish were grouped into the four methodological streams, irrespective of the language, after which synthesized findings were generated within each methodological stream.

We did not completely translate Arabic, Chinese, French, Russian, and Spanish language studies into English. Portions of the studies were translated into English as needed to meet the requirements of the review. As the other UN language findings from individual studies came from studies that were only partially translated into English, we treated these findings as a separate “sub-stream” at the time of synthesis of findings within methodological streams.

3.6 Information Sources for Literature Search

3.6.1 Information Sources for English Language Literature

We conducted a general search using the Wayne State University Library Summon function, which indexes all holdings in the library, Google Scholar, and general Google search.

We also searched within individual databases including: Web of Science; PubMed/Medline-National Library of Medicine (NLM); Cumulative Index of Nursing and Allied Health Literature (CINAHL); CINAHL Complete; Communication and Mass Media Complete (CMMC); PsychInfo; and WHO databases.

3.6.2 Information Sources for Other UN Languages Literature

Native readers of Arabic, Chinese, French, Russian, and Spanish who were fluent in English conducted the search. The following information sources were searched.

For Arabic, the information sources were: Al-Manhal, Dar-Al-Manduma, Google Scholar, general Google search, Wayne State library, and WHO databases.

For Chinese, the information sources were: CNKI (China National Knowledge Infrastructure), Wanfang Patent Database, Google Scholar, general Google search, Wayne State library, and WHO databases. In addition, contact persons suggested by the WHO were solicited for suggestions for relevant studies.

For French, the information sources were: Archive ouverte UNIGE, Cairn.info, Google Scholar, general Google search, Government of Canada publications, HAL archives ouvertes, JSTOR, La Houille Blanc, Persee.fr, Revues.org, Wayne State library, and WHO databases.

For Russian, the information sources were: Cyberleninka.ru, Google Scholar, general Google search, Mgimo.ru/library/ehd, Msu.ru/info/struct/dep/library, Nbmgu.ru, Wayne State library, and WHO databases.

For Spanish, the information sources were: CONACYT, Cuiden, Elsevier, Google Scholar, general Google search, Public Health institute Mexico, Wayne State library, and WHO databases.

3.6.3 Information Sources for Grey Literature

The search for grey literature in all languages used Google Scholar and general Google search as the primary information sources. In addition, an experienced librarian at the National Hazards Center library at the University of Colorado-Boulder, United States conducted a search specifically for grey literature. The search was conducted in close consultation with a team member who was physically present on location.

3.7 Literature Search Strategy, Search Terms, and Search Inclusion and Exclusion Criteria

3.7.1 Search Strategy

We adopted a two-phase strategy for literature searching. In the first phase, we did a general search that was intentionally broad in scope. In the second phase, a search focused narrowly on the objective of the present review was conducted.

3.7.2 Search Terms

We used the search terms noted below. Not all terms worked in all databases; therefore, thesauri were consulted for each database to find synonyms, if they existed, for each term, or any functionality that allowed the word to be “exploded” or “expanded.”

Disaster*	Trust
Disaster plan*	Public health
Communication	Messages
Risk communication	Warning messages or warning
Emergenc*	Media
Hazard*	Health campaign
Risk*	News
Threat*	Journalism
Emergency preparedness	Public participation
Emergency management	Community participation
Crisis (or other truncation used in a specific database:?,#)	Timing
Disaster preparedness	Safety
Hazard communication	Motivat*
Emergency communication	Governmen* and governance
Catastrophe communication	Public notice or information
Health communication	Information dissemination

3.7.3 Search Inclusion Criteria

The following broad inclusion criteria were used in the search for literature:

- Research related to the practice of risk communication and the process of disaster management with no preference for any specific emergency or health hazards.
- Research within the viewpoint or scope set by the risk communication field including, but not limited to: trust, uncertainty, communities, health, misinformation, health protection, media (including social media), messages, and stakeholders.

3.7.4 Search Exclusion Criteria

The following exclusion criteria were used in the search for literature:

- Research in organizational risk communication and disaster management such as technology failures.
- Research outside of the specified scope of the study, such as laboratory studies and those related to chronic disease, lifestyle, or personal living/ attributes (such as personal health, mental health, etc.).
- Pre-2003.

3.8 Article/ Report Selection

3.8.1 General Process

The hits generated by the literature search process were narrowed to select data-based primary articles and reports. The general process for selection of the articles/ reports for all languages was in two stages.

In the first stage:

- The hits obtained using a search were scanned by reading their title and abstract or summary;
- After scanning, the hits that were judged as related to risk communication during disaster/ emergency events were quickly read as full-texts and downloaded if found still broadly related;
- The downloaded full-texts were read carefully and selected if found related to the objective and phenomena of interest of the present review. These included, both academic and grey literature, data-based studies, reviews, guidelines, and media reports.

In the second stage:

- The full-texts of the selected articles and reports were again read and this time categorized as a data-based primary study or not. This included the grey literature.
- If an article/ report was a data-based primary study, it was further judged for relevancy to the review objective and phenomena of interest. A study that was judged as directly, indirectly, partially, or uncertainly relevant (as opposed to not relevant at all), was selected for extraction of its key findings. *Only these relevant primary study articles/ reports were directly used to generate the systematic review for this report.* These included studies used quantitative, qualitative, mixed-method, and case study methods.

To summarize, the article/ report selection process occurred in two broad stages. In the first stage, all literature that was related to disaster/ emergency risk communication, and review objective and phenomena of interest was selected. In the second stage, this literature was narrowed to select only relevant data-based primary study articles/ reports using quantitative, qualitative, mixed-method, and case study methodologies.

3.8.2 Quality Assurance of Selection Process

The first stage of the search and selection for English language articles/ reports was conducted by an experienced librarian with subject-matter expertise in the discipline of communication. Two training and norming sessions were conducted with the librarian. The second stage selection was done by all primary members of the research team, who had gone through a training and norming session.

Both the first and second search and selection stages for other UN languages were done by fluent readers and writers of Arabic, Chinese, French, Russian, and Spanish who were also fluent in English. Four norming and training sessions were conducted with this group in a group setting. In addition, individual training sessions were provided as needed.

3.9 Quality Appraisal of Selected Individual Studies

The individual data-based primary studies selected for the review were appraised for their quality. The quality appraisal for primary studies for all languages was done using the following tools:

- Quantitative-Comparison Groups(QN-CG) done by EPOC Risk of Bias
- Quantitative-Descriptive Survey (QN-DS) done by adaptation of Davids and Roman (2014)
- Qualitative (QL) done by CASP
- Mixed-Method and Case Study (MM, CS) done by McGill University MMAT.

Quantitative control/ comparison groups were individually appraised using the Effective Practice and Organisation of Care (EPOC; 2015) Risk of Bias tool. This tool provides nine criteria for assessing randomized control trials, non-randomized control trials, and control before-after studies. Detailed information on the definitions of levels of risk used in this tool is available in section 12.2.2 of the Cochrane Handbook.

Quantitative descriptive survey studies were individually appraised using an adapted version of Davids and Roman's (2014) quality appraisal criteria. This tool assessed on a 0 to 1 scale (0-not reported, 1-reported) the following areas: sampling, response rate, validity and reliability, sources of data, content and focus of study, and relevancy to the corresponding question. Final ratings were determined by percentage; weak (0-33.9%), moderate (34-66.9%), and strong (67-100%).

Qualitative studies were individually appraised using Critical Appraisal Skills Programme (CASP) (2013) checklist. Areas of the study appraised by CASP include appropriateness of qualitative methodology, data collection, relationship between research and participants, ethics, rigor of data analysis, clarity of findings, and value of research. Each area in CASP is assessed using "yes," "no," or "can't tell." Studies received a final rating of "high" (no significant flaws), "moderate" (minor flaws impacting credibility/validity), "low" (some flaws likely to impact credibility/validity), or "very low" (significant flaws impacting credibility/validity).

Mixed method and case study studies were appraised using Pluye et al.'s (2011) Methods Appraisal Tool (MMAT). Studies were assessed for the employed methods and methodological quality (i.e., qualitative, quantitative randomized control trials or non-randomized control trials, quantitative descriptive, and overall implementation of mixed methods). Each area in MMAT is assessed using "yes," "no," or "can't tell." Studies received a final rating of "high" (no significant flaws), "moderate" (minor flaws impacting credibility/validity), "low" (some flaws likely to impact credibility/validity), or "very low" (significant flaws impacting credibility/validity).

Individual media reports were appraised for their quality using the Authority, Accuracy, Coverage, Objectivity, Date, and Significance (AACODS) tool (Tyndall, 2008). Each area in AACODS is assessed using "yes," "no," or "can't tell." Studies received a final rating of "high" (no significant flaws), "moderate" (minor flaws impacting credibility/validity), "low" (some flaws likely to impact credibility/validity), or "very low" (significant flaws impacting credibility/validity). An important factor in weight with AACODS is given to aspects of authority.

3.10 Extraction of Data from Selected Individual Studies

3.10.1 Extraction of Data: Study Characteristics

The following study characteristics were extracted from individual data-based primary studies of all method types: Method; country focus; disaster/ emergency type; disaster/ emergency phase; and whether at-risk/ vulnerable population.

3.10.2 Extraction of Data: Study Findings

The purpose of extraction of findings from the individual data-based primary studies was to identify and note evidence of interest that mapped onto the phenomena of interest and the outcomes/ effects related to the review question. To extract the findings, we used the general process of reading and re-reading the abstract, results/ findings/ analysis, and discussion and conclusion sections to isolate the findings of interest. We did this process for all four methodological streams.

A quantitative meta-analysis was not suitable for the review as there were no studies that used comparison groups (randomized or non-randomized). As such, as recommended in Section 11.7.2 of the Cochrane Handbook dealing with results without meta-analyses, we followed a narrative summary approach to extraction of findings from studies in all four methodological streams.

Narrative findings were, thus, extracted from primary studies of all method types. The findings focused on the phenomena of interest and the outcomes/ impacts of the review objective. Each finding was written as a statement. The findings were extracted separately for each outcome.

Quantitative and qualitative evidentiary support for each finding was also extracted. From quantitative studies, we extracted numerical data, such as means, standard deviations, and probability values. While extracting these data we kept in mind whether the study was a group comparison (randomized, non-randomized) or descriptive. From qualitative studies, we extracted key phrases, sentences, and direct quotations. From mixed-method and case study studies, we extracted numerical data and key phrases, sentences, and direct quotations, as appropriate, related to each method. The extraction included page and paragraph numbers for the supporting evidence for every finding for all methodological streams.

3.10.3 Quality Assurance of Extraction of Data

An initial codebook for extracting study characteristics and findings was developed based on examples provided by the WHO. After receiving feedback on a draft from team members and the WHO, the document was suitably revised. Training sessions for the use of the codebook were conducted with the research team.

A pilot test of the codebook portion for extracting study characteristics was conducted with approximately 1% of the English language articles/ reports. For the pilot test, three team members coded each article. An analysis of the coding showed high agreement (approx. 80%) between the three coders.

For the codebook portion for extracting findings, a pilot test was conducted with approximately 1% of the English language articles/ reports with two readers. Results showed high agreement (approx. 80%) between the two readers.

The two pilot tests generated suggestions for refinement from the team members. The final codebook was created after incorporating this feedback.

3.11 Synthesis of Findings

3.11.1 General Process of Synthesis of Findings

The synthesis of findings was done in two stages as presented in the process design in Section 3.3. In the first stage, findings from individual studies were synthesized within methodological streams and then these within-method synthesized findings were evaluated for certainty/ confidence using appropriate tools. In the second stage, the within-method synthesized findings were synthesized across methodological streams, taking into account the certainty/ confidence evaluations.

3.11.2 Subgroup and Equity Analyses

In both the within-method and across-method stages, the synthesis of findings included subgroup analyses. These included examination of type of emergency event, phase of emergency event, country of emergency event, and presence of vulnerable population. The last two subgroups allowed considerations of equity in the synthesized findings.

3.11.3 Quality Assurance of Synthesis of Findings

The synthesis of findings was done by the lead author of the report. The synthesis process and the synthesized findings were discussed with all team members in weekly meetings. One team member closely read the synthesized findings and offered critique. The synthesized findings were developed based on the discussion and critique.

3.12 Synthesis of Findings Within Each Methodological Stream

For each methodological stream, the synthesized findings were created by building explanatory and higher level analytical statements supported by quantitative and qualitative evidence from individual studies.

For the two quantitative methodological streams, we again took directions from Section 11.7.2 of the Cochrane Handbook dealing with results without meta-analyses and followed a narrative summary approach to synthesis of findings.

For the qualitative methodological stream, we broadly followed the framework synthesis model (Barnett-Page, & Thomas, 2009; Pope, Ziebland, & Mays, 2000). We found this model suited to organize and analyze large amounts of data, which for us was represented by the corpus of findings and supporting evidence. The model is a mix of deductive-inductive processes. We started with a list of a priori framework categories generated from review objectives and phenomena of interest concepts, and modified the list as appropriate based on prior subject matter knowledge and reading of individual studies. Our goal was to synthesize the findings by identifying themes that emerged across the findings from individual studies and fit the framework categories.

For the mixed-method and case study methodological stream, the individual studies typically did not differentiate their overall findings based on type of methodology. For this stream, thus, we looked at the findings holistically and followed a broadly narrative summary approach.

3.13 Evaluation of Certainty/ Confidence in Synthesized Findings Within Methodological Stream

The assessment of certainty/ confidence of synthesized findings was done separately for each methodological stream using the following tools:

- Quantitative-comparison groups (QN-CG) (randomized, non-randomized) done by GRADE
- Quantitative-descriptive survey (QN-DS) done by applying the principles of GRADE
- Qualitative (QL) done by GRADE-CERQual
- Mixed-method and case study (MM, CS) done by applying the principles of GRADE and GRADE-CERQual.

Quantitative-comparison groups within methodological stream synthesized findings were assessed for certainty using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach (GRADE Working Group, 2004; Guyatt et al., 2010; Higgins & Green, 2011).

Findings were assessed on allocation sequence and concealment, baseline outcomes and characteristics, protections against contamination(s), presence of selective outcome reporting, and other possible forms of bias. Each category was given a rating of “low risk,” “high risk,” or “unclear risk.” Detailed information on the definitions of levels of risk used in this tool available in section 12.2.2 of the Cochrane Handbook. Findings received a final rating of “high quality” (it is highly likely that new research will not modify the finding substantially), “moderate quality” (it is somewhat likely that new research will not modify the finding substantially), “low quality” (it is somewhat likely that new research will modify the finding substantially), or “very low quality” (it is highly likely that new research will modify the finding substantially).

Quantitative-descriptive survey within methodological stream synthesized findings were assessed for certainty using a tool developed for the present review that was based on the principles of Grading of Recommendations Assessment, Development, and Evaluation (GRADE) as noted above. Adjustments were made to the GRADE process to create the tool for evaluation of certainty of findings from quantitative cross-sectional surveys that did not have comparison groups for outcomes of interest. There were four evaluation categories: High quality (highly likely that new evidence will *not* substantially modify the study findings); moderate quality (somewhat likely that new evidence will *not* substantially modify the study findings); Low quality (somewhat likely that new evidence will substantially modify the study findings); and very low quality (highly likely that new evidence will substantially modify the study findings). The evaluation categories were based on factors that can reduce the quality of study findings: Limitations in study design or execution; inconsistency of results; indirectness of evidence; imprecision of results; and publication bias for findings collated across multiple quantitative studies. See Appendix 8.1 for the tool.

Qualitative within methodological stream synthesized findings were assessed for confidence using GRADE-CERQual (Lewin et al., 2015). Findings were assessed on methodological limitations, relevance, coherence, and adequacy of data supporting the finding. Each finding was then given a rating of “high confidence” (it is highly likely that the finding is a representation of the phenomena), “moderate confidence” (it is likely that the finding is a representation of the phenomena), “low confidence” (it is possible that the finding is a representation of the phenomena), or “very low confidence” (it was not clear if the finding is a representation of the phenomena).

Mixed method and case study within methodological stream synthesized findings were assessed for certainty/ confidence using GRADE and GRADE-CERQual approaches.

3.14 Synthesis of Findings Across Methodological Streams

We synthesized the findings across the four methodological streams to develop an overarching synthesis of findings. The synthesized findings within a methodological stream were compared and contrasted with findings from the other methodological streams. Whenever the findings supported and amplified each other, they were combined into higher order findings that represented synthesis across the method streams. The evaluation of certainty in the within-method synthesized findings was kept in mind during this process.

All methodological streams did not yield the same kind or similar number of synthesized findings. We did not consider this a problematic issue as we were seeking to find the points of alignment of the findings across the method streams rather than simply merging them together, which would have given some methodological streams more importance than others.

Within-method findings that did not contribute to an across-method higher order finding were analyzed thematically. These thematic analyses were used to uncover a nuance or modification to the across-method findings, which were then either used to create a new higher order across-method finding or incorporated into an existing across-method finding.

A very few synthesized findings within a methodological stream provided evidence that countered the synthesized findings from other methodological streams. Whenever this happened, we strived to retain this finding as a separate finding in the final set of across-method findings or used it to modify an existing across-method finding.

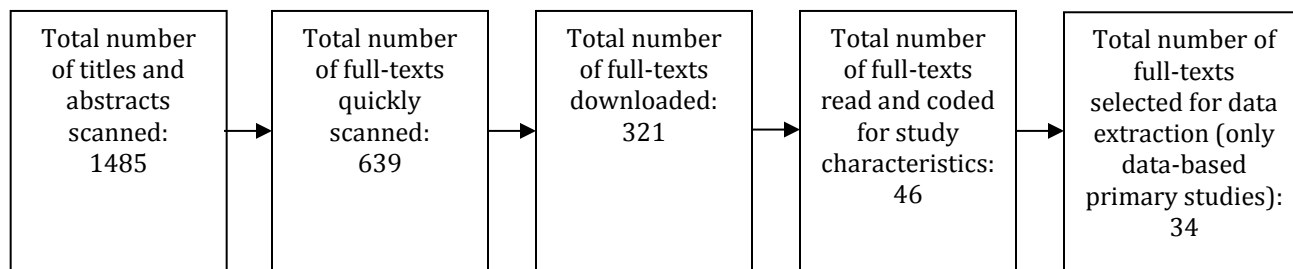
3.15 Media Reports

We extracted findings from individual media reports and then synthesized these findings across the individual reports. We used these across-media reports synthesized findings as another input for the final set of synthesized findings. A modified version of the AACODS tool was used for quality appraisal of the media reports.

4.0 RESULTS

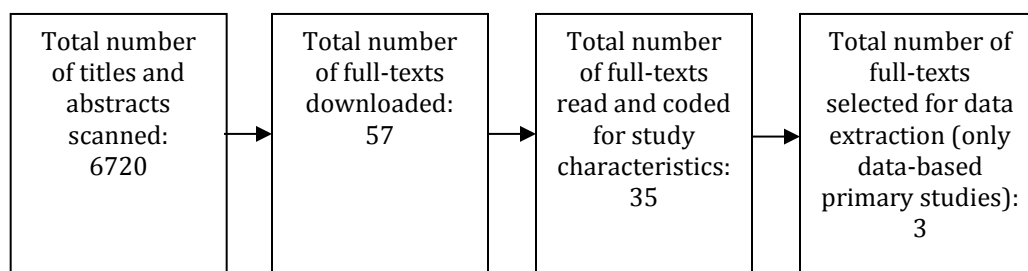
4.1 Study Selection

4.1.1 English Language

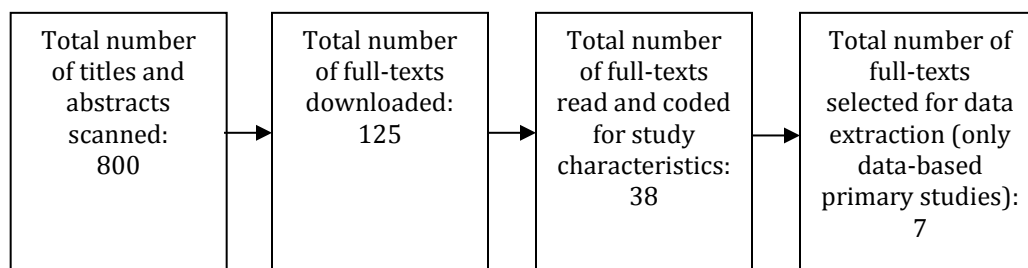


4.1.2 Other UN Languages

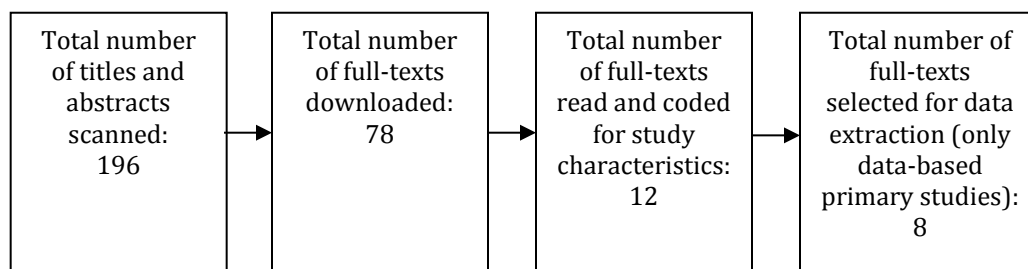
Arabic:



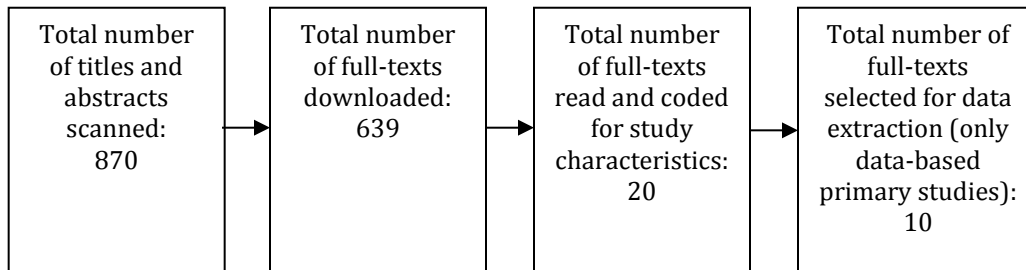
Chinese:



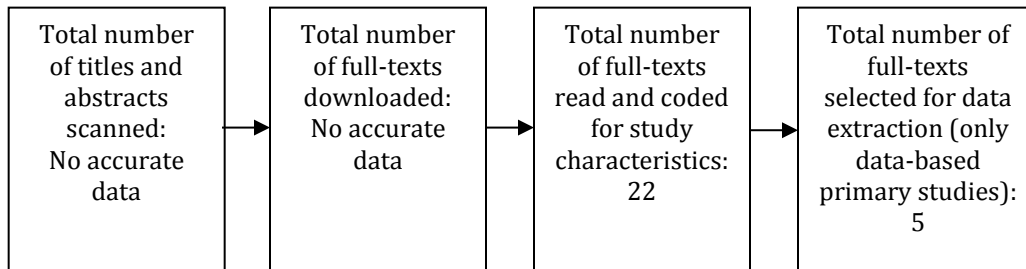
French:



Russian:



Spanish:



4.2 Study Characteristics

A knowledge map of the study characteristics is provided in Section 4.2.1 for English language studies and in Section 4.2.2 for other UN languages studies.

4.2.1 Knowledge Map of Characteristics of Studies-English Language

Key to Table

- . Total English language data-based primary studies coded (includes grey literature): 34
- . Grey literature studies: 0
- . Some categories are not mutually exclusive and so the frequencies will not sum to the total of 34.
- . *Method*: Quantitative-Comparison Groups (QN-CG); Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/ Case Study (MM, CS)

<i>Relevancy</i>	<i>Method General</i>	<i>Country Focus</i>	<i>Disaster/ Emergency Type</i>	<i>Disaster/ Emergency Phase</i>	<i>At-risk Groups</i>
Direct: 3 Indirect: 12 Partial: 13 Unclear: 6	QN-CS: 0 QN-DS: 21 QL: 5 MM, CS: 8	Australia: 2 Belgium: 2 Belgium/ Slovenia: 1 Canada: 2 Caribbean: 1 China: 1 India: 1 Indonesia: 1 Japan: 2 Mauritian: 1 Netherlands: 2 Russia/ Eastern Europe: 1	General: 5 Bioterrorism: 1 Cyclone/ Hurricane: 3 Earthquake: 1 Ebola: 1 Flood: 4 Flood/Water Boiling: 1 Food Borne Illness/ Terrorism: 1 Food Contamination: 2	All Phases: 0 Preparation: 5 Onset: 1 Containment: 5 Recovery: 1 Preparation & Onset: 6 Preparation & Containment: 3 Onset & Containment: 3 Preparation, Containment, &	Yes: 2 (Children and minority population)

		Singapore: 1 United Kingdom: 2 United States: 17 Not Specified: 1	Global Climate Change: 1 Infectious Disease: 5 Radiological: 3 Pesticide Residue: 1 SARS: 2 Terrorism: 1 Tornado: 1 Tsunami: 2 Wildfires: 1	Evaluation: 1 Preparation, Onset, & Containment: 2 Onset, Containment, & Evaluation: 2 Not Clear: 2	
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Of the 34 English language articles examined (see Section 7.1 for the references), three were directly relevant, 12 were indirectly relevant, 13 were partially relevant, and there were six where the relevance was unclear. There were no studies that used quantitative methods with comparison groups. Twenty-one studies employed quantitative descriptive surveys, five used qualitative methods, and eight employed mixed methods or were case studies.

Regarding countries, there was one study that included all the following countries: China, Singapore, Italy, Ireland, New Zealand, Australia, Slovenia, India, Russia and several unnamed countries in eastern Europe. The following countries were included in multiple studies: Canada (2), Japan (2), the Netherlands (2), United Kingdom (2), and United States (17). As indicated by this distribution, these studies focused on the global north and on high income nations with developed health care and public health care systems.

The types of disasters examined varied across the studies. The articles focused on bioterrorism (1), cyclone/ hurricane (3), earthquake (1), Ebola (1), floods (4), flood/water boiling (1), food borne illness/terrorism (1), food contamination (2), global climate change (1), infectious disease (1), infectious disease/meningitis (1), influenza/H1N1 (3), radiological (3), pesticide residue (1), SARS (2), terrorism (1), tornado (1), tsunamis (2), wildfire (1), and five took a general approach on disasters.

In terms of phase of emergency event, five studies focused on preparation phase, one on onset phase, five on containment phase, one on recovery phase, and 17 ranged from the onset through the containment phase. In two of the studies, it was not possible to determine which phase of the disaster was the focus of the work.

The majority of these studies did not focus on specific vulnerable populations but were focused on the general public. However, two studies that did focus on vulnerable populations included studies that focused on minority communities (African-Americans and Hispanic Americans) and children. A majority of the quantitative studies analyzed data with respect to gender and a sizable minority also included some measure of class, but how class/income was measured varied widely, with none of these studies focused on these specific populations as part of the research question.

4.2.2 Knowledge Map of Characteristics of Studies-Other UN Languages

Key to Table

. Total other UN languages data-based primary studies: 33

. Some categories are not mutually exclusive and so the frequencies will not sum to the total of 33.

. *Method*: Quantitative-Comparison Groups (QN-CG); Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/Case Study (MM, CS)

<i>Relevancy</i>	<i>Method General</i>	<i>Country Focus</i>	<i>Disaster/ Emergency Type</i>	<i>Disaster/ Emergency Phase</i>	<i>At-risk Groups</i>
Direct: 22 Indirect: 11	QN-CS: 0 QN-DS: 15 QL: 4 MM, CS: 14	China: 7 Finland: 1 France: 5 Islands of Mayotte and Reunion: 1 Japan/ South Korea/ Russia: 1 Kyrgyz: 1 Mexico: 2 Morocco: 1 Oman: 1 Russia: 6 Saudi Arabia: 2 Spain: 2 Switzerland: 1 Ukraine: 1 United States/ Europe/ Israel/ China/ Singapore/ Japan/ Russia: 1	General: 13 Food Borne: 1 Cardiovascular Diseases: 1 Chikungunya: 1 Cyclone: 1 Flooding: 4 H1N1: 3 H7N9: 1 Influenza General: 1 Marine Submergence: 1 Petroleum Spill: 2 SARS: 2 Security: 2	All Phases: 1 Preparation: 11 Onset: 4 Containment: 3 Recovery: 0 Evaluation: 2 Preparation & Containment: 1 Preparation & Evaluation: 4 Preparation & Onset: 3 Preparation & Recovery: 1 Preparation, Onset & Containment: 2 Preparation, Onset, & Evaluation: 1	Yes: 8 (Children, Elderly, Low SES, People with Disabilities/ Chronic Illness, Rural Residents, Unemployed)

Of the 33 other UN languages (i.e., non-English language) studies ((see Section 7.2 for the references), three were Arabic, seven Chinese, eight French, 10 Russian, and five Spanish. Twenty-two studies were directly relevant and 11 were indirectly relevant. The relevancy was judged as only direct and indirect due to lack of sufficient clarity for the partial and unclear categories for the coders.

Fifteen studies used quantitative methods (none were comparison groups), four employed qualitative methods, five employed mixed methods, and nine used a case study approach.

Regarding countries, seven studies focused on China, with the remaining focusing on an array of regions. These countries includes Finland (1), France (5), Islands of Mayotte and Reunion (1), Japan/South Korea/Russia (1), Kyrgyz Republic (1), Mexico (2), Morocco (1), Oman (1), Russia (6), Saudi Arabia (2), Spain (2), Switzerland (1), Ukraine (1), and United States/ Europe/ Israel/ China/ Singapore/ Japan/ Russia (1).

The types of emergency events studied were varied. The studies investigated food borne (1), cardiovascular diseases (1), Chikungunya (1), cyclone (1), flooding (4), H1N1 (3), H7N9 (1), influenza general (1), marine submergence (1), petroleum spill (2), SARS (2), security (2), and 13 took a general focused approach on emergencies/ disasters.

The phases of an emergency event covered in the studies were also varied. The studies examined preparation (11), onset (4), containment (3), evaluation (2), all phases (1), and a mixture of phases (12). Regarding at-risk/vulnerable groups, majority of the studies focused on general populations, with only eight studies presenting specific demographic information that identified at-risk/vulnerable groups. These at-risk/ vulnerable groups included children, elderly, people with low SES status, people with disabilities/ chronic illness, rural residents, and unemployed individuals.

4.3 A Note About the Grey Literature

There was no English language grey literature used in the present review. All the grey literature identified relevant to the review question did not include any data-based primary studies; instead, the literature either was best practices that related the practices to the existing research or it was theoretical essays, that referenced data-based studies and other essays.

4.4 Quality Appraisal of Individual Studies

Of the 34 English language studies used in the present review, none were placed in the quantitative-comparison group stream, 21 were in the quantitative-descriptive survey stream, five were in the qualitative stream, and eight were in the mixed methods/ case study stream.

In the quantitative-descriptive survey stream, 12 studies were rated to be moderate quality, seven of low quality, and two of very low quality. In the qualitative methods stream, four were rated to be of moderate quality and one of low quality. In the mixed methods/ case study methods stream, six were rated to be of moderate quality, one of low quality, and one of very low quality.

See Appendix 8.2 for table for English language studies that presents the quality rating, as well as relevancy and extracted findings, for each study.

For the 33 other UN languages individual studies, a quality appraisal could not be determined for all the studies. This is noted as needed when evaluating the certainty/ confidence of the synthesized findings.

4.5 Synthesis of Findings Within Methodological Stream and Evaluation of Certainty/ Confidence

For the English language studies, the synthesis of findings within methodological streams showed that the synthesized findings were very similar, if not identical, across the different methods. That is, the evidence within each methodological stream pointed to an overarching finding that was similar across the different streams, with the result that there was no substantive difference between the set of findings synthesized within streams and the set of findings that was synthesized across streams.

For the studies from other UN languages, by and large, the evidence within methodological streams mirrored that from the English language studies. We took these findings and incorporated them with the English language findings.

In sum, the process of synthesis of findings within methodological streams, for both English and other UN languages, showed a pattern of consistency in the findings across the streams and languages. Thus, we took the decision of creating only one set of synthesized findings that represented a synthesis that was both within methodological streams and across methodological streams.

We used the standard tools, such as GRADE and GRADE-CERQual, to evaluate the certainty/ confidence in the findings. However, only the English language studies were considered for the evaluation as the individual study quality appraisal was not consistently available for all the other UN language studies.

The final set of overall synthesized findings along with an evaluation of certainty/ confidence in the findings is presented in Section 4.6. This section also includes the English and other UN languages citations separated out by methodology that support the findings.

4.6 Synthesis of Findings Across Methodological Streams

As discussed in Section 4.5, the final set of overall synthesized findings represented a convergence of findings from within and across methodological streams. The citations from different methodological streams supporting each finding are noted along with the evaluation of certainty/ confidence in the finding within and across methodological streams.

Key to Table

Method: Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/ Case Study (MM, CS)

Citations-Language: English has no suffix; Arabic (AR); Chinese (CH); French (FR); Russian (RU); Spanish (SP)

Certainty/ Confidence Evaluation: QN-DS (GRADE Adapted) – High; Moderate; Low; Very low

QL (CERQual) – High; Moderate; Low; Very low

MM, CS (as appropriate) – High; Moderate; Low; Very low

Not Applicable (NA) – If only one other UN language study supported the finding.

Phenomenon of Interest/ Outcome	Synthesized Finding Across Methodological Streams	QN-DS Within Method Synthesized Finding		QL Within Method Synthesized Finding		MM, CS Within Method Synthesized Finding		Across Methods Certainty, Confidence Evaluation of Synthesized Finding
		QN-DS Supporting Citations (first author)	QN-DS Certainty Evaluation/ Evaluation Explanation Note. Only English language studies considered	QL Supporting Citations (first author)	QL Confidence Evaluation/ Evaluation Explanation Note. Only English language studies considered	MM, CS Supporting Citations (first author)	MM, CS Certainty, Confidence Evaluation/ Evaluation Explanation Note. Only English language studies considered	
Concern	Messages should come from different information sources; messages from organizations are more believable than user generated web content; same message can prompt different responses from different receivers	Hu (2014); Freberg (2012); Johnson (2016); Beaudoin (2009); Zia (2010); Kingdom of Morocco (2005) (AR); Gao (2014) (CH)	Low to Moderate Findings are consistent across studies, three of which were appraised of moderate quality and one very low quality	Anthony (2011); Xie (2011) (CH)	Moderate Two studies, both appraised of moderate quality with consistent findings	Murkova (2014) (RU);	NA No English language study.	Low to Moderate Studies are consistent in their findings; not all areas of the world or types of emergency events are covered.

Concern	Messages should be before an event and emerge early in the event; public health officials are urged to provide clear, timely, reliable information in non-technical language	Beaudoin (2009); Perko (2012); Perko (2013); Sugerman (2012); Eastwood (2009); Perry (2007); Janssen (2006); Zimmerman (2010); Fernandez (2013) (SP); Shalhoub (2015) (AR); Durnev (2009) (RU)	Low to Moderate Findings are consistent across eight studies, of which five are appraised of moderate and three of low quality. Several studies examined all disaster phases with generally consistent findings.	Taylor-Robinson (2009); Anthony (2011)	Moderate The two studies were consistent in findings across events, and both were appraised of moderate quality.	Luth (2013); Karan (2007); Eggers (2011); Fernandez (2013) (SP);	Moderate The findings from three studies, all appraised of moderate quality, are consistent across events; multiple mixed method add consistency and depth to the findings.	Moderate The finding about non-technical language was consistent across cultures and events as well as method streams.
Concern	Absence of early communication can promote rumors; media campaigns can promote action.	Beaudoin (2009); Wood (2012); deBoer (2014); Perko (2012); Perko (2013); Sherman-Morris (2010); Hechmati (2004) (FR); Durnev (2008) (RU)	Low Of the six studies, one was appraised of moderate quality and five low quality. Several of the studies examined all phases of the event; however, within them, there was little focus on early warning; findings for promotion of action were not	Taylor-Robinson (2009); Xie (2010) (CH)	Low to Moderate Only one English language study that was appraised of moderate quality.	Karan (2007); Eggers (2011); Tuerk (2013); Hechmati (2004) (FR); Durnev (2008) (RU)	Low to Moderate Two studies appraised of moderate quality and one of very low quality. Multiple data streams from mixed methods add weight to the findings.	Low to Moderate Multiple cultures and types of events are included in these studies.

			consistent across disaster types.					
Concern	Mediated messages will be integrated with communication from family, friends and social networks	Golding (2011); Freberg (2012); Hellequin (2013) (FR); Gavriloti (2005) (RU);	Low to Moderate Of the two studies, one was appraised of high quality and one of low quality. Findings are consistent across events and cultures.	Eisenman (2007); Romo-Murphy (2011); Xie (2011) (CH)	Moderate Both studies appraised of moderate quality. The qualitative data in these studies provides good evidence for the phenomenon of interest.	Romo-Murphy (2011); Freberg (2012); Rashid (2011); Wakefield (2003)	Moderate Three studies appraised of moderate quality and one of low quality. Finding was consistent across all studies; however message interpretation was not the central focus of all studies.	Low to Moderate Although this finding is consistent across the studies, the relatively small number of studies indicates low to moderate.
Concern	Television and radio are the most useful communication channels; however, when power grids collapse, interpersonal networks become crucial	Beaudoin (2009); Hu (2014); Sugerman (2012); Rashid (2011); Perry (2007); Al-Hamidi (2010) (AR); Hao (2009) (CH); Muniz (2011) (SP)	Moderate Five studies were appraised of moderate quality and one of low quality. All of the studies found that television and radio were useful and sought after communication channels.	---	---	Romo-Murphy (2011); Karan (2007); Arefiev (2012) (RU); Kechanov (2013) (RU); Temiliev (2013) (RU); Durnev (2008) (RU);	Moderate Both studies were appraised of moderate quality. Finding was consistent across both studies.	Moderate These findings are consistent across cultures and events. Visual information is evaluated as a useful communication technique across many populations.
Concern	Messages should promote action; messages should not focus on the	Clerveaux (2009); Sherman-Morris (2010); Perry	Low One study appraised of moderate quality, two of	---	---	Karan (2007); Fraustino (2015); Coronado (2012) (SP);	Moderate Both studies appraised of moderate quality. Both	Low to Moderate Relatively few types of actions were

	technical aspects of risk	(2007); deBoer (2014); Shalhoub (2015) (AR); Ruin (2010) (FR); Muniz (2011) (SP); Xie (2005) (CH)	low quality, and one of very low quality. While the finding is relatively consistent across studies, relatively few events were examined and this finding was not a central research focus of any study.				studies well-developed and executed case studies.	examined; in some instances, these messages were ignored.
Concern	People with underlying health conditions and direct exposure to threat have been found to perceive greater risks	French Republic (2014) (FR)	NA No English language study.	Eisenman (2007)	Low to Moderate Only one study that was appraised of moderate quality.	Arefiev (2012) (RU);	NA No English language study.	Low A paucity of studies makes evaluation problematic.
Concern	Messages must arise from and be adapted to cultural context; women respond distinctively to risk messages	Golding (2011); Drottz-Sjoberg (2012); Rundblad (2010); Al-Shaqsi (2013) (AR); Hellequin (2013) (FR); Qian (2009) (CH)	Low One study appraised of moderate quality and two of low quality. Not all of the studies separated findings by gender. However, this finding was consistent across all studies which included multiple cultures.	Gryzunova (2012) (RU)	NA No English language study.	Sharma (2009); Karan (2007); Setbon (2009) (FR); Nazarenko (2014) (RU); Rode (2008) (FR);	Moderate Both studies appraised of moderate quality. Both studies well-developed and executed case studies.	Low to Moderate This finding was seldom the sole focus of studies, but the finding emerged from every study, regardless of method. These studies include multiple events and cultures.

Motivation	Many sorts of messages, conveyed through many channels, will motivate people to seek additional information:	Sherman-Morris (2010); Beaudoin (2009); Perko (2013); Wood (2012); Bird (2012); Rutsaert (2013); Gao (2014) (CH)	Low to Moderate Three studies appraised of moderate quality and three of low quality. Studies focused on multiple types of risk events.	Taylor-Robinson (2009); Xie (2011) (CH)	Low to Moderate Only one study that was appraised of moderate quality.	Karan (2007); Sharma (2009); Barengo (2011) (SP); Francescuti (2007) (SP);	Moderate Both studies appraised of moderate quality. Both studies well-developed and executed case studies.	Low to Moderate Findings across method streams are consistent.
Motivation	Messages will not work well if: they do not take into consideration social and family networks; if they are identical; if they strike people as manipulative; if information sources do not have public health expertise; and if people do not have baseline knowledge to understand and remember messages.	deBoer (2014); Rundblad (2010); Johnson (2016); Drottz-Sjoberg (2012); Zia (2010); Al-Shaqsi (2013) (AR)	Low to Moderate Two studies appraised of moderate quality, two of low quality, and one of very low quality. Consistent finding across multiple cultures and different types of events.	Anthony (2011)	Low to Moderate Only one English language study that was appraised of moderate quality.	Fraustino (2015); Rode (2008) (FR); Heitz (2013) (FR); Sethon (2009) (FR)	Low to Moderate Only one English language study that was appraised of moderate quality.	Low to Moderate Findings across method stream were consistent; however a paucity of studies.
Motivation	The most influential message source will vary depending on disaster, but	James (2007); Sugerman (2012); Sherman-Morris	Moderate Four studies appraised of moderate quality and one of low	---	---	Luth (2013); Rashid (2011); Sethon (2009) (FR);	Low to Moderate One study appraised of moderate	Moderate The findings are consistent across method

	messages should be non-technical in nature.	(2010); Bird (2012); Eastwood (2009); Shalhoub (2015) (AR); Durnev (2015) (RU); Zaitseva (2010) (RU); Xie (2005) (CH)	quality. The need to use non-technical language finding was consistent across studies. This finding was consistent regardless of the message source in these studies.				quality and one of low quality. Studies showed consistent findings.	streams and also across types of risk and cultures. These finding also replicate the findings in earlier literature reviews.
Motivation	Messages that influence suggest specific actions, but warnings may go unheeded.	Beaudoin (2009); Sherman-Morris (2010); Golding (2011); Zimmerman (2010); Ruin (2010) (FR); Hao (2009) (CH)	Low One study appraised of moderate quality and three of low quality.	Taylor-Robinson (2009)	Low to Moderate Only one English language study that was appraised of moderate quality.	Sharma (2009); Karan (2007); Wakefield (2003); Fernandez (2012) (SP); Setbon (2009) (FR); Rode (2008) (FR);	Moderate All three studies appraised of moderate quality.	Low to Moderate Findings are relatively consistent across method streams.

4.6.1 Characteristics of Studies Providing the Final Set of Findings by Method

For the concern outcome, the following is an overview of the characteristics of the studies that comprise a methodological stream. See Section 4.6 along with Section 7.1 and Section 7.2 for references.

A total of 15 quantitative descriptive survey studies provided the findings; many studies supported more than one finding. As defined by the WHO, none of these studies focused on evaluation. Seven studies focused on preparation, seven on containment, and one on multiple phases. In most cases, preparation did not involve a specific event, for example, tornados in general were the focus of preparation rather than a specific tornado event. None of them focused on specific vulnerable populations. In terms of the types of event examined, these studies focused on the following: one on hurricanes, one on SARS, four on floods (with one study on the resulting boil water order), two on preparation for terrorist attacks, one on wildfires, two on flu pandemic (not SARS), one on tsunami, one on food recall, one on Ebola, one on tornados, and one on global climate change. One study did not focus on any specific event but on disaster generally. The nations of focus included the United States, China, Belgium, Russia, Mauritania, the Netherlands, Australia, and the United Kingdom.

Four different qualitative studies yielded the set of findings. Of those four studies, two focused on infectious disease (one connected with terrorism), one on hurricanes, and one on tsunami. The nations that served as study locus were the United States, United Kingdom, and Indonesia. Most of these studies were conducted in the global north. A narrow range in events examined also prompts questions of generalizability. Two of these studies focused on vulnerable populations: School children in the Caribbean and Latinos living in Los Angeles in the United States. In both instances, the samples were small. The relative paucity of studies suggests some caution when evaluating confidence.

Ten studies using mixed-method and case study yielded the set of findings. One additional case study that examined how children learn about hazards and disasters through a game was not found to be broadly applicable. Of the 10 studies, one focused on SARS, two on a cyclone/hurricane, one on food-borne illness connected with terrorism, one H1N1, two on floods, one on earthquakes, and one on all hazards. The nations that served as study locus were the United States, Japan, Canada, Singapore, and India. The studies tended to define vulnerability as the entire population exposed to a specific hazard or event. This definition of vulnerability is appropriate when issues such as terrorism or large disasters such as hurricane/ cyclones are the focus of the event.

For the motivation outcome, the following is an overview of the characteristics of the studies that comprise a methodological stream. See Section 4.6 along with Section 7.1 and Section 7.2 for references.

A total of 14 quantitative descriptive survey studies contributed to these findings. As defined by the WHO, none of these studies focused on evaluation; all of the studies cited here focused on either preparation, containment, or a combination of those two phases. None of them focused on specific vulnerable populations since in all cases large scale events such as terrorists attacks or floods were the focus of research. In terms of the types of event examined, these studies focused on the following: one on hurricanes, one on SARS, two on floods (with one study focusing on the resulting boil water orders), two about preparation for terrorist attacks, one on wildfires, two on flu pandemic (not SARS), one on food recall, one on Ebola, one on tornados, and one on global climate change. One study did not focus on any specific event but on disaster generally. The nations of focus included the United States, Belgium, Russia, Slovenia, Canada, the Netherlands, Australia, Belgium, and the United Kingdom.

Three qualitative studies yielded this set of findings. Of those, two focused on infectious disease and the third on food-borne illness. The nations that were the focus of these studies were the United States and the United Kingdom. The relative paucity of studies suggests some caution when evaluating quality. Two of the studies focused on vulnerable populations: School children in the Caribbean and Latinos living in Los Angeles in the United States.

Six studies using mixed-method and case study yielded this set of findings. Of these, one focused on SARS, one focused on all hazards, two on cyclone/ hurricane, and two on floods. The nations that were the focus of these studies were the United States and Singapore. Vulnerable populations were described as all those exposed to hazard events.

4.7 Media Reports

One media report (see Section 7.3 for the reference) was identified for the review objective in the search for English-language news stories. The media report examined a multi-platform health campaign in Sierra Leone during the Ebola outbreak. Central findings included that radio is an influential medium to provide people with health information, that health information should be developed in a specific cultural context, that social media can contribute to the overall impact of a health campaign, that the campaign reached about 68% of the residents of Sierra Leone, and that health messages should focus on specific actions that individuals can take to protect their own health. The report also noted that journalists who were used to traditional news reporting needed training to provide persuasive health information that was part of the campaign. The report combined a survey and in-person interviews with those in the radio industry who executed the campaign.

5.0 DISCUSSION

5.1 Summary of Results

5.1.1 Overall Summary

For the synthesis evidence for the present review, on elements and timing of messages that best influence public concern and motivation to action, 34 English language and 33 other UN language studies were used for data extraction and formulating synthesized statements within and across methodological streams, which in turn were evaluated for confidence/ certainty.

The results showed that explaining risk in probabilistic and technical terms is not helpful in promoting a variety of risk mitigation behaviors. Public health officials appear to be the most credible source for risk information; depending on the culture and in some cases, government officials and non-local information sources are generally found to be less credible. The traditional mass media, particularly radio and television, have been found to be the most impactful communication channels; when events include a loss of power, interpersonal communication networks become important. In addition, the results also showed that the messages should come from different information sources and emerge early in the outbreak; messages should be conveyed in non-technical language, and the lack of an early message allows rumors to take hold; messages from a set of sources will get integrated with messages from other sources, whether that is the mass media or family and friends; and it is important to note that many sorts of messages will be dismissed by individuals and sometimes communities for a variety of non-generalizable but sometimes shared reasons.

Only two studies focused specifically on at-risk/ vulnerable populations. One study examined how children in the Caribbean learned about disasters by playing a game and the second examined how a sample of Latinos in the Los Angeles area responded to risk messages. The study with children showed that age-appropriate games could help this age group prepare for disasters. In the Los Angeles study, the researchers found that those participants who were members of small groups that discussed the messages responded in different ways than did those who received only mediated risk messages. However, in both cases, it is not feasible to generalize the findings from the individual studies to vulnerable populations in different contexts or dealing with different kinds of disasters.

5.1.2 Results Vis a Vis Findings from Existing Reviews

The findings from the literature reviewed for the present review are consistent with the findings from previous reviews, extending some nuanced understandings but bolstering a set of consistent research findings. Specifically, the findings from the present review, particularly those from the case studies, suggest that mediated emergency communication messages can have an impact, particularly when they focus on a few health behaviors and when messages are consistent but not identical. The studies reviewed here provide some indication that social media can be a good source of additional information and that they can attract attention to problems, but that primary information sources remain the traditional media, particularly television and radio. Evidence from the present review supports earlier work that explaining risk in probabilistic and technical terms does not work well for promoting a variety of risk mitigation behaviors. Public health officials appear to be the most credible source for risk information; depending on the culture and in some cases the event, government officials and non-local information sources are generally found to be less credible. The findings from the other UN languages scholarship generally support these findings.

5.2 Research Gaps

Most of the studies for the present review focused on an emergency event other than emergent infectious disease; while there are parallels with hazards and disasters, there are also important differences between such events. Some of the studies evaluated public opinion or similar data that was more than five years old; although this is a problem, in many instances, these were the only data available to the studies. Many of the qualitative studies examined had methodological flaws and hence the validity of the conclusions drawn in that work is open to question. All the studies reviewed were post hoc and many of them were descriptive rather than predictive. Because of the nature of the review objective, studies that evaluated and analyzed patterns in media content without connecting those patterns to potential public response were not included. Further, there was no evidence to determine level of motivation to act on health recommendations, or the level of compliance with health recommendations.

In addition, there were no comparative studies that examined human response across the same set of questions across multiple types of hazards. Such research is currently being conducted by David M. Abramson at New York University, but it has yet to be published. Second, there were almost no studies that compared the response in different countries with different political systems across the same hazard within roughly the same time frame. The closest the current literature came to this is multiple case studies for the H1N1 flu pandemic. Both these gaps point to yet a third gap: the lack of quick response data to examine the earliest onset phase of emergent infectious disease risk communication. There is a parallel here: the hazards community lacks examination of response to the earliest onset - the initial 30 seconds - of events such as earthquakes, which provide almost no prior warning. While 30 seconds is probably the wrong time frame when the risk is an emergent infectious disease, scholars lack data on the first days of the impact of initial risk communication at the very onset of emergent risk.

While much of the scholarship for the present review focused on individual response to risk communication, this literature is based on the theories of individual differences. However, the literature has not examined individual differences from a market segmentation perspective, using the sort of socio- and psychographics more commonly used in advertising and social marketing research. Similarly, “vulnerability” in the current literature is generally defined either geographically or through traits such as age, gender, physical disability, etc. New research should examine vulnerability through a psycho-social and/or economic-social lens. Some of the literature examined in this review that arises from the impact of risk communication on communities hit by Hurricane Katrina hints at the impact of psycho-social factors on risk communication, but much more research is needed. There was also no empirical study in the way that WHO defines it of how risk information needs to be changed during the course of an event. Some studies—tabletop exercises that are often associated with responses to terrorism—have been published, other work is considered proprietary and has not been made public. There is a paucity of scholarship about potentially shifting risk information needs throughout an event, including the onset phase.

There is little to no scholarly study on how to promote individual preparedness for emergent infectious disease. Literature that examines preparedness for natural hazards in the United States found that two related but separable factors explained willingness to prepare: confidence in government and self-efficacy. This literature also raises another largely unexamined question: whether the goal of risk communication should be persuading individuals to act based on fact or whether an equally important goal might be to promote new norms, which gradually become incorporated into the culture. The case study of Singapore’s response to the H1N1 virus (Karan, 2007) analyzed for the present review suggests that “norming” effective risk behavior (washing hands) may be a more useful strategy than providing information and expecting individuals to respond. This concept of creating new norms may be particularly pertinent to emergent diseases such as Zika virus that can be sexually transmitted.

The creation of new cultural norms is one of the lessons of the AIDS epidemic, but the “norming” approach has received little systematic scholarly attention in the risk communication literature. The very nature of the research enterprise forces scholars to “segment” risks into discrete and unrelated “issues” to be examined. However, some of the earliest work on the intersection of risk and culture (Douglas & Wildavsky, 1982) suggests that culture helps to define risk and that people understand risks in relational ways, although those relationships are not mathematical or probabilistic in nature. How people connect risks through culture, and how those connections promote understanding and encourage early response, needs to be another focus of new research efforts.

5.3 Limitations of the Present Review

The present review has three main limitations. First, the other UN languages articles and reports were not fully translated into English, which may have led to some information to be missed. Second, the coding, data extraction, and findings synthesis was done only by one person which prevented the calculation of inter-coder reliability as a check for consistency of these data. Third, the evaluation of certainty/ confidence of synthesized findings within methodological streams could not be conducted in a manner similar to the other reports.

5.4 Authors’ Conclusions

Social science research develops on a different timeline than science, technology, engineering, and mathematics (STEM) research. Measures such as impact factors of specific journals and H factors for specific authors provide only an incomplete measure of the significance of particular studies. Social science scholars are expected to foreground theory. For example, infectious disease specialists are not expected to note that they employ the “germ theory of disease;” it is assumed. There is no parallel assumption about which theory is automatically employed in the social sciences.

The scholarship on human response to natural and technological hazards spans these hard science/ social science approaches. Social science scholarship from the hazards community has tended to focus on practical problems: how can people be encouraged to evacuate, what should governments and associated institutions do to prepare organizations and individuals for disasters and what systems need to be in place to allow communities to engage in disaster recovery and mitigation. Many of these practical problems involve communication at the organizational and institutional level; some of them also involve communication with the larger public. Hazards are but one kind of risk, but they present the closest academic parallel to the risks surrounding emerging infectious diseases.

The dominant theoretical understandings in risk communication, and the scholarly work that supports them, emerged in the 1970s, 1980s, and 1990s, well before the prescribed time of the present literature review. In some cases, research streams arose from or overlapped with the practical problems that were the focus of social science-based investigations of human response to hazards. In other cases, theory arose from fields such as public opinion formation or psychology and sociology. The most influential of these theories from the field of risk perception are: controlled vs. dread risk; lay as opposed to expert rationality as a way of understanding risk; culture as a significant influence on risk perception; social amplification of risk, or the notion that cultural understandings and norms can influence how individuals perceive risks. The dominant theoretical paradigms in risk communication are: individual differences, or the theoretical understanding (one widely shared in the social sciences), that individual differences (gender, education, life experience, etc.) among audience members will influence how individuals perceive, understand, and respond to identical messages; that professional routines influence the way risk messages are constructed and transmitted through the mass media; that individuals are active, as opposed to passive, seekers of information and active processors of it; that information processing by individuals is influenced by emotion

and rationality; that communication is an iterative process, including not just transmission of facts but those facts in context, a context that can be provided by narrative. Theory in risk communication and risk perception has not been reduced to a coherent whole—a unified field theory—and scholars in the hazards community who have focused on communication have relied on multiple theoretical approaches to formulate studies and explain their results.

The literature reviewed for the present review needs to be interpreted in this larger context. The authors of the empirical work reviewed and evaluated often acknowledge this early theoretical work in their formulation of research questions and hypotheses and in their analysis of the results; but the research that supports these central theoretical understandings lies outside the scope of this review.

Finally, and also unlike traditional research in various natural and medical science fields, when the focus is risk communication, research ethics prohibits the kind of condition-intervention-response construction of empirical studies that is more common in the medical and/or public health literature. Because of these ethical constraints, much risk communication literature is descriptive, post hoc, and seldom employs randomly assigned treatment groups. It is the view of the authors of this report that these limitations do not make these scholarly findings less valid or less “scientific.” They represent a different approach but one that reflects a human experience where multiple variables cannot be controlled and the best analysis reflects multiple theories rather than the parsimony that is so often sought in the natural and medical sciences.

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8.0 APPENDIXES

8.1 Adjustments to the GRADE Process for Quantitative Descriptive Surveys (Cross-sectional; No comparison groups for outcomes of interest)

A. Levels of quality of study findings

High quality: It is highly likely that new evidence will not substantially modify the study findings.

Moderate quality: It is somewhat likely that new evidence will not substantially modify the study findings.

Low quality: It is somewhat likely that new evidence will substantially modify the study findings.

Very low quality: It is highly likely that new evidence will substantially modify the study findings.

B. Factors that can reduce the quality of study findings

1. Limitations in study design or execution

We are more confident about the high quality of study results, when we have:

- . High validity and reliability of measurement of variables
- . Attention to minimization of confounding variables, through, for example, use of control variables

2. Inconsistency of results

We are more confident about the high quality of study results, when we have:

- . Homogeneity in the results across disaster types, national/cultural boundaries, etc.
- . Heterogeneity of results, if present, has a plausible explanation

3. Indirectness of evidence

We are more confident about the high quality of study results, when we have direct evidence, which is:

- . Direct - data are from affected populations, currently or in the past.
 - Less direct - data from populations who may be likely to be affected in the future.
 - Least direct - data from populations unlikely to be affected in the future
- . Study variables directly speak to question of interest and outcomes of interest

4. Imprecision of results

We are more confident about the high quality of study results, when results are more precise, which is:

- . Results are statistically significant
- . Sample size is at least 90 for single group

*5. Publication bias * (for a finding collated across multiple quantitative studies)*

We are more confident about the high quality of results collated as a finding across individual studies, when:

- . There is at least one study that shows nonsignificant/null results

8.2 Quality Appraisal of and Extracted Findings from English Language Individual Data-based Primary Studies (Organized by Method)

Key

Method: Quantitative-Comparison Groups (QN-CG); Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/Case Study (MM, CS)

Relevancy: Direct; Indirect; Partial; Unclear

Quality: QN-CG – High (low risk of bias); Moderate (minor risk); Low (some risk); Very low (significant risk)

QN- DS – Strong; Moderate; Low

QL - High; Moderate; Low; Very low

MM, CS - High; Moderate; Low; Very low

<i>Citation (first author)</i>	<i>Method</i>	<i>Relevancy</i>	<i>Quality Appraisal Rating</i>	<i>Findings</i>
Beaudoin (2009)	QN-DS	Indirect	Moderate	Media campaigns can be impactful, but impact tapers off.
Bird (2012)	QN-DS	Partial	Moderate	People accessed social media by phone; found information trustworthy and credible and also found government and mass media trustworthy and credible.
Clerveaux (2009)	QN-DS	Unclear	Very low	Study tested awareness through a game. Children ranging from 9 to 12 appeared to increase knowledge, particularly of preparedness and mitigation.
deBoer (2014)	QN-DS	Unclear	Low	Risk communication framing in terms of prevention involves notions of chance and harm. Focus on how to protect self and family from danger. Risk frame is expected to stimulate people to anticipate future unwelcome events.
Eastwood (2009)	QN-DS	Partial	Moderate	People exposed to both media messages and small group discussion are more likely to take action than those just exposed to mediated messages.
Drottz-Sjoberg (2012)	QN-DS	Unclear	Low	The difference between personal perception of risk and generalized risk may disappear over time. Risk communication involves values and systems deeply rooted in mental structures. Important to consider the positive relationship between positive exposure to risk and risk perception.
Freberg (2012)	QN-DS	Indirect	Moderate	Food recall messages generated by those in authority got stronger response than those from user generated content.
Golding (2011)	QN-DS	Unclear	Low	From point of view of public information officers, the greatest need is to be able to access and gain trust of minority communities.
Hu (2014)	QN-DS	Partial	Moderate	Respondents preferred traditional mass media channels, such as radio and television. Mobile phone use high during second stages of event. Media use varied among social groups.
James (2007)	QN-DS	Unclear	Moderate	From point of view of public information officers, greatest need is accessing and gaining trust of minority communities.
Janssen (2006)	QN-DS	Direct	Moderate	General public resists terms such as vaccine priority

				group; results in rejection of messages. People did not understand difference between seasonal flu and P1N1 vaccine.
Johnson (2016)	QN-DS	Partial	Moderate	Consuming news was the best predictor of how people evaluated risk. Strongest predictor was trust in the CDC, third stronger predictor was prior knowledge. News enhances both positive response and negative responses, for example, perceived risk.
Perko (2012)	QN-DS	Partial	Low	Higher audience knowledge correlated with willingness to take preventive measures. Risk communication needs to focus not just on knowledge but on other heuristic predictors, such as attitudes toward risk and risk perception.
Perko (2013)	QN-DS	Indirect	Low	Good communication of management actions with the public is required. More specific knowledge related to better understanding. Provide risk information as a regular part of public education. Specific knowledge plays a dominant role in the reception of information.
Perry (2007)	QN-DS	Partial	Moderate	Television and radio are equally useful, but television far exceeded radio in hours after event in terms of information seeking. There were the only two factors that correlated with speed of information flow. Age negatively correlated.
Rundblad (2010)	QN-DS	Indirect	Moderate	Public health officials most trusted source.
Rutsaert (2013)	QN-DS	Indirect	Moderate	Information seeking can be triggered by a lack of trust in self and agencies; gender also plays a role. Social media provide additional information value.
Sherman-Morris (2010)	QN-DS	Partial	Low	University emergency alerts work for students. 75% said they had taken shelter.
Sugerman (2012)	QN-DS	Indirect	Moderate	Television is the primary source. Messages that worked were non-technical. People with underlying health conditions were likely to perceive greater risk. Reduce the total number of messages.
Wood (2012)	QN-DS	Indirect	Low	Must communicate actionable risk, not technical details. To encourage preparedness, must communicate about actions to take; it helps if people also see what actions need to be taken.
Zia (2010)	QN-DS	Unclear	Very low	Flaws in mental models that people have may not be easy to change. Political conservatives are systematically different in those models.
Anthony (2011)	QL	Direct	Moderate	Respondents actively sought out different information sources; reading/seeing the same message from multiple sources was found less credible. Identical messages viewed as manipulative. Audiences understand messages may change over time.
Eisenman (2007)	QL	Partial	Moderate	Participants integrated media messages with information from friends, family, neighbors. Emotion appeals swayed people from ambivalence to action. Messages must consider obstacles encountered by vulnerable and minority communities.
Taylor-Robinson (2009)	QL	Partial	Moderate	Respondents reported needing accurate information earlier in the outbreak. Rumor spreads in the

				absence of information.
Zimmerman (2010)	QL	Partial	Low	Information should be conveyed in a controlled, calm way. In case of sarin gas, people in authority were believed to be the most credible sources.
Romo-Murphy (2011)	QL	Partial	Moderate	Radio was primary information source during onset. Community and social networks were important when mass media system collapsed. Should employ mass media and culturally embedded information sharing.
Eggers (2011)	MM, CS	Indirect	Moderate	Message should reflect in-depth understanding of consumers' perceptions and priorities. Consumers trust is based on what matters to them. Best communication will fail if consumers lack trust and confidence in those communicating.
Fraustino (2015)	MM, CS	Indirect	Moderate	Evaluation of zombie apocalypse campaign. Campaign got attention but was unsuccessful in changing behavior.
Karan (2007)	MM, CS	Direct	Moderate	Media campaigns on public health issues can work. Public adoption of two specific health measures was extensive. Information was mediated; campaign involved multiple forms of communication and was centralized.
Luth (2013)	MM, CS	Partial	Moderate	Audience members say they prefer to receive information from public health personnel rather than politicians or agency officials. Credibility is enhanced by involved public health professionals. Bureaucratic inefficiency may contribute to low vaccination rates.
Rashid (2011)	MM, CS	Indirect	Low	News content has an impact on risk perception; not all audience members interpret flood information in the same way. Visual information may be helpful in conveying meaning.
Sharma (2009)	MM, CS	Indirect	Moderate	Environmental cues strongly associated with decision to evacuate. Social cues less influential. Past cultural experience also influenced decision as did previous experience with evacuation.
Tuerk (2013)	MM, CS	Indirect	Very low	Campaign to encourage people to seek help with PTSD. Most of those who returned survey were women. Among respondents, most reported multiple exposure to potentially traumatic events.
Wakefield (2003)	MM, CS	Partial	Moderate	Use of visual information helps understanding and some response.