Evidence Syntheses to Support the Guideline on Emergency Risk Communication

Q7: What are the elements and steps of effective, strategic communication planning?

Final Report

Submitted by
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Date: December 21, 2016
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Wayne State University

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Library assistance provided by Damecia Donahue.

We acknowledge the assistance of staff (in alphabetical order) Mary Alleyne, Robin Collins, Victoria Dallas, Janine Dunlop, Andrea Hill, Charylce Jackson, and Angela Windfield.

World Health Organization

Methodology assistance provided by consultant Jane Noyes, library assistance provided by Tomas Allen, and general research assistance provided by Nyka Alexander.

We acknowledge the assistance of staff Oliver Stucke.

Project initiated and conceptualized by Gaya Gamhewage and Marsha Vanderford.

Authors

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

Strategic planning primarily involves the assessment and evaluation of intervention activities in order to improve public awareness and influence behavior before, during and after a public health emergency. There is no singular strategy for ensuring successful communication in such situations. Education programming about the potential for specific kinds of emergency events and protocols for response should be administered prior to the crisis, as this is the period where communities are in the greatest distress. It is important to give more consideration to the various methods that may be necessary to educate the variety of audiences affected by an emergency event.
Strategic planning efforts must take into account how life circumstances, cultural values, and perspectives on risk influence behavior during an emergency event. Issues like trust, social isolation and attitudes toward planning must be considered when dealing with various populations. The quality of response depends, in great part, on meeting the needs of the most vulnerable populations, as these individuals have the greatest potential for loss and often the least amount of resources to act before and during a public health emergency event.

Interdisciplinary collaboration and coordination between public health officials, first responders, community leaders, and other personnel associated with response is an important factor and strategic communication with multiple stakeholders is necessary to mitigate public health emergency situations. Training and being proactive in preparing family and community members to take immediate action in response to an emergency event is another important factor. All personnel should consider a more “inside-out” approach that involves using the community as a resource and establishing networks to better understand local needs and concerns. Communication remains a central component of successful strategic planning in emergency situations. Carefully considering ways to use communication that is culturally specific to ensure the greatest reach of key messages across multiple audiences.

1.3 Objective

1.3.1 Question

The objective was to conduct a systematic review of the extant literature on effective strategic communication planning during risk communication. Specifically, the purpose of the systematic review is to address the following question:

What are the elements and steps of effective, strategic communication planning?

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), responding and implementing partners.
Phenomena of Interest: Approaches to strategic communication planning, including types of participants, planning processes, and components of resulting plans.
Comparison: All hazards versus specific threats; varied development processes, data-driven versus best practices, inclusion of metrics/indicators. Variations in approaches to strategic communication planning related to equity considerations such as local contextual and population characteristics.
Evaluation: Impact on breadth/generalizability of resulting plan, feasibility of implementation, buy-in of leadership and implementers.
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 best approaches (elements, components, steps, processes) to strategic communication planning.

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 planning elements and steps that were effective or in the absence of evidence of effect appeared to work best as follows:

Elements and steps of strategic communication planning:
→ Increase/decrease of planning effectiveness or planning best practices.

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 types of hazards/events, types of effectiveness data, different planning processes, components of resulting plans. Instead of seeing these terms as comparison groups, as may be the case in a randomized trial, we took these concepts/variables to be as potentially associated with planning 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.

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 disaster/emergency event. Also of interest were data from studies of populations who were likely to be affected by a relevant disaster/emergency event, particularly studies that focused on promoting individual preparedness. Also of some interest were data from studies that addressed how organizations, predominantly government organizations or individuals employed by governments, consider risk perception and risk communication messages in regards to engaging communities.
2.0 **EXISTING 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 17 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 are narrative synthesis.
- Relevancy judged as only direct and indirect (see above).

<table>
<thead>
<tr>
<th>Review Citation (first author) and Review Purpose</th>
<th>Modified AMSTAR Quality Rating</th>
<th>Relevancy</th>
<th>Key Relevant Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cairns (2013): to determine the role of communication competency alongside disaster assessment and management in controlling communicable disease outbreaks.</td>
<td>Low</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Author</td>
<td>Year</td>
<td>Method</td>
<td>Importance Level</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------</td>
<td>------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Codreanu</td>
<td>2014</td>
<td>Direct</td>
<td>Moderate</td>
</tr>
<tr>
<td>Gesser-Edelsburg</td>
<td>2015</td>
<td>Direct</td>
<td>Moderate</td>
</tr>
<tr>
<td>Glik</td>
<td>2007</td>
<td>Direct</td>
<td>Moderate</td>
</tr>
<tr>
<td>Hoppner</td>
<td>2012</td>
<td>Direct</td>
<td>Moderate</td>
</tr>
<tr>
<td>Kellens</td>
<td>2013</td>
<td>Direct</td>
<td>Moderate</td>
</tr>
<tr>
<td>Levac</td>
<td>2012</td>
<td>Indirect</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
| Lin                    | 2014          | Direct     | Moderate         | To survey literature pertaining to the Moderate Direct A variety of factors influence individuals’ willingness to engage in self-preparation behavior in response to a
H1N1 pandemic in an effort to address the relationships between communication inequalities and influenza outbreaks. | Moderate | Direct | Health crisis, including demographic characteristics, communication behaviors, and attitudes toward the crisis and management authorities. Further, engagement with social networks promotes both community involvement and information sharing, both of which are factors that positive influence compliance with self-preparation measures.

Mair (2014); to synthesize literature pertaining to post-crisis recovery strategies among noted tourist destinations. | Moderate | Indirect | In tourist locations, disaster response ought to be funded by both government and relevant industries. Destination managers ought to collaborate with media outlets so that the quality of information sent to tourists is controlled and that disaster impacts are not sensationalized. Knowledge-sharing between various stakeholders is key to both effective preparation and recovery.

Rebmann (2009); to demonstrate the role of infection prevention specialists in emergency management strategies across various contexts. | Moderate | Indirect | Infection prevention experts can play key roles in all four phases of disaster management; as such, they ought to communicate and collaborate with public health agencies to promote education, aid in surveilling disaster conditions, and shape public health policy.

Revere (2011); to learn about the tools utilized by public health agencies to communicate with health care providers. | Moderate | Direct | Health care providers are likely to experience a detrimental overabundance of messages due to redundancies in emergency message transmissions through different formats and delivery systems. There is insufficient research that aims to evaluate different emergency message transmission systems to health care providers in a scientifically rigorous way.

Romo-Murphy (2014); to investigate the function of broadcast media in disaster preparedness education for natural disasters. | Low | --- | ---

Ruggiero (2013); to synthesize the body of literature pertaining to crisis communication and events of terrorism. | Low | --- | ---

Ryan (2015); to determine the impacts natural disasters such as cyclones might have on the management of noncommunicable diseases. | Moderate | Indirect | Natural disasters like tropical cyclones can have profound secondary effects on public health by harming the health infrastructure needed to both respond and recover to such disasters. Specifically, they can disable communication systems, reduce access to resources like clean water, disrupt medical services and treatment, and destroy and preclude access to key medical equipment. As such, existing literature demonstrates the need for health organizations to implement greater protective measures and prepare for disasters by generating alternative treatment and communication options, as well as storing extra supplies.

Savoia (2013); to trace patterns in current research across public health communication | Moderate | Direct | Most public health communication research tends to be theoretical in nature, or otherwise engages in poorly-designed empirical research that largely neglects the employment of theoretical models to evaluate the
regarding sociodemographic factors, behaviors, and preparedness outcomes. effectiveness of different types of messages in contexts of public health emergencies. As such, researchers should begin conducting studies to assess what message designs are best. Further, analysts should consider evaluating messages during crises in real-time so that corrections can be made for the public if necessary.

<table>
<thead>
<tr>
<th>Source</th>
<th>Quality</th>
<th>Type</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thacker (2011); to explore the role of Epi-Aids in CDC crisis assessment and management efforts.</td>
<td>Moderate</td>
<td>Indirect</td>
<td>The CDC’s deployment of Epi-Aids has granted the organization the capacity to immediately respond to health crises on an international level. The investigation and reactive work done by such field operatives in the context of health crises is key to allow health organizations to adapt to new circumstances and to increase public trust in such organizations.</td>
</tr>
<tr>
<td>Watchinger (2013); to understand how the public’s risk perception can best be managed through governance in the case of natural disaster.</td>
<td>Moderate</td>
<td>Direct</td>
<td>Individual risk perception of natural disasters is primarily influenced by previous experience with natural disasters as well as degree of trust in authorities. These factors can be influenced by the cultural and demographic characteristics of individuals. Most studies suggest that the most effective way to improve understanding of natural disaster risk, increase trust in authorities, and motivate self-preparation among the public is to deploy greater public participation measures.</td>
</tr>
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</table>

### 2.3 Summary of Relevant Findings From Existing Systematic Reviews

The existing reviews noted above view risk communication as an interdisciplinary phenomenon. Overall, these works consider a variety of public health crises, including natural disasters, terrorism, pandemics and epidemics, as well as public health emergencies in general. The reviews are largely based upon studies that analyze crisis communication in nations of the developed world, meaning that they examine countries with established public health infrastructures. As Table 1 demonstrates, 3 of the 17 reviews were found to be of low quality, 14 of moderate quality, and none of high quality. The following findings are consistently offered across the reviews:

- Risk perception among the public is a very important factor in determining individuals’ preparation behaviors for a crisis. Risk perception itself is affected by a variety of factors, including demographic characteristics, trust in authorities and health officials, access to resources, prior disaster experience, and disaster knowledge.
- Community involvement is an important factor in determining one’s preparation behaviors; therefore, disaster education, training, and knowledge-sharing ought to be engrained within these interpersonal social networks.
- Public health crises require effective collaboration between agencies and organizations at all levels in order to practice swift and flexible management strategies.
- The effectiveness of communication channels is important to consider – not simply in terms of the relationship between health organizations and the public, but between distinct health organizations themselves.
- Public health organizations should incorporate their field operatives at all levels of disaster management, from planning to emergency response and recovery.
- Research generally fails to interpret empirical findings through the lens of a theoretical model that could help to understand, and thus, predict the measured phenomena so that more concrete and practical recommendations for the improvement of crisis communication and planning can be made.
2.4 Summary of Research Gaps Identified by Existing Systematic Reviews

The reviews indicate that the body of literature is lacking the following:
• Research that investigates the utility of social media for health and emergency organizations as a tool to coordinate strategic planning across agencies and to disseminate messages to the public during crises.
• Evidence-based assessments of disaster and risk communication messages; particularly, assessments of messages in the contexts of different crises, as well as in the contexts of different audiences.
• Studies that offer a clearer understanding of the relationship between risk perception and behavior, as well as intervening factors such as uncertainty.
• Empirical research performed using a theoretical model to remedy gaps between theory and practice.

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 Figure 3.1. 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 mix-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

Findings from Individual Studies
By Method

- Quality Appraisal of Individual Studies
- Data Extraction/Findings from Individual Studies

Method: Quantitative-Comparison Groups
- English Language Individual Studies
- Other UN Languages Individual Studies
- Grey Literature Individual Studies

Method: Quantitative-Descriptive Survey
- English Language Individual Studies
- Other UN Languages Individual Studies
- Grey Literature Individual Studies

Method: Qualitative
- English Language Individual Studies
- Other UN Languages Individual Studies
- Grey Literature Individual Studies

Method: Mixed-Methods/Case Study
- English Language Individual Studies
- Other UN Languages Individual Studies
- Grey Literature Individual Studies

Findings from Individual Studies

Synthesized Findings
Across Individual Studies
Within Method

- Synthesized Findings (with Subgroup Analysis)
- Evaluation of Certainty/Confidence of Synthesized Findings
- Explanation of Certainty/Confidence Evaluation

Synthesized Findings
Across Methods

Synthesized Findings Across Individual Studies

- Quantitative-Comparison Groups Findings
- Quantitative-Descriptive Survey Findings
- Qualitative Findings
- Mixed-Methods/Case Study Findings

Synthesized Findings Across Individual Media Reports

Final Set of Findings Synthesized Across Methods (with Subgroup Analysis)
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.”

<table>
<thead>
<tr>
<th>Term</th>
<th>Synonym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster*</td>
<td>Alert</td>
</tr>
<tr>
<td>Disaster plan*</td>
<td>Alert system</td>
</tr>
<tr>
<td>Communication</td>
<td>Warning</td>
</tr>
<tr>
<td>Risk communication</td>
<td>Warning system</td>
</tr>
<tr>
<td>Emergenc*</td>
<td>Plan</td>
</tr>
<tr>
<td>Hazard*</td>
<td>Communication plan</td>
</tr>
<tr>
<td>Risk*</td>
<td>Strategy</td>
</tr>
<tr>
<td>Threat*</td>
<td>Strategic plan</td>
</tr>
<tr>
<td>Emergency preparedness</td>
<td>Evaluate (various)</td>
</tr>
<tr>
<td>Emergency management</td>
<td>Procedure</td>
</tr>
<tr>
<td>Crisis!s (or other truncation used in a specific database:?,#)</td>
<td>Strategic communication</td>
</tr>
<tr>
<td>Crisis communication</td>
<td></td>
</tr>
<tr>
<td>Disaster preparedness</td>
<td>Risk prevention</td>
</tr>
<tr>
<td>Hazard communication</td>
<td>Disaster management</td>
</tr>
<tr>
<td>Emergency communication</td>
<td>Disaster recovery</td>
</tr>
<tr>
<td>Catastrophe communication</td>
<td>Disaster response</td>
</tr>
<tr>
<td>Health communication</td>
<td>Decision/decision making</td>
</tr>
</tbody>
</table>

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-Control/Comparison Groups done by EPOC Risk of Bias
- Quantitative-Descriptive Survey done by adaptation of Davids and Roman (2014)
- Qualitative done by CASP
- Mixed-method and case study 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 due to the very small number of 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 (randomized, non-randomized) done by GRADE
- Quantitative-descriptive survey done by applying the principles of GRADE
- Qualitative done by GRADE-CERQual
- Mixed-method and case study 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), 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 the 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 as noted above.
4.0 RESULTS

4.1 Study Selection

4.1.1 English Language

Total number of titles and abstracts scanned: 4875
Total number of full-texts quickly scanned: 3523
Total number of full-texts downloaded: 75
Total number of full-texts read and coded for study characteristics: 63
Total number of full-texts selected for data extraction (only data-based primary studies): 44

4.1.2 Other UN Languages

Arabic:

Total number of titles and abstracts scanned: 6720
Total number of full-texts downloaded: 57
Total number of full-texts read and coded for study characteristics: 11
Total number of full-texts selected for data extraction (only data-based primary studies): 9

Chinese:

Total number of titles and abstracts scanned: 800
Total number of full-texts downloaded: 125
Total number of full-texts read and coded for study characteristics: 34
Total number of full-texts selected for data extraction (only data-based primary studies): 8

French:

Total number of titles and abstracts scanned: 196
Total number of full-texts downloaded: 78
Total number of full-texts read and coded for study characteristics: 17
Total number of full-texts selected for data extraction (only data-based primary studies): 14
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
. Total English language data-based primary studies (includes grey literature): 44
. Grey literature studies: 1
. Some categories are not mutually exclusive and so the frequencies will not sum to the total of 44.
. Method: Quantitative-Comparison Groups (QN-CG); Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/Case Study (MM, CS)

<table>
<thead>
<tr>
<th>Relevancy</th>
<th>Method General</th>
<th>Country Focus</th>
<th>Disaster/ Emergency Type</th>
<th>Disaster/ Emergency Phase</th>
<th>At-risk Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct: 41</td>
<td>QN-CG: 3</td>
<td>Australia: 3</td>
<td>General/ Multiple: 5</td>
<td>All Phases: 11</td>
<td>Yes: 18</td>
</tr>
<tr>
<td>Indirect: 3</td>
<td>QN-DS: 10</td>
<td>Canada: 2</td>
<td>Earthquake: 4</td>
<td>Preparation: 12</td>
<td>(Pregnant</td>
</tr>
<tr>
<td>Partial: 0</td>
<td>QL: 9</td>
<td>China: 1</td>
<td>Flood: 6</td>
<td>Containment: 1</td>
<td>women: 1;</td>
</tr>
<tr>
<td>Unclear: 0</td>
<td>MM, CS: 22</td>
<td>Chile: 1</td>
<td>Food safety: 1</td>
<td>Evaluation: 2</td>
<td>Residents in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Congo/ S. Africa: 3</td>
<td>Hurricane/ Cyclone/ Typhoon: 1</td>
<td>Preparation &amp; Recovery: 1</td>
<td>acute care</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Iran: 2</td>
<td>Industrial Accident/ Explosion: 3</td>
<td>Preparation, Onset &amp; Recovery: 2</td>
<td>facility and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Israel: 1</td>
<td>Infectious Disease/ Pandemic: 9</td>
<td>Preparation, Onset &amp; Containment: 1</td>
<td>nursing facility: 2;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan: 2</td>
<td>Radiological: 1</td>
<td>Preparation, Onset, Containment &amp; Evaluation: 2</td>
<td>Economically</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Netherlands/ Belgium: 1</td>
<td>Water supply: 2</td>
<td>Preparation, Onset, Containment &amp; Evaluation: 6</td>
<td>disadvantaged: 4;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Singapore: 2</td>
<td>Wildfire/Grassfire: 5</td>
<td>Preparation &amp;</td>
<td>Displaced</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sweden: 1</td>
<td>Bioterrorism/ Chemical: 4</td>
<td></td>
<td>victims in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thailand: 1</td>
<td></td>
<td></td>
<td>affected areas: 2;</td>
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<tr>
<td></td>
<td></td>
<td>United States: 23</td>
<td></td>
<td></td>
<td>Residents in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>rural areas: 1)</td>
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</tbody>
</table>
Of the 44 English language articles examined (see Section 7.1 for the reference), 41 were directly relevant and 3 were indirectly relevant. Three studies conducted research using quantitative comparison groups methods, 10 used other quantitative descriptive methods, nine used qualitative methods, and 22 used a mixed method or case study approach.

A great majority of the studies originated from the United States (23). In North America there were also studies in Canada (2). The rest were spread very thin over other regions of the world. From Asia there were six, including Singapore (2); Japan (2); China (1) and Thailand (1); S. America, including Chile (1); the Middle East, including Israel (1) and Iran (2); Australia (3); Africa, including S. Africa (2) and the Congo (1); and Europe, including Netherlands (1) and Sweden (1). One study covered multiple countries.

Regarding the types of disasters, the majority of studies dealt with public health crises and pandemic (9). Floods were covered by 6 studies. Some studies spoke generally across crises (5). Studies focused on specific types of disasters were spread almost equally between earthquakes (4), bioterrorism (4), and wildfires (5). Incidents that were studied less frequently included typhoon/hurricane/cyclone (3), radiological incidents (1); industrial accidents/explosions (3), water supply crises (2), and food-related disaster (1).

As is consistent with strategic planning efforts, the majority of studies applied to the preparation phase of disaster (12). An equally significant number of studies applied to all phases of disaster (11). A number of articles (17) focused on a combination of phases. Two studies focused solely on evaluation and one focused solely on containment.

Vulnerable/at-risk populations were addressed in 18 studies that primarily dealt with crisis/disaster victims and displaced individuals in affected areas (10). A few studies (4) focused on at-risk groups, including racial and ethnic minorities and economically challenged individuals. Of the remaining studies, two (2) represented patients in residential care facilities with functional limitations, residents in rural areas far removed from the disaster recovery efforts (1), and pregnant women (1).
Of the 52 other UN languages (i.e., not English) data-based primary studies (see Section 7.2 for the references), there were 9 Arabic, 8 Chinese, 14 French, 18 Russian, and 3 Spanish studies. Thirty-seven studies were directly relevant and 15 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.

Nineteen of the studies used quantitative-descriptive survey method, seven employed qualitative methods, and 26 employed mixed methods or case study approach.
The country of origin for the studies included in this review was spread widely around the globe. Canada and the United States made up three of the studies. Others were divided between countries in Africa (6), including Morocco, Algeria, Ethiopia and Egypt; countries in North America, including Canada (2), the U.S. (1), and Mexico (1); countries in the Middle East (4), including the UAE, Saudi Arabia; countries in Europe (21), including France, Spain, Russia, Kazakhstan, and Switzerland; countries in South America (2), including Chile and Ecuador; and countries in Asia, including Chine (7) and Japan (1). The remaining studies combined multiple locations.

The types of disasters were also varied. Although 23 studies described crisis and disaster broadly, other studies named pandemic/infectious disease and public health disasters (10); floods (8); earthquakes (3); volcanic eruptions (2); and environmental disasters (2). Many disaster types were only represented by one study, including security crisis, corporate crisis, labor strike, and nuclear reactor.

Only one study focused on all phases of disaster/emergency. Other studies focused on preparation (22), containment (1), recovery (1), and evaluation (2). The remainder focused on a mixture of phases (26).

Regarding at-risk/vulnerable groups, most of the studies focused on general populations, but vulnerable populations reached across four groups in this review. The identified at-risk/vulnerable groups included persons with disabilities (1); citizens in affected areas, particularly rural areas where they were more vulnerable (8); immigrants (1); and citizens with low socio-economic status (7).

4.3 A Note About the Grey Literature

The grey literature (non-academic) data-based primary studies were treated similar to the academic primary studies. The literature for the review (only English language noted) contained one report coded as grey literature, which used quantitative descriptive methodology to examine the breakdown of communication equipment in the acute phase of an earthquake in Japan. Although all phases of disaster were noted, the study was particularly concerned with the acute phase (specifically the first 4 days of the disaster). The study found that stable communication during the acute phase is vital in a disaster. Battery powered communication devices were recommended, as they allow for more stable communication and allow crisis responders to send larger volumes of data during disaster.

4.4 Quality Appraisal of Individual Studies

Of the 44 analyzed English language studies, two were placed in the quantitative-comparison groups stream, 10 in the quantitative-descriptive survey stream, nine in the qualitative stream, and 23 in the mixed methods/ case studies stream. Within the quantitative-comparison groups methods stream both studies were rated to be of moderate quality. In the quantitative-descriptive survey methods stream six studies were rated to be of high quality, three were rated to be of moderate quality, and one of low quality. In the qualitative methods stream three were rated to be of high quality, three to be moderate quality, and three of low quality. In the mixed methods/ case studies methods stream, 14 studies were rated to be of high quality, six were rated moderate quality, and three were rated to be of low quality.

See Appendix 8.2 and Appendix 8.3 for tables for English language studies that present the quality rating, as well as relevancy and and extracted findings, for each study.

For the 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 (see Section 4.5).
### 4.5 Synthesis of Findings Within Methodological Stream and Evaluation of Certainty/Confidence

**Key to Table**

- **Method:** Quantitative-Comparison Groups (QN-CG); 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-CG – High; Moderate; Low; Very low
- QN-DS – High; Moderate; Low; Very low
- QL – High; Moderate; Low; Very low
- MM, CS – High; Moderate; Low; Very low

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<tbody>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QN-CG</td>
<td>It is more difficult to change actual behavior than to increase knowledge and awareness. Thus, it is important to look at some of the challenges to modifying behavior across disaster types, particularly among vulnerable populations like pregnant women, and find more effective intervention methods to influence behavior shift during the disaster preparedness phase. There is a need for strengthened response capacity within existing preparedness systems. It is more important to build efficacy (of response) than to enhance threat perceptions as a path toward greater response willingness.</td>
<td>Yasunari (2011); Barnett (2014); Glik (2014)</td>
<td>Moderate</td>
<td>Findings consistent among studies, which met initial aims. Moderate quality research design using a control group.</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QN-DS</td>
<td>Some populations are more equipped than others to have evacuation plans in place. This is true in countries like China, Mexico and France. Consider age and gender as factors in capacity for response as it relates to</td>
<td>Burke (2008); Republique Francaise (2014) (FR); Su (2008) (CH); Wu (2009) (CH); Gomez (2012)</td>
<td>Moderate</td>
<td>Overlapping findings by six studies of which five were individually appraised to be strong and</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QN-DS</td>
<td>Disaster responders must take into account the role of culture in preparedness. There is no one strategy that works across disaster situations. Every disaster has different features that may dictate shifts in information needs of diverse populations, as determined from the evaluation phase. Found strategies should be built upon an in-depth and focused understanding of consumers’ perceptions, priorities and information needs. One study was relative to explosion/fireworks disaster in the Netherlands. Vulnerable population included victims of disaster. Another study, conducted in the U.S., found that perceptions among individuals who consider themselves similar can contribute to preparedness actions and information seeking behaviors relative to human-caused disasters as determined by a survey of residents in Georgia.</td>
<td>Paek (2010); Roorda (2004)</td>
<td>High</td>
<td>Consistent among two studies, one appraised as moderate quality and one appraised as high quality. Clear aims. Appropriate research design. Design addresses research issues, but one study relevant to smaller disaster issues. Rigorous studies but not all broke down demographic info. One study made direct link between race/ethnicity and disaster decisions. One study completed 50 semi-structured phone interviews with adults. Used workshop with panel of...</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QN-DS</td>
<td>Collaboration serves multiple purposes during disaster occurrences. Disaster response professionals representing different agencies may have different priorities during all phases of disaster, particularly the preparation, onset, containment and evaluation phases. Although there is much work on the importance of collaboration in the U.S., Saudi Arabia and China, agencies will likely have varying perspectives on process that must be addressed before response strategies are put in place during natural disasters, biological attacks, outbreaks like SARS and radiological contaminations as determined by studies involving experts and affected populations. Collaboration will help to address gaps in infectious disease emergency planning. Partnerships between hospitals and public health agencies may make health professionals in the U.S. and China better prepared to recognize signs and symptoms in order to rule out “non-credible threats” during all phases of disaster with particular emphasis on the preparation phase as reported by health workers. Another study found areas in Morocco facing large-scale health crises like natural disasters should aim to collaborate with other areas during the preparation and evaluation phases, especially when dealing with low SES residents within the same region.</td>
<td>Tuler (2005); Zimmerman (2010); Rebman (2009); Brannen (2004); Al-Douwihi (2004) (AR); Kingdom of Morocco (2005) (FR); Xie (2011) (CH);</td>
<td>High</td>
<td>Nine studies confirmed these findings of which two were individually appraised to be moderate and seven were appraised as high quality. Sufficient sample size. Clear aims. Method appropriate. Valuable. Clear disc of findings.</td>
</tr>
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<td>does not function the same in every disaster situation, particularly flash floods and chemical disasters. In Iran and the U.S., using mass media to spread information may not be effective in environments where individuals rely more on familial and community connections than traditional news sources. In these instances, training of (and interventions with) community/family members may be more effective in spreading key messages during all phases of disaster, particularly the preparation, onset, recovery and evaluation phases.</td>
<td>Stable communication is key in the U.S. and E. Japan during disaster response. Consider alternative sources of communication to keep information flowing, particularly during the acute stage, but relative to all phases of disaster. Consider portable satellite communication devices during earthquakes and wildfires that help to provide more stable communication and reverse 911 warning systems, which deliver recorded information to a database of telephone numbers and locations.</td>
<td>Studies from Canada, U.S., Egypt, Saudi Arabia, China and Spain recommend that officials engage the public during planning and decision-making stages of disaster management in order to best address the needs of citizens and to promote goodwill and trust during an actual event.</td>
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<td>(2011); Blando (2008);</td>
<td>Yamamura (2014); Strawderman (2012)</td>
<td>Government of Canada (2002) (FR); Cadouil (2008) (FR); Ouda (2012) (AR); Al-Douwihi (2004) (AR); Al-Hamidi (2010) (AR);</td>
<td>High</td>
<td>Two studies confirmed these findings of which one was individually appraised to be high quality and one was appraised as low. Good sample size. Recruitment strategy noted. Some rigor in analysis but discussion brief. One study had a response rate of less than 10 percent.</td>
<td></td>
</tr>
</tbody>
</table>
Disaster preparation ought to include the drafting of messages to be sent to the public in the event of natural disasters and security crises, which should also be pretested among citizens to measure their effectiveness relative to the preparation and onset phases of disaster. Pre-crisis planning strategies employed would potentially influence containment, recovery and evaluation phases.

<table>
<thead>
<tr>
<th>Effective Planning/Best Practices</th>
<th>QN-DS</th>
<th>Officials engaging with members of the community in Egypt during crisis planning related to outbreak like H1N1 should be cautious about sharing sensitive information during planning and implementation to prevent sensitive health information from being delivered incorrectly as a measure to ensure effectiveness of crisis planning.</th>
<th>Abdel Haleem (2011) (AR)</th>
<th>Moderate</th>
<th>Finding based on one study assessed as moderate in study quality.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational campaigns and health related information administered in the preparation and containment phases is beneficial for populations in rural areas in China and France, who tend to be more vulnerable during disease outbreak disasters. These campaigns can also aid in managing risk related to industrial accidents.</td>
<td>QN-DS</td>
<td>Qiang (2009) (CH); Halary (2002) (FR)</td>
<td>Moderate</td>
<td>Findings consistent among two studies, both appraised to be moderate quality.</td>
<td></td>
</tr>
<tr>
<td>Maintaining emergency monitoring and alert systems in Russia is key to effective communication during and just prior to the onset of a crisis, particularly for those in affected areas after natural disasters. Another study found water body level monitoring systems in Russia are effective tools in predicting and planning for the onsets of floods during</td>
<td>QN-DS</td>
<td>Gabrichidze (2013) (RU); Faleev (2014) (RU); Zhong (2009) (CH)</td>
<td>High</td>
<td>Findings were consistent across three studies, all of which appraised to be high quality.</td>
<td></td>
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</tbody>
</table>
the onset, containment and recovery phases relative to populations in affected areas. Public alert systems in China are vital to mitigating the impacts of flooding during the preparation phase relative to those in affected areas.

<table>
<thead>
<tr>
<th>Effective Planning/Best Practices</th>
<th>QL</th>
<th>Disaster response organizations in Canada and the U.S. need to find ways to merge scientific knowledge/expertise with local knowledge (firsthand experience), which can improve planning efforts during all phases of disaster by involving community members in problem-solving, using strategies to understand consumer perceptions, and engaging in other activities during wildfires, disease outbreaks and other health-related disasters.</th>
<th>Falconi (2012); Shkolovski (2008); Corburn (2003); Eggers (2011)</th>
<th>High</th>
<th>Four studies confirmed these findings. Three individually appraised to be high quality and one appraised as moderate. One article had rigorous procedures but a relatively low response rate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QL</td>
<td>Risk communication information needs to involve collaboration with key disaster response organizations to ensure that information is contextually relevant to communities affected by the disaster, such as variations in vulnerability throughout different segments of the population and campaigns that are integrated in the community to ensure a more lasting impact. This is true for the evaluation phase of disaster relative to floods and earthquakes in Australia, Israel and Ethiopia.</td>
<td>Shenhar (2015); Prior (2008); Shepherd (2004); Tamru (2002) (FR)</td>
<td>Moderate</td>
<td>Four studies confirmed these findings. Two individually appraised to be low quality, one appraised as moderate and one appraised to be high. One study conducted two surveys at two different points in the campaign. One study had a rigorous research design but only secured 8 participants. Despite</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QL</td>
<td>It is important for health care professionals on the front lines of disaster response in China to outline elements of their response plans and exercise the plans before disaster like earthquakes and pandemic outbreaks occur, as poor collaboration can result in overstretch of emergency systems. Also important for government entities to begin studying and tracking the more subtle and pervasive impact of disaster response on these professionals, including but not limited to decreased morale, burnout and stress that may come from operating under high threat levels. This is relevant during the preparation, onset, containment and evaluation phases.</td>
<td>Smith (2010); Tolomiczenko (2004); Xiong (2008) (CH)</td>
<td>High</td>
<td>Three studies confirmed these findings. All individually appraised to be moderate quality. One study vetted research instrument by an internal review team. Another study had solid aims, but the study was narrowly focused. Data was sufficiently rigorous.</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>QL</td>
<td>Failure to create a sufficient number of flexible contingency plans prior to general health crises in Egypt can force unprepared professionals to make impulsive management decisions that are less effective. Findings are relative to health professionals during the preparation, onset and containment phases. Contingency plans in the United Arab Emirates ought to be continuously evaluated over the course of all phases of crises, with particular emphasis on the onset and containment phases as it relates to volcano eruption disasters.</td>
<td>Shaheen (2012) (AR); Ayyad (2012) (AR)</td>
<td>Moderate</td>
<td>Findings were consistent among two studies, both appraised to be moderate quality.</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>MM, CS</td>
<td>Use multiple channels to disseminate messages in Iran, Singapore, and Sweden</td>
<td>Castenfors (2001); Jahangiri</td>
<td>Moderate</td>
<td>Five studies confirmed these</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>MM, CS</td>
<td>Disaster efforts in Canada, such as educational campaigns, must focus more on preparation, not just response. This is particularly true during the onset and evaluation phases relative to rabies outbreaks where residents in affected areas are concerned.</td>
<td>Skinner (2014); Li (2015) (CH); Lukyanovich (2012) (RU); Carsley (2004) (FR)</td>
<td>Moderate</td>
<td>Four studies confirmed these findings. One individually appraised to be low quality, one appraised as moderate and two appraised to be high. Clear aims, appropriate data collection. Data supported research issues. Another study was more exploratory.</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>MM, CS</td>
<td>Disaster efforts must involve local level stakeholders in response efforts, message dissemination, risk communication, and mitigation. Use alternative communication channels to increase community capacity and knowledge. Responders need to be proactive in building relationships with necessary stakeholders to galvanize local knowledge.</td>
<td>Horsley (2002); Eisenman (2007); Aldunce (2007); Bell (2009); Hoover (2013); Lai (2012); Roess (2011); Steelman (2012);</td>
<td>High</td>
<td>Eleven studies confirmed these findings. One individually appraised to be low quality, five appraised as moderate and five appraised to be high.</td>
</tr>
<tr>
<td>Effective Planning/Best Practices</td>
<td>MM, CS</td>
<td>Particularly community engagement and cultural competence. This work was relative to disasters broadly, wildfires and hurricanes in the U.S., wildfires in the Congo, floods in Chile, and pandemic outbreak in the U.S. and Singapore, during all phases of disaster. For most, vulnerable populations included those most affected by the disaster/crisis.</td>
<td>Carsley (2004) (FR); Jakubowski (2004) (FR); Vallejos Romero (2013) (SP); Richemond (2005) (FR)</td>
<td>One study incorporated a community-based longitudinal study.</td>
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<tr>
<td>Effective Planning/Best Practices</td>
<td>MM, CS</td>
<td>Prior disaster experience can be a benefit in some areas in the U.S. and Australia, by producing the awareness necessary for behavioral change during all phases of disaster, particularly during preparation. But it can also cause individuals after hurricanes and other natural disasters to perceive real threats as less serious.</td>
<td>Boon (2016); Kapucu (2008)</td>
<td>High Two studies confirmed these findings. Both individually appraised to be high quality. One study conducted a pilot first to test appropriateness of the questions. Good sample size for pilot leading up to the main study. Another study had a 92 percent response rate.</td>
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</table>
| Effective Planning/Best Practices | MM, CS | Need to learn more about countries and regions in the U.S. with more vulnerable populations. These populations perceive risk in different ways, do not have the same access to evacuation resources, and, in some cases, have varying degrees of physical ability to respond during all phases of disaster, particularly as it relates to hurricanes, and pandemic. | Bell (2009); Castenfors (2001); Eisenman (2004); Eisenman (2007); Hoover (2013) | High Five studies confirmed these findings. One individually appraised to be low quality; one appraised as moderate and three appraised as high quality. Clear aims. Rigorous research design. Appropriate
<table>
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<tr>
<th>Effective Planning/ Best Practices</th>
<th>MM, CS</th>
<th>Officials in Russia who involve the community within communication planning in the preparation phase must be able to manage potential distrust for public authorities among the citizenry during general crises with high levels of risk. In Russia it is important to consider at the preparation stage, various cultural elements of the community when managing general crisis events. Local government in Russia generally does not consider the feedback of the general population when implementing measures for crises during general crises during the preparation phase. Citizen feedback is essential to developing strategies to manage future occurrences as discovered from a water shortage crisis in the U.S.</th>
<th>Blanchard-Boehm (2008); Maksimov (2013) (RU); Vallejos Romero (2013) (SP); D’Ercole (2002) (FR)</th>
<th>High</th>
<th>Four studies confirmed this finding. Three were appraised as high quality and one was appraised as moderate. Tested for statistically significant relationship between variables. Aims of the studies met.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Planning/ Best Practices</td>
<td>MM, CS</td>
<td>In Russia and South Africa, evolving technologies and new channels should be incorporated with emergency alert and communication systems during the preparation phase of general crises events in order to keep them updated and maintained when dealing with the general population. Russian alert systems have often not been as effective during the preparation phase of general crisis events in disseminating critical information, to the general public. More advanced</td>
<td>Jack (2015); Nikolskiy (2012) (RU); Shklyaeva (2015) (RU); Maksimov (2013) (RU); Myachina (2014) (RU); Ryhzenko (2014) (RU); Levchuk (2012) (RU); Ayubov (2014) (RU)</td>
<td>High</td>
<td>Eight studies confirmed these findings. Four individually appraised to be moderate quality and four were appraised to be high. Not all studies looked at ethical concerns or broke down population demographics</td>
</tr>
</tbody>
</table>
systems are necessary. Part of this includes developing plans on how to administer these systems during disaster occurrences. One study examined planning for community water systems among three provinces in South Africa. but aims were met and studies met requirements for rigor. One made site visits and developed an assessment tool.

| Effective Planning/Best Practices | MM, CS | Contingency plans ought to be continuously evaluated over the course of all phases of crises in order to plan for new occurrences that come up in the management of these events. One study examined labor strikes in Egypt. Findings have specific relevance for the preparation phase. Another study from Ecuador found it beneficial for officials to tailor communication plans to accommodate the public’s travel routes relative to the preparation, onset, containment and evaluation phases of during volcanic eruptions and earthquakes to better plan for evacuating residents in affected areas and children. | Metzger (2000) (FR); Ahmed (2015) (AR) | Moderate | Two studies confirmed these findings, both appraised as moderate quality. |

| Effective Planning/Best Practices | MM, CS | The maintenance of functioning emergency technology and alert systems in Russia and French-speaking Switzerland is key to effective crises response during the preparation, onset, recovery and evaluation phases of crisis relative to pandemic influenza outbreaks and other general crises where the general population is concerned. In Russia, advanced forecasting technologies used during the preparation phase of general crisis events can aid in predicting and warning the public of the threat of flooding. | Kozlov (2011) (RU); Hechmati (2004) (FR); Ipalakov (2012) (RU); Taliercio (2010) (FR) | High | Four studies confirmed these findings. One individually appraised to be moderate quality and three were appraised to be high. |

<p>| Effective | MM, CS | Disaster alert and | Kachanov | High | Five studies |</p>
<table>
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<th>Planning/Best Practices</th>
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<tr>
<td><strong>Effective Planning/Best Practices</strong></td>
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<tr>
<td>MM, CS</td>
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<td><strong>Effective Planning/Best Practices</strong></td>
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<th>Planning/Best Practices</th>
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<tr>
<td><strong>Effective Planning/Best Practices</strong></td>
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</table>
Findings were synthesized within all method streams, including quantitative (comparison groups and descriptive studies), qualitative, mixed methods and case studies. Many of the studies confirmed each other, sharing elements of findings that indicate the need to better understand the impact of location, population and disaster type when developing strategies for response. Quantitative studies using control groups were not found to be helpful as an indicator of strategic planning efforts following crisis/disaster. It may be difficult to use such research designs to influence disaster-planning strategies because we cannot plan in advance for the unknown with events that demand immediate response and have elements of surprise and increased threat. In contrast, studies using mixed methods and case study approaches were found to be the better indicators of importance relative to strategic planning for disasters.

Studies showed there is no one strategy that works across every crisis/disaster situation. Quantitative descriptive studies and mixed method/case studies provided the most evidence concerning the need for greater levels of collaboration between response agencies; the need to explore alternative channels of communication for managing crisis events and disseminating information during all phases; the need to involve local-level participants in the management of these events and the post-crisis learning process; the need for more pre-test studies to learn more about perceptions of effectiveness among particular audiences; and the need to study ways to close the gap relative to influencing behavior, particularly among vulnerable populations (specifically) and affected populations (broadly). Countries like the United States, China and Japan have become important sites for post-crisis learning that funnels back into strategic planning efforts. Relative to pandemic and natural disasters, these are important cases to better understand message dissemination, containment and coordination of first responders. Finally, the findings point out that it is important for individuals on the front lines to exercise disaster plans before events, particularly in pandemic and natural disaster situations. Going forward these cases will provide fertile ground for crisis learning that influences strategic planning efforts.

### 4.6 Synthesis of Findings Across Methodological Streams

**Key**

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

Certainty/Confidence Evaluation:

- **QN-CG (GRADE)** – High; Moderate; Low; Very low
- **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

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<table>
<thead>
<tr>
<th>Phenomenon of Interest/Outcome</th>
<th>Synthesized Finding Across All Four Method Streams (with country, type and phase of disaster, vulnerable population contexts)</th>
<th>Citations (first author) Supporting Synthesized Finding Across Method Stream</th>
<th>Evaluation of Certainty/Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Planning/Best Practices</td>
<td>Strategic planning efforts must be contextualized for the diversity of populations involved in disaster situations. This may involve learning more about regions with more vulnerable populations, expanding the knowledge base among response personnel regarding the characteristics of vulnerable populations and how their status impacts threat perception, risk</td>
<td>Yasunari (2011); Barnett (2014); Glik (2014); Paek (2010); Roorda (2004); Eggers (2011); Boon (2016); Kapucu (2008); Blanchard-Boehm (2008); Shenhar (2015); Hoover (2013); Falconi (2012); Lai (2012);</td>
<td><strong>QN-CG (GRADE):</strong> Moderate&lt;br&gt;&lt;br&gt;<strong>QN-DS (GRADE Adapted):</strong> Moderate to High&lt;br&gt;&lt;br&gt;<strong>QL (CERQual):</strong> Moderate to High&lt;br&gt;&lt;br&gt;<strong>MM, CS (as appropriate):</strong></td>
</tr>
</tbody>
</table>
perception, capacity to evacuate and potential for behavioral change. In order to reach these populations there is a greater need to coordinate response efforts with local stakeholders and disaster organizations and reconcile scientific expertise with local knowledge and prior firsthand experience. Requesting input from members of the public themselves and directly engaging with citizenry may help officials more thoroughly adapt crisis planning to the needs of those citizens, as well as better gauge the level of disaster knowledge already held by the public.

**Involving multiple channels and means of communicating disaster messages**, particularly in moving populations from awareness and knowledge to behavioral change. This is not only relative to the type of media used to reach audiences, but also includes the use of satellite communication devices, intervention programs, long-term information campaigns, and training community and family members to spread key messages. Crisis alert technologies can be helpful in planning for and predicting the onset of crises, as well as in disseminating critical information to the public; however, should these devices be relied upon by public health authorities, they must be continuously updated and evaluated in order to avoid negative consequences due to miscommunication during disasters. This finding was significant during all phase with emphasis on the preparation phase. Disasters included industrial accidents in Sweden and South Africa during the preparation, onset, and response phases.
containment and evaluation phases; earthquakes in Japan, Iran during all phases; hurricanes in the U.S. during the onset, containment, recovery and evaluation phases; floods in Thailand, Chile, China, Eastern Europe, France and Iran during all phases; infectious disease and pandemic in Singapore, the Congo, the U.S., Switzerland, and Mexico during all phases; wildfires in the U.S. during the preparation phase; and chemical disasters in the U.S. during all phases. Several articles (13) spoke to disaster more broadly in Russia, Kazakhstan, and Japan during all phases of disaster with particular focus on the preparation phase. Not all of the studies highlighted vulnerable populations. Some addressed citizens/residents that were vulnerable because of location (i.e., rural areas). Other articles addressed population more generally as citizens in affected areas, which also suggests some vulnerability based on the circumstances experienced during the crisis/disaster.

### Focus disaster efforts on preparation, not just response.
Ensure that personnel on the front lines of disaster response outline elements of their response plans and exercise the plans before disaster occurs. Proactively address the different priorities and perspectives of responding agencies and negotiate processes for response that can effectively be put into place during disaster. Design messages prior to the onset of the crisis and conduct research as to their effectiveness, such as pretesting messages among segments of the public so that potential problems may be identified and corrected. Create multiple, flexible plans capable of addressing several different scenarios that may occur during the crisis and can be continuously evaluated over the course of all crisis phases. Disasters included a labor strike and general health crises in Egypt during the preparation, onset and containment phases; natural disasters and security crisis, and corporate crisis in Saudi Arabia during the preparation and onset and containment phases; a volcanic eruption in the UAE; public health emergencies and pandemic in China.

|---|---|
QN-DS (GRADE Adapted): High 
QL (CERQual): High 
MM, CS (as appropriate): Moderate |
During the preparation and containment phases; disaster more broadly in Spain during the preparation phase; industrial accidents in Sweden during the preparation, onset, containment and evaluation phases; general pandemic in the U.S. and Canada during the preparation, onset, containment and evaluation phases; radiological disaster in the U.S. during the evaluation phase; chemical/biological attacks in the U.S. during all phases. Vulnerable populations in the studies included residents in nursing facilities, health workers under strain, and citizens in affected areas.

**Facilitate partnerships between hospitals, public health agencies, and other relevant organizations** to ensure that health professionals are prepared to recognize signs and symptoms in order to efficiently and expeditiously rule out "non-credible threats, as well as to make sure that health care providers have adequate supplies and service infrastructure in place in order to avoid overstretch. Track the impact of disaster response efforts on these professionals to learn more about the often-pervasive impact of being on the front lines. Nations at large should also collaborate with other countries when faced with a public health crisis, particularly with those within the same region. Disasters studied included infectious disease and pandemic in the U.S. during the preparation phase and in Canada during the preparation, onset, containment and evaluation phases; bioterrorism in the U.S. during all phases; infectious disease in China during the containment phase; industrial accidents in Algeria during the preparation, onset, containment and recovery phases; natural disasters in Saudi Arabia during the preparation and onset phases and in Morocco during the preparation and evaluation phases; environmental/atmospheric disaster in Chile during the preparation and containment phases; floods in France during the recovery and evaluation phases; and phase. One study focused on earthquakes in multiple locations, including China, the U.S. Russia and Japan during the containment phase. One study

| QN-CG (GRADE): --- |
| QN-DS (GRADE Adapted): High |
| QL (CERQual): High |
| MM, CS (as appropriate): High |
focused on public health crises in WHO member states in Belgium, Austria, Norway, Canada and the UK during the onset, containment and evaluation phases. Most of the foreign language studies referred to disaster more broadly in countries including Russia. Some populations were listed more broadly as residents in affected areas where the level of vulnerability depends on the effect of the crisis/disaster. Other populations more vulnerable during these occurrences included residents in long-term care facilities and acute care facilities, local health officials on the front lines. The foreign language studies tended to focus on populations more broadly.

Across the method streams some key themes emerged. Studies pointed to the importance of understanding the needs of populations that are most vulnerable in crisis and disaster situations, particularly during public health emergencies. Some populations are more equipped to demonstrate active behaviors during response recovery efforts. This finding was significantly evident in studies that used mixed method and case study approaches, which encouraged a better understanding of how these populations perceive risk and communication channels that might be best to reach these populations. Through quantitative approaches and mixed method and case study approaches, studies found commercial media are not the standard in all locales for disseminating information during the preparation, onset, and recovery stages of disasters. Individuals in some areas rely more on familial and community connections than traditional news sources. This was true relative to natural disasters and disease outbreaks in the Middle East, Asia and Europe. Findings also indicated a need to pre-test disaster messages in order to better understand effectiveness, particularly during the preparation and onset phases.

Communication efforts during crisis and disaster should be multi-layered and include functioning emergency technology (found particularly in Europe) to manage communication systems during all phases of disaster. Stable communication is a key factor in delivering effective warning systems. In these cases, alternative sources of communication may be wise.

Studies indicated the need to better understand the impact of education campaigns, particularly in rural areas where widespread response efforts may not be immediately felt. This was true in North America, Asia, Europe and Africa.

An area in need of further research is collaboration efforts and how they function in disaster. One area particularly cited in the studies is the need for collaboration between hospitals and health centers and health personnel, especially first responders. This was found during all phases of disaster. While increased collaboration may not be possible at all stages of crisis response, it is most necessary during the preparation and evaluation phases. More collaboration during these phases could generate strategic planning strategies relative to identifying priorities among responding agencies in the onset, containment and recovery phases; strategies for message dissemination; coordinated response efforts; and sharing of best practices for future occurrences.
### 4.7 Media Reports

Six media reports were identified for the review objective in the search for English-language news stories (see Section 7.3 for the references). All six reports stressed the importance of effective communication as a means of increasing knowledge in disaster preparation and response. Most of the articles reported on disaster broadly, but four focused on specific disasters, including one on Ebola in W. Africa and two on earthquakes in Nepal and Tokyo. All articles addressed the preparedness and response phase of disaster.

One article emphasized factors that were key to survival for earthquake victims in rural areas of Nepal. The article noted people in disaster areas need access to information as much as first responders in order to make the best decisions for themselves and their families. Some specific strategies included using alternative forms of communication in these zones and training journalists to disseminate information, specifically related to containment/prevention efforts.

Although digital communication may not be widespread, social media preparedness where available to allows victims to report on their status and keep up with family members. Of these six reports, five discussed the importance of social media usage and digital communication during the preparation and response phase of natural disasters. One article focused on an increase in the usage of social media platforms like Google’s Person Finder and Facebook’s Safety Check and the overall increase of internet usage to perform functions like calling for help during disaster situations. Another article focused on the increased usage of apps that perform a variety of functions, including sending alerts, hazard monitoring, setting up private family networks, locating trapped family members.

A key finding across the articles was the importance of collaborative efforts to improve information sharing, which two articles found to be directly correlated with behavior change. In fact, one news release released by the CDC related to a coordinated campaign between government, private and non-profit sectors and health professionals reported that individuals with advanced knowledge participated in more preparedness behaviors, including developing a household disaster plan. Another CDC release based on a report addressing preparedness challenges for children stressed the importance of multi-level emergency planning between regional, state and local personnel as a key factor in planning for the needs of children affected by disaster.

Another key finding was the need for increased efforts toward disaster preparedness as a mechanism for effective response. The more relevant information communities have in advance of occurrences, the better equipped they are to respond in ways that reduce further contamination and expedite recovery efforts.

The findings from these reports inform the findings of the analyzed studies and grey literature, particularly as it relates to the socio-cultural barriers that may exist when responding to crises in more remote areas where access to information is diminished. One strategy may be to give individuals in affected areas an opportunity to participate in discussions that address the stigmas associated with disease in order to motivate new prevention behaviors. The findings also confirm the importance of involvement from local government officials, aid organizations, news media and the general public in the preparation, containment and response phases of different types of disasters to exchange necessary information and address misinformation.
5.0 DISCUSSION

5.1 Summary of Results

5.1.1 Overall Summary

For the synthesis of evidence for the present review, on effective strategic planning for public health emergency/disaster events, 108 studies (46 English language and 62 other UN languages) were included, appraised for quality, used for data extraction and formulating synthesized findings within methodological streams, which in turn were evaluated for certainty and confidence in findings, and then synthesized across methodological streams. The collection of studies in this review demonstrates the importance of merging scientific expertise with local knowledge (firsthand experience) of the communities affected by disaster. Strategic planning efforts must take into account the role of culture in disaster preparation and response in order to contextualize efforts to meet the needs of diverse populations. As noted earlier, there is no one strategy that works across disaster situations. Efforts across disaster stages must involve local stakeholders, who play an important role in communicating key messages and moving populations from awareness to action.

Researchers have focused much work on disaster response, helping us to understand the stages necessary to mitigate disaster situations. However, the studies in the present review encourage more proactive efforts devoted to disaster preparedness, particularly in regions and communities with populations that may be de-sensitized to the threat and harm caused by disaster, and because of previous history with disaster situations, may have low risk perception. With these populations, increased information does not automatically lead to behavioral change. Thus, it is important to use multiple channels and means of communicating to reach these populations. This involves moving beyond traditional forms of mass mediated communication to more localized forms of communication, including but not limited to use of community and family members to spread key messages, intervention programs, long-term awareness campaigns and making information available through community centers, religious centers and other important facilities these populations access for information in a disaster.

Some of the reviewed studies addressed at-risk populations, which were most often defined as displaced individuals most affected by the occurrence. Other at-risk populations addressed included convalescent individuals bound by functional limitations, racial and ethnic minorities, economically challenged individuals and individuals in rural areas, far removed from disaster recovery efforts. In fact, studies indicate the need to better understand the impact of education campaigns in these more rural regions, where widespread response efforts may not be immediately felt. This was true in North America, Asia, Europe and Africa.

5.1.2 Results Vis a Vis Findings from Existing Reviews

The findings of the present review largely align with the conclusions of existing reviews. There are three general points of alignment.
First, there is further evidence of the need for various health agencies, emergency systems, and other public services to collaborate and establish communication networks in preparation for crises in order to diminish public confusion, more efficiently utilize resources, and ensure both wider and faster public coverage. Second, the present review connects more research, relative to existing reviews, suggesting that health communication must consider the communities, cultures, and lifestyles of different segments of the public, and further, design disaster education and preparation around these social structures. Third, relatively more research was revealed in the present review that supports previous findings that risk perception is the primary predictor for disaster prevention and mitigation behaviors, and moreover, that risk perception is itself determined by a variety of factors, including knowledge of disasters, trust in officials, and demographic characteristics. As such, the present review serves to highlight the importance of these findings for both future research as well as crisis communication practice.

The body of literature relevant to the present review has developed so as to better address some of the areas in which existing reviews indicated the field was lacking. For example, existing reviews expressed concern over the dearth of research regarding the use of social media in health and crisis communication contexts. The present review demonstrates some expansion of the analysis dedicated to social media use. Indeed, studies have found that social media use allows greater personalization of health messages for varying subgroups of the public so as to accommodate different needs, increases both communication speed and the accessibility of that information to the public at large, and can even work to ameliorate the public's lack of trust or confidence in health officials and public authorities. Notably, however, these studies generally consider social media as an alternative channel of communication rather than as a primary or distinct channel. Additionally, the present review uncovered studies that do evaluate various aspects of message efficacy in crisis communication scenarios, both in the context of messages sent to the public as well as in the context of messages sent to and between agencies. Finally, researchers have continued to investigate the relationship between the public’s risk perception and engaging in disaster management behaviors and have uncovered additional factors that might modify that relationship, such as gender, socioeconomic status, and trust in public authorities.

The present review and the existing reviews also share some areas that both overlook. First, there are few studies that employ a theoretical approach to aid their methodologies or interpret their findings so as to mend disconnects between empirical data and actual practice. Second, while several studies have collected evidence regarding message efficacy in terms of channel, frequency, and repetition, considerably fewer analyses have examined message content. Lastly, research has made some headway into understanding the complicated relationship between risk perception and behaviors of disaster preparation and mitigation among the public. As previously discussed, these studies have predominantly isolated factors that modify this relationship; however, little has been offered in the way of how crisis communication ought to adapt to these characteristics to increase desired behaviors. Overall, the present review demonstrates that burgeoning research is building productively on the findings noted in the existing reviews, but the body of literature pertaining to the objective of the present review is far from complete.

5.2 Research Gaps

Overall, studies in the present review were overwhelmingly slanted toward populations in the United States with some studies in Australia, Africa, and some Asian countries such as China and Japan, and Eastern Europe. Not as much attention was paid to Central and South America, the Middle East, Europe or Canada. There were also research gaps related to the phases of disaster as roughly half of the studies focused on the onset phase and just over half the studies focused on the evaluation phase. Although some vulnerable populations were mentioned, including pregnant women, aging citizens and persons with health challenges, more studies should focus on these populations to better understand the implications of strategic planning efforts in regions with vulnerable populations.
Most studies were based on data from smaller sample sizes, which makes it unlikely that researchers garnered samples fully representative of affected populations. Although studies documented demographic data, many did not present detailed data on gender, ethnicity, socio-economic status, (dis)ability, and other such demographic characteristics, unless it was a significant factor of the purpose of the study. For instance, one study in a more patriarchal community used the limited number of women in the region as a reason for the lack of women in the study, but there was no discussion of attempts made to increase the number of women beyond the few included in the study. Without this information it is difficult to judge the level of effort put in by researchers in securing demographically diverse samples.

The types of public health emergency events/disasters most often studied were seismic events such as earthquakes and tsunamis; weather phenomena such as storms and floods; and emerging infectious diseases. There are opportunities to develop studies that address chemical disasters, industrial accidents, food contamination, and water supply crises. Most studies analyzed natural disasters such as earthquakes, typhoons/hurricanes, fires and floods or infectious disease outbreak that happen with little-to-no-warning time across multiple phases. More studies on strategic planning for disaster should isolate the preparation and response phases in order to emphasize lessons learned from the field.

Most studies examining social media analyzed its use during the preparation and containment phases; fewer studies analyzed social media use during the recovery phase. It appears that the containment phase is considered the most desirable and important phase to study within the subfield of social media study within risk communication so as to catch social media users in action while the disaster is still ongoing. Most studies focused on community and/or affected populations’ use of social media and fewer on how local governments, NGOs, health organizations, and providers use social media to inform and interact with the public.

Finally, few studies focused on specific strategies recommended making a clearer connection between increased information during the planning/preparation phase and action/behavior change during the onset and recovery/response phases. This kind of information will help to enhance infrastructures for disaster surveillance and to standardize protocols for multi-disciplinary response among those individuals and entities whose job it is to mitigate disaster events.

5.3 Limitations of the Present Review

The present review has two 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.

5.4 Authors’ Conclusions

The present review shows there is no one strategy that works across every crisis/disaster situation. Strategic planning for crisis and disaster functions best through collaboration among constituent groups involved in the preparation, containment, response and sense making of these events. One of the most significant and consistent findings from this review indicates the need for local level response that involves community members. Not enough of the studies in this review captured specific demographic data on the populations under study. This data can be useful in determining which strategies work best with specific populations.
Further research should determine the strategies that may work to shift response behaviors among affected populations from information awareness to action. Education campaigns can play a greater role in affecting this kind of change, particularly in areas where populations do not have the same access to traditional forms of messaging and response. Leveraging key stakeholders in the communities affected by crisis and disaster is also an important factor.

With regards to communication, every population does not respond in the same way to traditional communication channels. Social media were not found to be influential for strategic planning. Instead, studies suggested emergency response systems and non-traditional forms of message dissemination, particularly in the preparation phase, were more helpful. In the case of pandemic and public health-related crises, the use of emergency response systems and non-traditional message channels is most important in order to influence prevention and communicate to the public the steps that may prevent further spread of disease.

Finally, studies demonstrated a continued need to learn from previous crisis and disaster incidents. This was true particularly in the United States, China, and Japan relative to natural disasters and pandemic threats. This kind of learning can funnel back into strategic planning efforts to affect necessary change in the management of crisis and disaster situations around the globe.
6.0 FUNDING

This project was funded by the World Health Organization, Department of Communications (Contract PO 201393190 WHO Registration 2015/586494-0 and Contract PO 201428650 WHO Registration 2016/601521-0).
7.0 FULL LIST OF INCLUDED STUDIES, EXISTING REVIEWS, AND OTHER REFERENCES

7.1 Full List of Included Studies: English Language


7.2 Full List of Included Studies: Other UN Languages

**Arabic**


Chinese


French


**Russian**


Левчук М. С. (2012) Оповещение населения о ЧС без проводов. ОПС Пожарная Безопасность, 4, 128-130.


Лукьянович А. В., Альмов А. В., & Пашков А. А. (2011) Развитие ОКСИОН в рамках реализации мероприятий Федеральной целевой программы «Снижение рисков и смягчение последствий чрезвычайных ситуаций природного и техногенного характера в Российской Федерации до 2010 года». Технологии Гражданской Безопасности, 2, 76-82.


Максимов И. А., Краснокутский А. В., Акулов А. Ю., & Удилова И. Я. (2013) Оповещение и информирование в системе мер гражданской обороны и защиты от чрезвычайных ситуаций: тенденции, перспективы, проблемы развития. Техносферная Безопасность, 1, 1-7.

Ayubov E. N. (2014) Analysis of the Factors, influencing the effectiveness and the efficiency of the emergency alert systems in an effort to ensure the safety in public places. Civil Defense Strategies: Problems and Research, 1, 521-531.

Аюбов Э. Н. (2014) Анализ факторов, влияющих на эффективность и экономическость систем информирования и оповещения населения в целях обеспечения безопасности в местах массового пребывания людей. Стратегия Гражданской Защиты: Проблемы и Исследования, 1, 521-531.


Козлов А. В. (2011) Субъекты функции Российского Государства по предупреждению и ликвидации чрезвычайных ситуаций. Молодой Ученый, 10, 60-68.


Mельников М. И. & Ковтун А. С. (2014) Самоорганизующаяся сеть оперативного взаимодействия для нужд населения и специальных служб. Доклады Томского государственного университета систем управления и радиоэлектроники, 2, 281-286.


Рыженко А. А., Рыженко Н. Ю., & Эльтемерова О. В. (2014) Проблемы информирования и оповещения населения о чрезвычайных ситуациях. Технологии техносферной безопасности, 2, 1-6.


Никольский С. (2012) Оповещение населения о ЧС: существующие решения и новые разработки. ОПС Пожарная Безопасность, 2, 134-137.


Шкляева Н. В. (2015) Состояние и перспективы сил и средств РСЧС России. Международный студенческий научный вестник, 6, 1-5.


Габричидзе Т. Г. (2013). Трагедия в Крымске: выводы и предложения по обеспечению безопасности. Вектор науки ТГУ, 3, 118-120.


[Дурнев Р. А. (2009) Система информирования и оповещения населения: обоснование рациональных объемов реализации функций. Проблемы управления, 1, 72-75.]


[Фалеев М. И., Черных Г. С., & Старостин А. С. (2014). Оценка опасностей и угроз, обусловленных катастрофическими наводнениями, и предложения по защите населения и территорий от них. Стратегия гражданской защиты: проблемы и исследования, 2, 18-32.]

Spanish


7.3 Full List of Included Studies: Media Reports


Info key to survival for quake victims; Communication crucial to find loved ones, food and shelter. (2015, May 5). Pretoria News (South Africa), p. 5. Web publication.


7.4 Existing Reviews


Codreanu, T. A., Celenza, A., & Jacobs, I. (2014). Does disaster education of teenagers translate into better survival knowledge, knowledge of skills, and adaptive behavioral change? A systematic literature review. Prehospital and Disaster Medicine, 29, 629-642. doi: 10.1017/S1049023X14001083


7.5 Other References


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 (Quantitative-Comparison Group Method)

Key to Table
- **Method:** Quantitative-Comparison Groups (QN-CG)
- **Relevancy:** Direct; Indirect; Partial; Unclear
- **Quality:** QN-CG – High (low risk of bias); Moderate (minor risk of bias); Low (some risk of bias); Very low (significant risk of bias)

<table>
<thead>
<tr>
<th>Citation (first author); Method; Relevancy; Quality Appraisal Rating</th>
<th>Study Description; Findings</th>
<th>Statistical Information</th>
</tr>
</thead>
</table>
| **Citation:** Barnett (2014)  
**Method:** QN-CG  
**Relevancy:** Direct  
**Quality Appraisal Rating:** Moderate/Minor Risk of Bias | Study Description  
A theory-based preparedness training randomized intervention with workers from 71 local health departments (LHD) in urban and rural settings across nine states in the United States used two training scenarios (weather, radiological terrorism) and had three main outcomes, willingness to respond to an event, perception of threat of an event (threat likelihood/susceptibility x severity), and perception of efficacy in performance of one’s duties (ability to perform required duty x impact on combating threat). Results showed that the highest impact from the training intervention on willingness to respond was for LHD workers who had low threat and efficacy perceptions pre-intervention, with greater willingness to respond increase observed for the radiological terrorism scenario.  
**Findings**  
There is a need for strengthened response capacity within existing preparedness systems. It is more important to build efficacy (of response) than to enhance threat perceptions as a path toward greater response willingness. | Outcomes were pre-/post-intervention change scores (1-9 scale) for willingness to respond, perception of threat, and perception of efficacy. Based on pre-intervention scores, four groups created for analysis, low threat/low efficacy, low threat/high efficacy, high threat/low efficacy, and high threat/high efficacy.  
**Willingness to Respond:**  
Weather scenario – no statistically significant effects  
Radiological scenario – statistically significant effects for low threat/low efficacy group for intervention vs. control (n = 735, change difference = 1.79, p < .001); and high threat/low efficacy group for intervention vs. control (n = 735, change difference = 1.58, p < .001).  
**Perception of Threat:**  
Both scenarios, no statistically significant effects for interventions vs. control.  
**Perception of Efficacy:**  
Weather scenario – no statistically significant effects  
Radiological scenario – statistically significant effects for low threat/low efficacy group for intervention vs. control (n = 773, change difference = 15.14, p < .001); and high threat/low efficacy group for intervention vs. control (n = 773, change difference = 11.15, p < .001). |
| Citation: Glik (2014) | Study Description: An intervention for enhancing disaster preparedness using a randomized longitudinal cohort design with two conditions, community health worker led discussion groups along with mailed information versus mailed information only, found that mailed information only was equally sufficient to move households to higher stages of decision making (awareness, intention, behavior, maintenance) to obtain disaster supplies but the discussion group condition led to statistically significant change to higher decision making stages for complex disaster planning.  
Findings: Clear and consistent messages delivered through a community-based organization increases engagement with activities for preparedness and response Messages disseminated through mass-media campaigns are often inconsistent, leading to misunderstanding amongst the public, which leads to a decrease in engagement with activities for preparedness and response (particularly among low SES population). | Overall Change to Higher Decision Making Stages Within Each Condition  
Disaster Supplies: Discussion Group pre to post, Chi-square = 45.63, p = 0.000  
Mailed pre to post, Chi-square = 49.27, p = 0.000  
Communication Plan: Discussion Group pre to post, Chi-square = 82.24, p = 0.000  
Mailed pre to post, Chi-square = 37.74, p = 0.000  
Change to Higher Decision Making Stages Across Conditions  
Disaster Supplies: Discussion Group vs. Mailed at pre, Chi-square = 4.23, p = 0.238  
Discussion Group vs. Mailed at post, Chi-square = 4.13, p = 0.248  
Communication Plan: Discussion Group vs. Mailed at pre, Chi-square = 1.57, p = 0.665  
Discussion Group vs. Mailed at post, Chi-square = 21.31, p = 0.000 |
| Citation: Yasunari (2011) | Study Description The disaster preparedness intervention randomly assigned pregnant women in Japan to an intervention (educational program) or control condition (no program). Analyses were done only with the subset of subjects who were having their first child and did not have any disaster experience. The pre-post change in the intervention group showed greater improvement in both awareness and behavior compared to the pre-post change in the control group.  
Findings: More difficult to change actual behavior than to increase knowledge and awareness. The very act of responding modified the behavior of the pregnant women, producing a Hawthorne Effect of sorts. | Intervention group (n = 99; M age = 31.4, SD = 4.3 years; M gestational week 22.9, SD = 3.8 weeks) and control group (n = 104; M age = 30.7, SD = 4.6 years; M gestational week = 24.7, SD = 5.8 weeks). Awareness and behavior measured as answering question as yes/no; the % below represents yes.  
Awareness Control group - No statistically significant pre-post change.  
Intervention group - 'Emergency message dial' (pre 69.7% vs. post 82.8%, p = 0.030)  
'Message board' (pre 51.5% vs. post 67.7%, p = 0.020)  
'Neighborhood hospitals/clinics' (pre 52.5% vs. post 68.7%, p = 0.020)  
'Evacuation site' (pre 47.5% vs. post 67.7%, p = 0.040)  
'Explain pregnancy status' (pre 86.9% vs. post 97.0%, p = 0.010)  
Behavior Control group – No statistically significant pre-post change.  
Intervention group- |
- ‘Discussion of emergency contact family’
  (pre 20.2% vs. post 43.4%, \( p = 0.000 \))
- ‘Immediately find out family contact’ (pre
  46.5% vs. 70.7%, \( p = 0.001 \))
- ‘Preventing overturned furniture’ (33.3%
  vs. 48.5%, \( p = 0.030 \)).
### 8.3 Quality Appraisal of and Extracted Findings from English Language Individual Data-based Primary Studies (Quantitative-Descriptive Survey, Qualitative, and Mixed-Method/Case Study Methods; Organized by Method)

**Key to Table**
- **Method:** Quantitative-Descriptive Survey (QN-DS); Qualitative (QL); Mixed-Method/Case Study (MM, CS)
- **Relevancy:** Direct; Indirect; Partial; Unclear
- **Quality:** QN-DS – Strong; Moderate; Low
  - QL – High; Moderate; Low; Very low
- MM, CS – High; Moderate; Low; Very low

<table>
<thead>
<tr>
<th>Citation</th>
<th>Method</th>
<th>Relevancy</th>
<th>Quality Appraisal Rating</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roorda (2004)</td>
<td>QN-DS</td>
<td>Indirect</td>
<td>Moderate</td>
<td>Every disaster has different characteristics and will generate different information needs. After a new disaster it should be decided what questions need to be addressed in the future and what research strategy is therefore most adequate.</td>
</tr>
<tr>
<td>Rebmann (2009)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>Hospitals must continue to address gaps in infectious disease emergency planning.</td>
</tr>
<tr>
<td>Paek (2010)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>Preparedness occurs in stages of change. People are at different cognitive levels when it comes to consciously preparing for an emergency. Attention to media news is a predictor of emergency preparedness. The perception of others who are similar to themselves was also a predictor of preparedness in this study.</td>
</tr>
<tr>
<td>Blando (2008)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Job training and fact sheets delivered directly to intended audiences are very effective in enhancing knowledge among the public and emergency responders. Commercial media (like TV) was found to be detrimental in educating the public about important health interventions.</td>
</tr>
<tr>
<td>Burke (2008)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>Age is a factor in information seeking behaviors. Men and younger respondents were more likely to have an evacuation plan in place. These are populations that are more likely to feel that they can evacuate, as ability to evacuate decreases with age. Elderly people were found to be more isolated without accessibility to information.</td>
</tr>
<tr>
<td>Brannen (2004)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>The ability to rule out a “non-credible threat” strengthens with increased knowledge of signs and symptoms and when there are partnerships with public health agencies.</td>
</tr>
<tr>
<td>Zimmerman (2010)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>Important to understand that different professionals involved in the same response activity will likely emphasize different things as events unfold.</td>
</tr>
<tr>
<td>Ardalan (2011)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>High</td>
<td>Participating in a family preparedness program/intervention and engaging in risk mapping helps motivate individuals to take preparedness actions.</td>
</tr>
<tr>
<td>Yamamura (2014)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Stable communication in the acute stage of the aftermath of disaster is vital. Satellite</td>
</tr>
</tbody>
</table>

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communication devices that are portable and battery powered can be beneficial when communication problems arise. These devices provide more stable communication and allow responders to send larger volumes of data.

<table>
<thead>
<tr>
<th>Author</th>
<th>Design</th>
<th>Route</th>
<th>Frequency</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strawderman (2012)</td>
<td>QN-DS</td>
<td>Direct</td>
<td>Low</td>
<td>Reverse 911 warning systems as an efficient way in disaster evacuation situations because they provide customized specific info to those in affected areas.</td>
</tr>
<tr>
<td>Corburn (2003)</td>
<td>QL</td>
<td>Direct</td>
<td>High</td>
<td>Local knowledge (firsthand experience) can improve planning for communities facing the most serious environmental health risks. Responding organizations need to find ways to fuse the expertise of scientists with insights from the community. Despite evidence that local knowledge can offer valuable insights for environmental problem-solving, professionals continue to treat community members as largely ignorant of the technical and scientific aspects of the hazards they face.</td>
</tr>
<tr>
<td>Eggers (2011)</td>
<td>QL</td>
<td>Direct</td>
<td>Moderate</td>
<td>Consumer-focused strategies should be built upon an in-depth and focused understanding of consumers’ perceptions, priorities and information need.</td>
</tr>
<tr>
<td>Prior (2008)</td>
<td>QL</td>
<td>Direct</td>
<td>Low</td>
<td>While people living in at-risk areas may receive risk communication information, the way they interpret and act on the information is often inconsistent with messenger’s intent. There is a need to address situational community characteristics when delivering [bushfire] risk communication information. What works is an integrated risk communication approach, which involves collaboration with key parties to ensure communicators provide information that is contextually relevant for the community.</td>
</tr>
<tr>
<td>Shklovski (2008)</td>
<td>QL</td>
<td>Direct</td>
<td>High</td>
<td>Information communication technology (ICT) use provides a means for communicating community-relevant information, especially when individuals become geographically dispersed as a result of disaster. In some cases community members are using innovation to develop new practices by using ICT to address problems that arise from the lack of information caused by dispersion.</td>
</tr>
<tr>
<td>Shepherd (2004)</td>
<td>QL</td>
<td>Direct</td>
<td>Low</td>
<td>Information flows differently through hierarchical collectivist or individualist communities. There are certain factors that are relevant to culturally and linguistically diverse communities, including language used in communicating information, previous disaster experience, and external belief in a higher power.</td>
</tr>
<tr>
<td>Shenhar (2015)</td>
<td>QL</td>
<td>Direct</td>
<td>Low</td>
<td>Awareness campaigns should be part of an integrated long-term process in order to have a lasting effect.</td>
</tr>
<tr>
<td>Falconi (2012)</td>
<td>QL</td>
<td>Direct</td>
<td>High</td>
<td>The need for inclusion and identification of at-risk groups in pandemic planning is an important gap in</td>
</tr>
</tbody>
</table>
the literature. Information needs to be accessible to support high-risk populations. Policies related to which groups have vaccination priority must be clearly communicated during pandemic. The need to establish and foster relationships between community organizations is critical to management of a pandemic. Need to place more emphasis on public education to improve risk management.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
<th>Relationship</th>
<th>Impact</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith (2010)</td>
<td>QL</td>
<td>Direct</td>
<td>Moderate</td>
<td>Important for facilities (long-term care facilities) to define their key pandemic planning elements and exercise their plans before a disaster occurs.</td>
</tr>
<tr>
<td>Tolomiczenko (2005)</td>
<td>QL</td>
<td>Indirect</td>
<td>Moderate</td>
<td>Suggests a subtle and pervasive secondary impact from SARS. Concerned more with issues of burnout and decreases in morale among healthcare practitioners who, although they managed fewer cases stemming from the outbreak, still had to operate under elevated threat levels of the overall ordeal. While all groups found SARS stressful, nurses reported greater impact on morale and job satisfaction.</td>
</tr>
<tr>
<td>Jahangiri (2010)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Disaster response efforts must take into account the multiple channels that populations access related to disaster preparation. For example, television does not function the same in every culture/geographic location. In this study over 70 percent of the population regarded TV as the most appropriate means of media communication, although other studies reveal populations that don’t place as much emphasis on TV or mass media as a primary source of disaster-related information. This study found in the aftermath of a quake, aid centers and mosques were as much a source of information as newspapers and TV in the aftermath of an earthquake.</td>
</tr>
<tr>
<td>Eisenman (2007)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Racial and ethnic communities are most vulnerable during disaster mainly because of economic status and resources. In-depth investigation of evacuation decisions are needed to understand why impoverished, urban, minority communities may be less likely to evacuate. Communications and disaster plans need to account for obstacles encountered by urban, minority communities.</td>
</tr>
<tr>
<td>Kapucu (2008)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Repeated hurricane threats can cause a type of numbness that leads to under-preparedness and increased exposure to danger.</td>
</tr>
<tr>
<td>Steelman (2012)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Effective communication does correlate with the adaptation of flexible fire management strategies, but has a stronger positive relationship with the adoption of effective crisis strategies in general.</td>
</tr>
<tr>
<td>Roess (2011)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Community outreach activities are effective in improving disease-specific knowledge and may</td>
</tr>
</tbody>
</table>
encourage individuals to seek out health advice. Particularly in areas where health resources are limited, community participation is critical for identifying hazards related to outbreaks.

<table>
<thead>
<tr>
<th>Author</th>
<th>Type, Source</th>
<th>Directness</th>
<th>Intensity</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karan (2007)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>The nation's integrated response, use of the mass media to communicate with those in the affected areas, and other interpersonal channels played a major role in creating awareness, clarifying misconceptions and encouraging a sense of social responsibility in the control and spread of the disease.</td>
</tr>
<tr>
<td>Jack (2015)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Emergency response plans (ERPs) prepare organizations for emergencies and provide instructions on what to do when a water system is compromised.</td>
</tr>
<tr>
<td>Li (2015)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Disaster response personnel must take into account the complexity of the evacuation process. Simulations can be performed to help increase situational awareness and facilitate decision-making.</td>
</tr>
<tr>
<td>Aldunce (2007)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Improvements to disaster management need to be done at the local level in order to achieve a holistic and integrative management, including community participation.</td>
</tr>
<tr>
<td>Boon (2016)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>General perceptions of climate change threats vary by location, necessitating specific/targeted messages; prior disaster experience may encourage individuals to perceive future threats as less serious, meaning that future threats must be emphasized by officials. Inaccessibility of scientific language combined with inherent mistrust of government leaves many skeptical about climate change information, necessitating the dissemination of clear information from trustworthy spokespersons.</td>
</tr>
<tr>
<td>Lai (2012)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Communication directed at the public ought to be implemented at the local community level, in which various stakeholders participate; multiple agencies must collaborate as part of a network to ensure both coordination and flexibility; nations must reach out to other regional governments for aid, who ought to respond given the trans-boundary nature of pandemics. Such coordination is key to deal with surges in demand for supplies.</td>
</tr>
<tr>
<td>Hoover (2013)</td>
<td>MM/CS</td>
<td>Indirect</td>
<td>Moderate</td>
<td>Message mapping can be a useful strategy to create clear, consistent public health messages that can be disseminated rapidly. Consistent key messages across multiple audiences will minimize and limit the number of competing messages in a disaster situation. By developing an overall community health education plan, health officials and communicators can target information and materials to specific populations and be consistent in reinforcing health messages for those</td>
</tr>
</tbody>
</table>
communities, families and individuals.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Periodicity</th>
<th>Communication Method</th>
<th>Provenance</th>
<th>Strength</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kongthon (2012)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Although there may be some advantages to the use of social media in disaster situations, there are some drawbacks as well. For example, information that is false, outdated, or inaccurate could compound situational awareness of a crisis and slow down relief efforts.</td>
<td></td>
</tr>
<tr>
<td>Skinner (2014)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Low</td>
<td>The speed and accessibility of social media outlets like Twitter can be used as means of disaster communication, provided that consistent and helpful hashtags can be generated; As areas develop new disaster plans need to be generated that increasingly focus on the lives of both stakeholders and nearby residents; increased focus needs to be placed on disaster prevention rather than disaster response.</td>
<td></td>
</tr>
<tr>
<td>Bell (2009)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Low</td>
<td>Crowded urban areas in developing and industrialized countries are uniquely vulnerable to public health crises. Traditional local-level strategies may not be easily scalable to meet the needs of huge, densely populated cities, especially in developing countries.</td>
<td></td>
</tr>
<tr>
<td>Horsley (2002)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Too often, public sector agencies lack crisis communication plans, which prevents them from being proactive in crisis situations. Many don’t have relationships with media either. Article emphasizes the need for agencies to be more proactive in building necessary relationships to leverage in crisis situations.</td>
<td></td>
</tr>
<tr>
<td>Blanchard-Boehm (2008)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>When the onset of a future crisis is visible, officials must not only educate citizens regarding the crisis and solutions, but must also collect citizen feedback about that information so that the communication strategies may be adjusted in time to mitigate the crisis.</td>
<td></td>
</tr>
<tr>
<td>Castenfors (2001)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>High</td>
<td>Urban settings are at greater risk of both having accidents and of experiencing more severe consequences, due to complex infrastructure and greater congestion; Multiple means of communication must be established so that various groups with different access can all receive information.</td>
<td></td>
</tr>
<tr>
<td>Cole (2007)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Moderate</td>
<td>Care communication is irrelevant if crisis and consensus communications are ineffective; If a crisis is known to be coming, messages ought to be prepared in advance; Messages must be delivered by spokespersons deemed credible by the audience; Multiple messages ought to be drafted to adapt differing demographic groups.</td>
<td></td>
</tr>
<tr>
<td>Chess (2007)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Low</td>
<td>Interagency task forces key to effective preparation and communication; Trust between professionals from different agencies key to facilitate communication; flexibility from inter-agency networks is superior to increased control from</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Methodology</td>
<td>Collaboration</td>
<td>Preparatory Level</td>
<td>Summary</td>
<td></td>
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<tr>
<td>Tuler (2005)</td>
<td>MM, CS</td>
<td>Direct</td>
<td>Moderate</td>
<td>There is much research on best practices and importance of collaboration among stakeholders, without considering the fact that there are various perspectives on process by stakeholder group.</td>
<td></td>
</tr>
</tbody>
</table>