

**World Health Organization
Department of Communications**

Evidence Syntheses to Support the Guideline on Emergency Risk Communication

Q9: What are the best ways to engage communities in emergency risk communication activities to respond to events/ contexts?

Final Report

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1.0 INTRODUCTION

1.1 Background

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

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

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

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

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

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

1.2 Rationale

Disaster/ emergency events with public health implications are communicatively understood by all publics and benefit from emergency risk communication before, during, and after such events. Historically, governmental agencies, charged with leadership responsibilities for managing potential and actual disasters/ emergencies, identified the impending disasters/ emergencies, crafted messages for instructing impacted publics on the appropriate measures to take, and attempted to warn/ persuade publics to action by disseminating the messages through a limited number of communication channels, typically determined by the technology, or lack thereof, in the affected area.

The number, complexity, and severity of disasters/ emergencies continue to increase. Many public health agencies at multiple levels—local, state, regional, national, and international—operate organizational divisions dedicated to planning, preparedness, and response/ recovery. These hierarchical agencies must effectively coordinate efforts inter-organizationally and directly communicate/ interact with relevant publics. Whether identifying and understanding a particular event or initiating subsequent risk communication, lead agencies in today’s context acknowledge the importance of including publics in varied aspects of all phases, but have yet to do so in ways grounded in evidence-based knowledge. Community engagement in activities is necessary; however, *how to* engage the community and *in what* specific activities of planning, preparedness, and response/recovery have yet to be rigorously examined in the extant research. With the help of the present review, WHO and other responsible agencies can have another tool to protect the health of at-risk publics as well as support future research to address identified weaknesses and gaps in the literature.

1.3 Objective

1.3.1 Question

The objective was to conduct a systematic review of the extant literature on the best practices to engage communities, including community sectors, households, and individuals, in preparing for and responding to emergency events with public health implications. Specifically, the purpose of the systematic review is to address the following question:

What are the best ways to engage communities in emergency risk communication activities to respond to events/contexts?

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, and 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; at-risk communities and stakeholders.

Phenomena of Interest: Strategies and tactics for encouraging participation of at-risk communities in emergency planning and response.

Comparison: Differing tactics: Integration of at-risk communities into planning processes, providing incentives to community leadership, use of formal reporting systems and feedback loops, and others. Variations in strategies and tactics related to equity considerations such as local contextual and population characteristics.

Evaluation: Impact on level of engagement and retention of community participation, public trust in health protection information, level of coverage of information sharing, perceived relevance among communities of national response to local questions/concerns.

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 map also allowed us to refine the objective of and the approach to the present review as discussed below.

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

The phenomena of interest are strategies and tactics for encouraging participation of communities in emergency planning and response.

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 strategies and tactics that were effective or in the absence of evidence of effect appeared to work best as follows:

Strategies and tactics for

- Participation in planning activities, *pre-event design* efforts.
- Participation in activities for emergency risk communication preparedness, *pre-event actions*.
- Participation in activities for emergency risk communication response, *event and post-event actions*.

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, 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. There are at least two considerations that are relevant.

First, the question and the description of the phenomenon of interest focus on “communities.” There is no singular definition of a community; definitions may privilege the notion of a geographically bounded place or, in contrast, a cooperative/ collaborative group(s) made up of particular groups with various roles/ functions, particular group(s), or even a gathering of individuals who share some common characteristic/ concern. In the absence of a universal definition, it may be helpful to distinguish three types of local communities: a community-at-large as a designated geographical area governed by officials with formal leadership responsibilities; community-sectors as professional, and in some cases volunteer, groups with planning, preparedness, and response responsibilities and who work with leaders and other sectors; and community individuals consisting of individuals/ households. The absence of a singular definition makes the identification and selection of research articles somewhat problematic and, more importantly, decreases the practical utility of a synthesis of the analyzed findings in which the different types of community are collapsed and combined.

Moreover, besides identifying community type in relation to outcomes, it is important to focus on what type of community is studied. Who are the participants engaged in activities? Governing leaders? Organizational sectors? Individual households or residents? Any findings based on a type of community impact is important relative to research synthesis and practical utility as well as the specifics of any recommendation.

These three types of community defined here correspond to “levels” within a community and, hereafter, when generically discussed in the present review are referred to as community levels.

Second, the review question prioritizes community engagement in *activities to respond to events/ contexts*. This suggests the primary phenomenon of interest is to determine the strategies and tactics that will engage communities in *pre-event activities* related to *action behaviors* for readiness to promptly enact advised behaviors if a potential event moves to the onset of the event and/or for reducing the actual consequences of an evolving event. There are two fundamentally different types of action behaviors: a) preparedness behaviors before an event and b) response behaviors during an event, and both, arguably, constitute response to events/ contexts.

Although, the SPICE framework explicates the phenomenon of interest as “encouraging participation of emergency planning and response,” planning per se is not present in the review question. When planning is added to the review question, the ambiguity increases rather than decreases as well as the scope of this review increases. Moreover, there is less distinction between this review question and the review question that focuses on planning, which includes how to get the community involved. Thus, numerous, more nuanced questions about the question of this review emerge. These include: Is planning seen as an action behavior? Is planning of a different nature than preparedness and response? The project team developed the following definitional parameters for the present review: *preparedness* refers to *pre-event actions* to reduce risk, *response* refers to *actions during an event* to mitigate consequences, and *planning* refers to *pre-event design* efforts. These distinctions are noted in the present review whenever possible.

Likewise, the comparison category for outcomes/ effects description 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 refers to differing tactics: Integration of at-risk communities, providing incentives to community leadership, use of formal reporting systems and feedback loops, and others. Instead of seeing these terms as only relevant to comparison groups, as may be the case in a randomized trial, we are taking these concepts/ variables as potentially associated with efforts to maximize community participation 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 non-randomized), we did not compare (or contrast) the key concepts/ variables between groups. Rather we looked for the concepts/ variables in the group studied and association claims between the concepts/ variables and activity outcomes and focused on identifying best practices as directed by the review objective.

1.3.6 Data and Population of Interest

The primary data of interest were from field studies of populations that were *directly* affected by a relevant public health 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 SYSTEMATIC REVIEWS

2.1 Approach to Existing Systematic Reviews

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

2.2 Quality Rating and Relevant Findings

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

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

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

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

2.2.1 Existing Reviews: Ratings and Findings Summary

Notes for Table

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

Review Citation (first author) and Review Purpose	Modified AMSTAR Quality Rating	Relevancy	Key Relevant Findings
Gurabardhi (2005: <i>An Empirical Analysis of Communication Flow, Strategy and Stakeholders' Participation in the Risk Communication Literature 1988-2000</i>)	Moderate	Indirect	This review examined literature on risk communication for trends in content, not effectiveness, in the environmental, industrial, and technological domains from 1988-2000. They approached the literature by using the theoretical perspective of control mutuality in communication (two-way flow, dialogic approach, and stakeholder input in decision making). Communication flow refers to one-way (top-down or bottom-up)

<p>The aim is “to apply a quantitative analysis to the content of risk communication literature with respect to communication strategy, communication flow and decision-making characteristics.”</p>			<p>communication or two-way. Communication strategy refers to technical information (data sheets, information based on quantitative risk assessment, and comparative risk assessments, or persuasion (marketing approach, message clarity, audience perception of risk issues, and risk education, or dialog (characteristics of discourse). Stakeholders’ participation in risk decision-making processes relates to stakeholders (government, industry, shareholders, NGOs, community leaders, and general public) input in risk decision-making processes. Over, the time span studied, they found an increase in the number of articles with two-way communication flow (community advisory panels, citizen juries, negotiation, etc.). The most productive researchers study two-way flow. Persuasive and informational approaches continue; yet dialogic approaches are present focus by the most productive researchers. There has been a gradual increase in number of articles studying stakeholders’ input in decision-making. The most productive and Western European researchers are increasingly focused on stakeholders’ input. The literature was not examined by specific type of risk/emergency, location of risk/event, phase of emergency, or individuals affected by risk/event.</p>
<p>Kumagai (2004)</p>	<p>Low</p>	<p>--</p>	<p>--</p>
<p>Lettierri (2009): <i>Disaster Management: Findings from a Systematic Review</i></p> <p>The aim is “to contribute to the existing knowledge on disaster management by reviewing its literature, through a systematic review methodology that has been used in the medical sciences over the last 15 years.”</p>	<p>Moderate</p>	<p>Indirect</p>	<p>The review examines the disaster management literature from 1980-2006. It is largely clustered in four areas: theoretical frameworks, phases of disaster management, actors involved, and technology/informational support. Upon analysis, the review coded for mitigation, preparedness, response, strategy, learning, recovery, and signaling. Strategy came from the business process literature. The four actor roles are formal agents, researchers, population, and media. Historically, population and media were considered to have indirect roles, however academic debate now centers on population involvement with strategy/pre-crisis and the role of volunteers during response. Research has typically focused on failures between organizations and media, yet media can be helpful “when it properly informs the population and supports the various direct actors.” The literature was not examined by specific type of disaster, location of disaster or individuals affected by the disaster.</p>
<p>Levac (2012): <i>Household Emergency Preparedness: A Literature Review</i></p> <p>The aim is “review the existing literature on household emergency preparedness in North America.”</p>	<p>Moderate</p>	<p>Indirect</p>	<p>This review synthesizes the literature household preparedness (plans, supplies) for disasters with focus on Canadian studies from 1995-2000. It emphasizes the complexity of preparedness, involving personal and contextual factors. Community residents perceive preparedness as important. Somewhat paradoxical, households typically perceive preparedness as a responsibility of local governments rather than households. Community preparedness is associated with shared values and strong social/economic</p>

<p>“This review will highlight the need for disaster to ‘involve community members as active participants’ in preparedness activities” It also discusses persons with disabilities and an “understanding of the factors that influence preparedness.”</p>			<p>infrastructures. Determinants associated with and factors influencing preparedness are reviewed. People with disabilities are especially under-prepared and vulnerable to negative consequence. Literature gaps noted were strategies to engage communities in preparedness activities, overcome identified challenges, and foster/leverage social capital. The literature was not examined by specific type of disaster.</p>
<p>McCaffrey (2015): <i>Community Wildfire Preparedness: A Global State-of-the-Knowledge Summary of Social Science Research</i></p> <p>This review builds on a previous review by looking at the articles that have been published since 2010. Specifically, it examines the social dynamics of fire management.</p>	Moderate	Indirect	<p>This review examines the literature on wildfire preparedness published from 2011 to 2014 and what has been learned about public response. Prior to 2011, a fairly substantial number of articles were US-based studies on pre-fire mitigation. Since then, roughly half have been conducted outside of the US, the majority of which in Australia, and focused on dynamics during and after a fire. Research (in relation to this question) on community wildfire preparedness highlights the value of connecting people to a shared risk, with each other, and with knowledgeable people as well as developing relationships. Facilitating social interactions, interactive learning, and networking can “increase mitigation at the individual and community level by facilitating information exchange” and building a sense of community. Important considerations are place attachment, local knowledge, and adequate financial support.</p>
<p>Savoia (2013): <i>Communication in Public Health Emergency Preparedness: A Systematic Review of the Literature</i></p> <p>This review “describes current research in the area of communication to the public in public health emergency preparedness, focusing on the association between socio-demographic and behavioral factors and communication as well as preparedness outcomes.”</p>	Moderate	Indirect	<p>This review examines the literature on communication to public in public health emergency preparedness with a focus on the association of socio-demographic and behavioral factors and communication and preparedness outcomes. Articles published in 2009 were reviewed for the presence/absence of variables and outcomes in the Structural Influence Model of Communication Inequalities; this model illustrates communication to publics and posits its import for public health emergency preparedness behaviors. Of the empirical studies, 74% were population-based studies and 26% were information/media content analyses. None were experimental in design. There were consistent results on the association between population socio-economic factors and public health emergency preparedness communication and preparedness outcomes. The type of disasters were coded but the specific location of the disaster was not. They did not code for strategies or community-level outcomes.</p>
<p>Schiavo (2014): <i>Communicating Risk and Promoting Disease Mitigation Measures in Epidemics and Emergency Disease</i></p>	Moderate	Direct	<p>This review examined the literature on communicating risk and promotion of mitigation measures from 2002 to 2013. Twenty-nine studies met criteria: a) quantitative, b) focused on communication rather than mitigation measure effectiveness, c) focused on intervention level—community, healthcare, multi-sector—not</p>

<p><i>Settings</i></p> <p>This review aims “to identify and assess evidence on interventions to communicate risk and promote disease mitigation measures in epidemics and emerging disease outbreaks.” The review “focuses on data that are relevant to low and middle-income country settings.”</p>			<p>individual behaviors, and d) relevant to Low to Middle Income Countries. Strategies (community mobilization, mass media, entertainment education such as street performers) to support the role of community-based interventions (geographic, school, homeowners) were associated with improved health and social outcomes. Targeting two levels rather than one resulted in significantly improved outcomes. They highlight that many LMICs are without capacity/finances to design, implement, and assess interventions. The limited number and scope of articles make any conclusions untenable</p>
<p>Wachinger (2013): <i>The Risk Perception Paradox—Implications for Governance and Communication of Natural Hazards</i></p> <p>The aim of this review “lies on the discussion of results from an interdisciplinary review of previous studies about risk perception and behavioral response regarding natural hazards.”</p>	Moderate	Indirect	<p>This review examines the literature on risk perception, particularly in relation to natural hazards. The 25 empirical, Europe-only articles focused on risk perception and individual preparedness for action. Direct experience with the natural hazard, trust in authorities, and confidence in protective measures were the informational/personal/contextual factors associated with risk perception. The authors note a Risk Perception Paradox, whereby a high perception of risk, usually associated with protective intentions/behaviors, may have an unintended, opposite reaction. To counteract this paradox, the review suggests participatory exercises and involvement in the design and testing of emergency plans are probably most effective when trying to create awareness, build trust, and foster personal responsibility; individuals will better differentiate what authorities can do and what they can do to self-protect and manage crises.</p>

2.3 Summary of Relevant Findings From Existing Systematic Reviews

The seven existing reviews of moderate quality according to AMSTAR appraisals focused on risk communication (3), emergency/disaster preparedness (2), disaster management (1), and risk perception (1) for a variety of emergency events, including disasters in general, emergent infectious diseases, natural disasters, industrial hazards, and technological hazards. The reviews usually approached risk communication as a multi-disciplinary phenomenon. All the reviews had risk communication findings with some relevance for emergency health events. They predominantly drew from studies on events in the developed world; particularly the US/Canada, Western Europe, and, more recently Australia (specifically for wildfires). The one review that focused on Low to Moderate Income Countries reported inconclusive findings due to a paucity of studies.

The objective of the present review asks for the “best ways to engage communities in emergency risk communication activities to respond to events/ contexts.” Each existing review provided specific definitions (and often unique variants) for concepts in this objective, which complicates the precision of the overall findings across the reviews. After a thorough reading of each review, we chose to break up the objective into its constituent parts.

The words “best ways” suggest that some strategies and tactics to gather and engage communities may be better than others. However, no review fully focused on different strategies or tactics per se to engage community participation in activities conducted to encourage community actions of preparedness and response nature.

Additionally, the concept of “community” may refer to individuals and households in a community (geographic, ethnic, social, vulnerable, etc.), community sectors, or the community-at-large. Although much research starts by focusing on communities-at-large based on the geographic area of the emergency event, the actual communities studied often refer to community levels more specifically defined by role and (potential) impact.

The final clause—“in emergency risk communication activities to respond to events/contexts”—suggests activities that take place prior to an event/context. This parallels much of the research as it disproportionately examines prevention and preparedness behaviors, actions that take place before an event, due to the difficulty and ethical/moral quandaries regarding conducting activities/evaluating behaviors during an unfolding and evolving event.

With the above context in mind, the following findings span the existing reviews:

- *How best* to engage communities in activities to respond to emergency events is seldom of direct focus and little studied. Instead, much of the research simply stated that more public involvement/engagement rather than less was positively related to improved community response.
- Public participation in planning, preparedness, response, and evaluation activities is generally associated with improved, actual individual and community preparedness/ response actions.
- Only two reviews looked specifically at the community-at-large level rather than the community-sectors or individual level. The general and implicit premise appears to be that the greater the number of individuals engaged in activities, the better the community-at-large response.
- Most of the studies reviewed continue to place extensive focus on individual personal and contextual factors in relation to household/ community emergency preparedness.

2.4 Summary of Research Gaps Identified by Existing Systematic Reviews

There are no existing reviews in the area of emergency events with public health implications that focus fully on the phenomenon of interest in this review. Not one review sought to address how to gather/engage communities at any level, let alone the best ways. In those instances when communities are gathered and participating in planning and/ or preparedness/ response activities, the importance of the community participation rather than the process (strategy and tactics) utilized to obtain the participation was noted.

Additionally, existing reviews cite studies that predominantly focus on events in the United States, Canada, and Western Europe. As to be expected, the somewhat dated existing reviews draw from older studies and therefore do not include the more recent studies, which have begun to focus on events more broadly dispersed throughout the world. There is growing evidence of gathering communities in the more recent studies, and this may arguably be associated with geographical locations that have reduced access among communities (at all levels) to up-to-date communication technology infrastructure combined with an ongoing oral tradition in popular culture.

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.

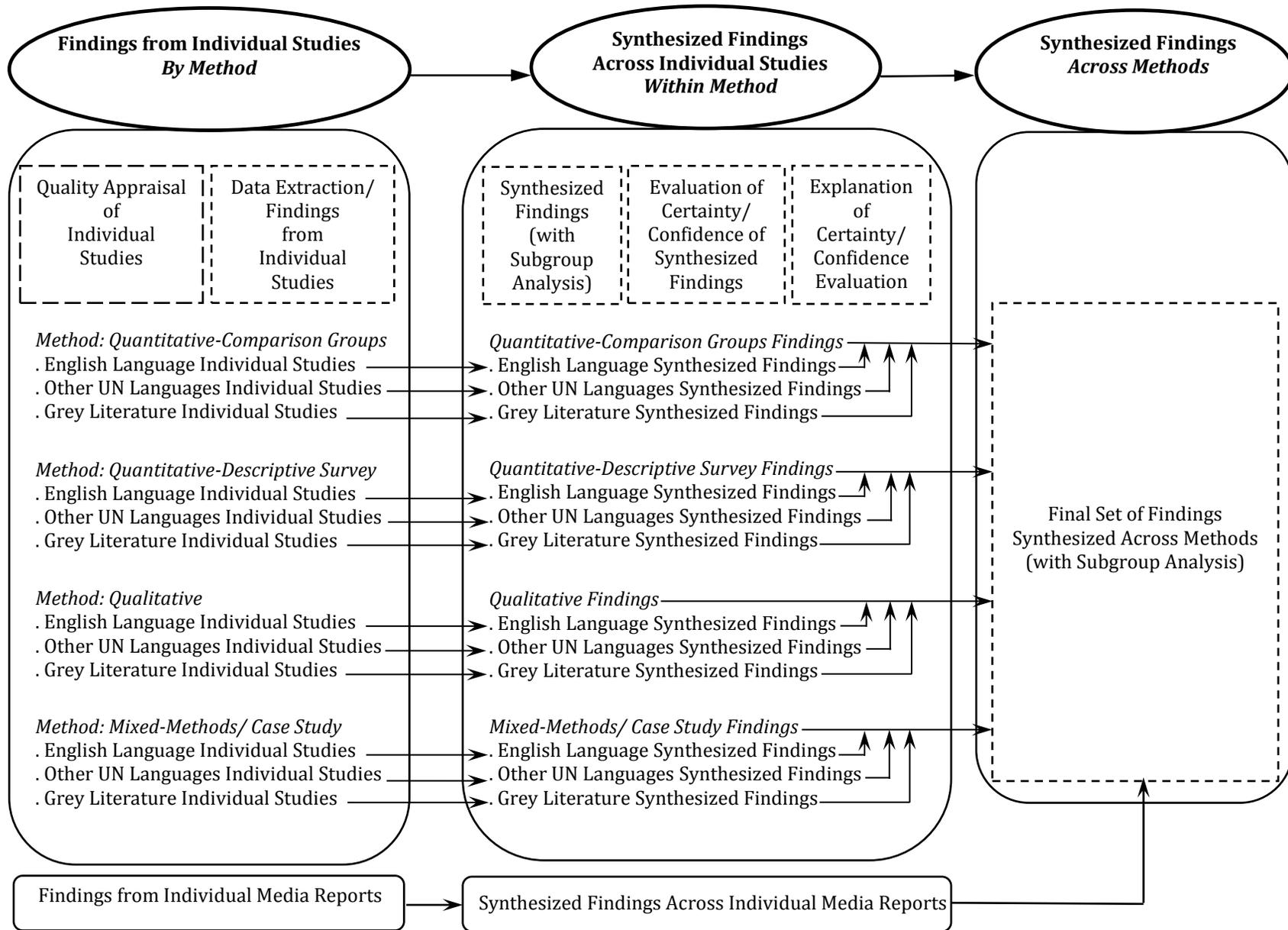
Using the above methodological groupings as a starting point, in the initial Rapid Knowledge Map we identified five methodological streams that best covered the method types found in the primary studies selected for the review:

- 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



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

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

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

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

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

3.5 English and Other UN Languages

3.5.1 Languages Included in Review

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

3.5.2 Review Process for Other UN Languages

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

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

3.6 Information Sources for Literature Search

3.6.1 Information Sources for English Language Literature

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

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

3.6.2 Information Sources for Other UN Languages Literature

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

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

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

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

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

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

3.6.3 Information Sources for Grey Literature

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

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

3.7.1 Search Strategy

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

3.7.2 Search Terms

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

Disaster*	Community/community at large
Disaster plan*	Emergency management
Communication	Trust
Risk communication	Resilience
Emergenc*	Mental health
Hazard*	Public health
eRisk*	Non-government (various)
Threat*	Disaster/emergency/crisis response
Emergency preparedness	Public response
Emergency management	Awareness (public)
Crisis (or other truncation used in a specific database:?,#) Crisis communication	Activity, action
Disaster preparedness	Risk prevention
Hazard communication	Participation (public, community)
Emergency communication	Response/responsiveness
Catastrophe communication	Preparedness
Health communication	Decision/decision making

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), “low confidence” (it is possible that the finding is a representation of the phenomena), or “very low confidence” (it was not clear if the finding is a representation of the phenomena).

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

3.14 Synthesis of Findings across Methodological Streams

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

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

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

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

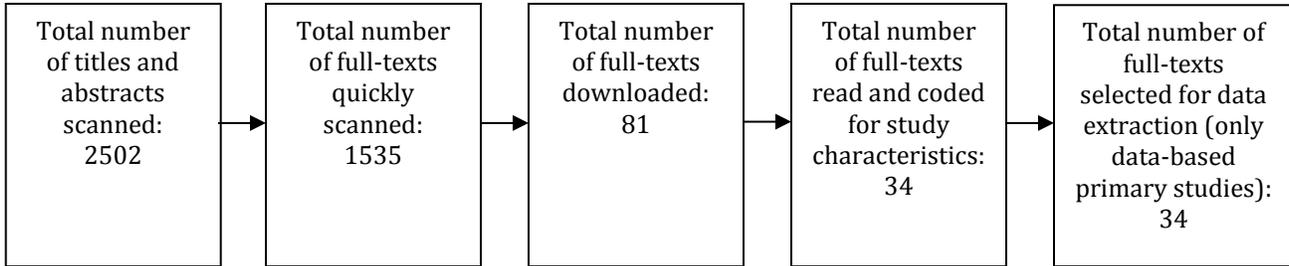
3.15 *Media Reports*

We extracted findings from 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

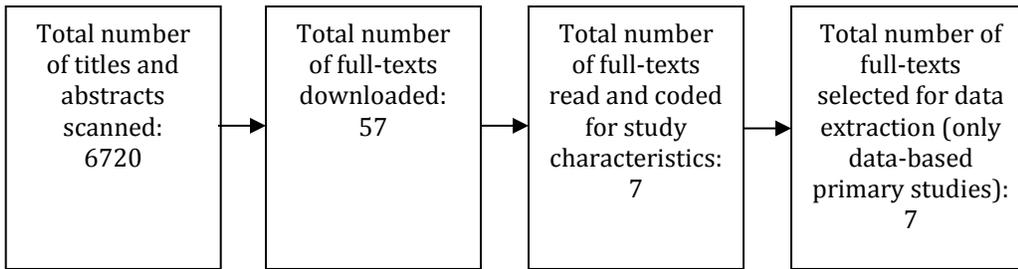
4.1 Study Selection

4.1.1 English Language

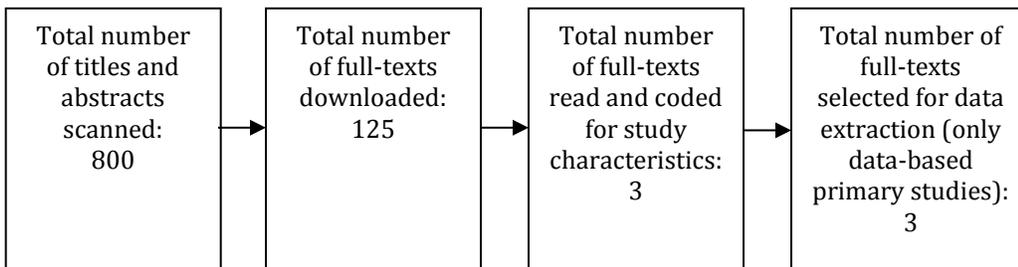


4.1.2 Other UN Languages

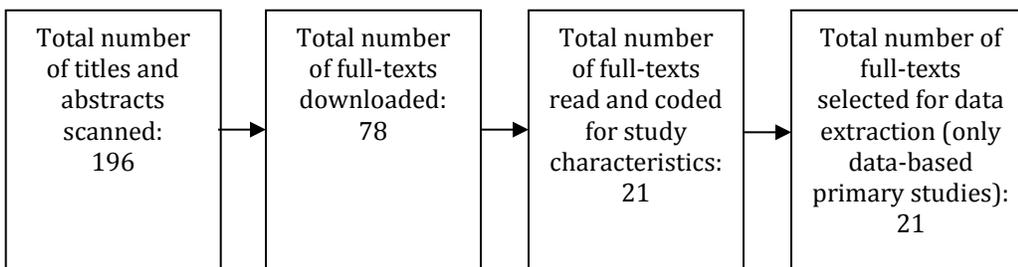
Arabic:



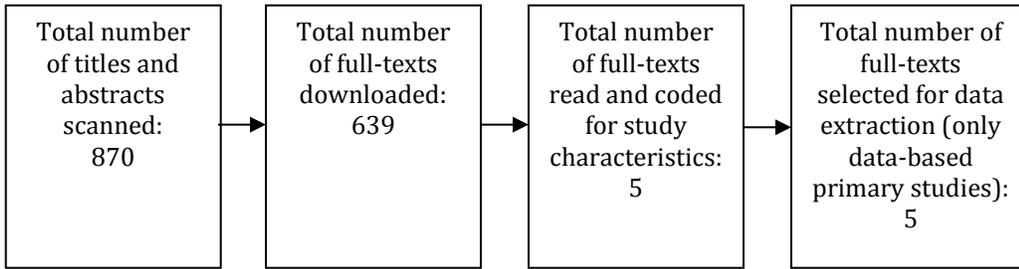
Chinese:



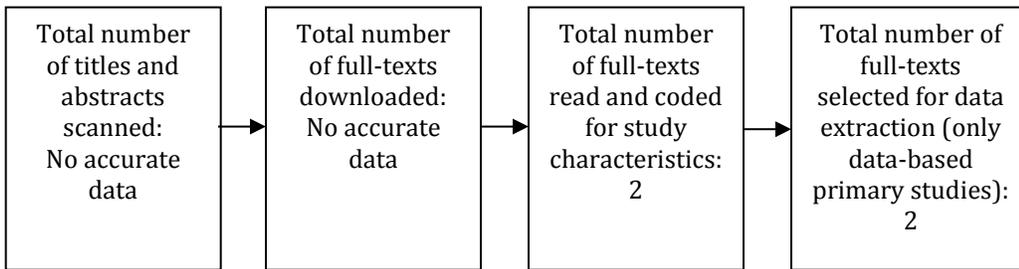
French:



Russian:



Spanish:



4.2 Study Characteristics

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

4.2.1 Knowledge Map of Characteristics of Studies-English Language

Key to Table

. Total English language data-based primary studies (includes grey literature): 34

. Grey literature studies: 1

. Some categories are not mutually exclusive and so the frequencies will not sum to the total of 34.

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

Relevancy	Method General	Country Focus	Disaster / Emergency Type	Disaster / Emergency Phase	At-risk Groups
Direct: 8 Indirect: 17 Partial: 9 Unclear: 0	QN-CS: 5 QN-DS: 14 QL: 5 MM, CS: 10	Australia: 3 Belgium: 1 Caribbean: 1 Canada: 2 China: 2 Congo: 1 El Salvador: 1 India: 1 Indonesia: 1 Iran: 3 Israel: 1 Japan: 1 Netherlands: 2 Singapore: 1	General/Multiple: 14 Bushfire/wildfire: 2 Earthquake: 4 Flood: 5 Food Safety: Hurricane: 1 Industrial: 1 Infectious Disease: 1 H*N1: 1 Monkey pox: 1 SARS: 2 Storm: 1 Volcano: 1	All Phases: 1 Preparation: 10 Recovery: 1 Evaluation: 1 Preparation & Onset: 2 Preparation & Recovery: 1 Preparation & Evaluation: 3 Onset & Containment: 2 Onset & Evaluation: 1	Children: 2 Immigrants: 2 Indigenous: 1 Latinos: 1

		Spain: 1 Sweden: 1 Thailand: 1 Taiwan: 2 USA: 11 Not Specified: 2		Preparation, Onset, & Containment: 2 Onset, Containment, & Recovery: 1 Preparation, Onset, Containment, & Recovery: 1	
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Of the 71 studies examined for the present review (see Section 7.1 for the references), 34 were written in the English language. Of these, eight were fully relevant, nine were partially relevant, and 17 were indirectly related. Nineteen of the studies employed quantitative methods, five employed qualitative methods, and 10 employed mixed methods/case study approaches.

Regarding countries, 11 of the studies focused on the United States, with the remaining focusing on an array of countries/regions throughout the world. These countries included Australia (1), Belgium (1), the Caribbean (1), Canada (2), China (2), Congo (1), El Salvador (1), India (1), Indonesia (1), Iran (3), Israel (1), Japan (1), the Netherlands (2), Singapore (1), Spain (1), Sweden (1), Thailand (1), Taiwan (2), and two were not identified.

Nearly half (14) of the studies focused on disasters/emergencies in general or of multiple types. The remaining events included bushfires/wildfires (2), earthquakes (4), floods (5), hurricane (1), industrial (1), infectious disease (1), H1N1 (1), Monkey pox (1), SARS (2), storm (1), and volcano (1). Notably, 14 of the studies focused solely on the preparation phase. The remaining studies focused on various phases, including a single phase or configuration of phases. Six studies also examined and discussed at-risk groups: children (2), immigrants (2), indigenous (1), and Latino minority population (1).

4.2.2 Knowledge Map of Characteristics of Studies-Other UN Languages

Key to Table

. Total UN language data-based primary studies (includes grey literature): 37

. Some categories are not mutually exclusive and so the frequencies will not sum to the total of 37.

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

<i>Relevancy</i>	<i>Method General</i>	<i>Country Focus</i>	<i>Disaster/ Emergency Type</i>	<i>Disaster/ Emergency Phase</i>	<i>At-risk Groups</i>
Directly Relevant: 22 Indirectly Relevant: 15	QN-CS: 0 QN-DS: 14 QL: 7 MM, CS: 16	Algeria: 1 China: 3 Czech Republic: 1 Egypt: 4 Ethiopia: 1 France: 10 Germany: 1 Islands of Mayotte and Reunion: 1 Japan: 1 Madagascar: 1	General: 11 Arsenic/Lead: 1 Chikungunya: 1 Earthquake: 2 Electromagnetic Fields: 1 Epidemic Diseases: 1 Flood: 14 Food Safety: 1 H*N*: 3	All Phases: 2 Preparation: 6 Onset: 2 Containment: 1 Recovery: 2 Evaluation: 5 Preparation & Onset: 1 Preparation, & Evaluation: 5 Onset &	Yes: 15 (Children, low SES status, older adults, rural households, immigrants, people with disabilities)

		Mexico: 1 Morocco: 1 Philippines: 2 Poland: 1 Russia: 5 Saudi Arabia: 2 Spain: 1 United States: 1 Not Specified: 2	Illegal Immigrants: 1 Nuclear: 1 Volcano: 2	Recovery: 1 Recovery & Evaluation: 1 Recovery & Preparation: 1 Preparation, Onset, Containment: 6 Preparation, Recovery, & Evaluation: 3 Onset, Containment, & Recovery: 1	
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Of the total 71 primary data-based studies examined for objective of this review, 37 were written in other UN language (i.e., not English). Of these 37 studies (see Section 7.2 for the references), six were in Arabic, three in Chinese, 21 in French, five in Russian, and two in Spanish. Twenty-two 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.

Fourteen of the articles used quantitative descriptive methods, seven employed qualitative methods, and 16 employed mixed methods/case study approaches.

Regarding countries, 10 of the studies focused on France, with the remaining studies focusing on an array of regions. These countries included Algeria (1), Czech Republic (1), China (3), Egypt (4), Ethiopia (1), Germany (1), Islands of Mayotte and Reunion (1), Japan (1), Madagascar (1), Mexico (1), Morocco (1), the Philippines (2), Poland (1), Russia (5), Saudi Arabia (2), Spain (1), United States (1), and two not specified.

One-fourth of the studies focused on disasters/emergencies in general or of multiple types. The remaining events included arsenic/lead (1), Chikungunya (1), earthquakes (2), electromagnetic fields (1), epidemic diseases (1), floods (14), food safety (1), H1N1 (3), illegal immigrants (1), nuclear (1), and volcanoes (2). Floods accounted for thirty-five (35%) of the disaster/emergency events.

Twenty-four of the studies included preparation as one of the phases. The remaining studies focused on various phases, including a single phase or configuration of phases. Six studies also examined and discussed at-risk groups: children (2), immigrants (2), indigenous (1), and Latinos minority population (1).

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. Of the 34 English language articles, there was one report from the grey literature. The report detailed a mid-term review of the Hyogo Framework for Action in relation to the Spanish Tous dam-break and flooding in 1982.

4.4 Quality Appraisal of Individual Studies

Of the 34 English language studies, for relevancy, eight studies were fully relevant, nine were partially relevant, and 17 were indirectly relevant. With regards to quality, for the quantitative-comparison groups studies, three were appraised as moderate quality (minor risk of bias), and two as low quality (some risk of bias). For quantitative-descriptive survey studies, five were appraised as strong, seven as moderate, one

as moderate to low, and one as low. For qualitative studies, one was appraised as high, two as moderate, and two as very low. For the mixed-method and case study studies, one was appraised as strong, six as moderate, one as low, and two as very low.

See Appendix 8.2 and Appendix 8.3 for tables for English language studies that present the quality rating, as well as relevancy 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 (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

Phenomenon of Interest/ Outcome	Method	Synthesized Finding Statement (with subgroup analysis of type, phase, and country of disaster, and vulnerable population)	Citations (first author) Supporting Synthesized Finding Within Method Stream	Evaluation of Certainty/ Confidence of Synthesized Finding Within Method Stream	Explanation of Evaluation
Activities	QN-CG	Ardalan (2010): A community intervention for flash flood preparedness using village disaster taskforces and family training in randomly selected intervention and control villages in Iran showed statistically significant improvement on all outcome measures of preparedness in the intervention villages relative to the control villages. Ardalan (2013): A community educational intervention using primary health care workers in Iran covering awareness and preparedness regarding	Ardalan (2010); Ardalan (2013); Glik (2014)	Moderate	Two studies, both in Iran by the same lead researcher, report the finding among randomly selected individuals from control and intervention villages. One study in the U.S. found was of equal strength.

		<p>earthquakes and floods. The study was conducted in a randomly selected intervention and control region and had a pre-post design. Pre- to post-intervention change in scores on disaster awareness and preparedness showed statistically significant greater improvement in the intervention households compared to the control households.</p> <p>Glik (2014): An intervention for enhancing disaster preparedness using a randomized longitudinal cohort design with two experimental conditions, community health worker led discussion groups along with mailed information versus mailed information only, found that mailed information was equally sufficient to encourage households to obtain disaster supplies but the interpersonal education condition led to statistically significant higher adoption of complex disaster planning.</p> <p>Participation in activities in Iran increased earthquake and flood preparedness actions in Iran and for disasters-in-general in the U.S.. Participatory community task forces and public health volunteers as part of interventions resulted in increased awareness and preparedness actions. Focused on preparation phase. Vulnerable household members and low-income Latinos received specific attention.</p>			
Activities	QN-CG	Eisenman (2009): An	Eisenman	Low	Finding based on one

		<p>intervention for enhancing disaster preparedness using randomized block design with two experimental conditions, community health worker led discussion groups versus culturally tailored mailed information only, showed that both conditions improved purchase of disaster supplies and creation of a communication plan, but the discussion group condition showed statistically significant greater improvement than the mailed information condition.</p> <p>Social networks increased disaster preparedness for disasters in general among Latino households in Los Angeles, CA, USA. Focus on preparation phase and vulnerable population.</p>	(2009)		study assessed as low in study quality.
Activities	QN-CG	<p>Ardalan (2010): A community intervention for flash flood preparedness using village disaster taskforces and family training in randomly selected intervention and control villages in Iran showed statistically significant improvement on all outcome measures of preparedness in the intervention villages relative to the control villages.</p> <p>Ardalan (2013): A community educational intervention using primary health care workers in Iran covering awareness and preparedness regarding earthquakes and floods. The study was conducted in a randomly selected intervention and control region and had a pre-post design. Pre- to post-</p>	Ardalan (2010); Ardalan (2013)	Moderate	Two studies, both in Iran and by same, lead researcher, report the finding among randomly selected individuals from control and intervention villages.

		<p>intervention change in scores on disaster awareness and preparedness showed statistically significant greater improvement in the intervention households compared to the control households.</p> <p>Risk perception has a positive association with awareness and preparedness actions for earthquakes and floods in Iran. Rural households, in contrast to urban ones, are more aware and prepared for disasters. Studies focus on preparation phase with specific attention to vulnerable household members.</p>			
Activities	QN-CG	<p>Glik (2014): An intervention for enhancing disaster preparedness using a randomized longitudinal cohort design with two experimental conditions, community health worker led discussion groups along with mailed information versus mailed information only, found that mailed information was equally sufficient to encourage households to obtain disaster supplies but the interpersonal education condition led to statistically significant higher adoption of complex disaster planning.</p> <p>Yen (2009): In an outbreak of acute hemorrhagic conjunctivitis (AHC) infectious disease in Taiwan, the study compared the cities of Taipei, which received an integrated risk communication program that included short messaging service (SMS)</p>	Glik (2014); Yen (2009)	Moderate	Two studies, one of low quality and one moderate quality. The low quality one examined messages in the context of general disasters. The moderate quality study was done in the context of floods. This narrowed context facilitated tailoring and targeting.

		<p>messages sent to all citizens with mobile phones, and Keelung, which did not receive such a program. The analysis showed that Taipei had a statistically significant shorter epidemic duration (13 vs. 34 days) and attack rate (5 vs. 14 days).</p> <p>Clear and consistent messages with framing specific to targeted publics increased participation in activities and event actions for preparedness/response actions (as studied for general disasters among Latinos in the U.S. and in a community intervention that tested an SMS system for use in preparation, onset, and containment phases of an EID in Taiwan)</p>			
Activities	QN-CG	<p>Ardalan (2010): A community intervention for flash flood preparedness using village disaster taskforces and family training in randomly selected intervention and control villages in Iran showed statistically significant improvement on all outcome measures of preparedness in the intervention villages relative to the control villages.</p> <p>Ardalan (2013): A community educational intervention using primary health care workers in Iran covering awareness and preparedness regarding earthquakes and floods. The study was conducted in a randomly selected intervention and control region and had a pre-post design. Pre- to post-intervention change in</p>	Ardalan (2010); Ardalan (2013)	Moderate	Two studies, both in Iran and by same, lead researcher, report the finding among randomly selected individuals from control and intervention villages.

		<p>scores on disaster awareness and preparedness showed statistically significant greater improvement in the intervention households compared to the control households.</p> <p>Risk perception has a positive association with awareness and preparedness actions for earthquakes and floods in Iran. Rural households, in contrast to urban ones, are more aware and prepared for disasters.</p>			
Activities	QN-DS	<p>When leaders, with formal responsibilities related to emergencies, include community individuals (as planners and attendees) in pre-event activities for 1) plan/s development, 2) information/education dissemination, 3) training on who is responsible for what and what to do, 4) conducting preparedness actions, and 5) relationship bonding/building, there are increases in preparedness and response actions. This applies to individual/household and community level actions. Kingdom of Morocco (2005) study focused especially on low SES.</p> <p>Post-event screenings, such as those for PTSD after an earthquake in Japan, can help to connect individuals to services.</p>	<p>Cretikos (2008); Jahangiri (2010); McComas (2003); Perry (2008); Tuerk, (2013)</p> <p>Al-Sayed (2010) AR; Ouda (2010) AR; Zahraan (2006) AR; Kingdom of Morocco (2005) FR</p>	Moderate	<p>Numerous countries of focus (Australia, Egypt, China, France, Iran, Morocco, Saudi Arabia, USA) across numerous types of disaster (earthquakes, EID, environmental, fire, floods, food safety, general, H*N1, wildfire, and volcano) contribute to this synthesized finding.</p>
Activities	QN-DS	<p>Events with credible public officials and experts help to build relationships of trust, confidence, and credibility. Studies about preparation for floods in</p>	<p>McComas (2003); Paek (2010); Perko (2013); Terpstra (2011)</p>	Low	<p>The findings suggest complex associations with countries of focus limited to the USA and Western Europe. Only one study specifies disaster and includes</p>

		<p>the Netherlands, nuclear emergencies in Belgium, and general emergencies in the U.S. suggest that high levels of trust (and similarly low levels of trust) may be associated with increased and/or decreased risk perception, participation in and satisfaction with activities, and preparedness/response actions. This relation is also found when studying the onset and containment phases for general emergencies in the U.S.</p> <p>When significant others believe actions are appropriate, individuals are more likely to take actions as found during the preparation phase for emergencies in general among individuals in the U.S.</p>			only some participants directly affected to a flood in 1953.
Activities	QN-DS	<p>Consideration of local contexts are important when engaging the community in activities for preparedness and response in floods, hurricanes, and public health emergencies. Multiple studies looked at low SES within local contexts.</p>	<p>Al-Sayed (2010) AR; LuftAllah (2010) AR; Ouda (2010) AR; Zaharan (2006) AR; Lu (2010) CH; Baggio (2006) FR; WHO (2004) FR; WHO (2011) FR; Kingdom of Morocco (2005) FR; Maret (2008) FR</p>	Moderate	<p>Numerous countries of focus (Egypt, France, Morocco, China, and more) across numerous types of disaster. All these studies of other UN languages indicate how the finding plays an important role in diverse areas throughout the world. Individual study appraisal not available for some studies.</p>
Activities	QN-DS	<p>Consistent messages (not repetitive use of same message) disseminated many times and through a myriad of media channels usually empowers community individuals by increasing knowledge and preparedness/response actions. Targeting and</p>	<p>Chan (2007); Clerveaux (2010); Cretikos (2008); Heath (2009); Jahangiri (2010); Paek (2010); Roess (2011);</p>	Moderate	<p>Numerous countries of focus (Australia, Caribbean, Egypt, China, Congo, France, Hong Kong, Iran, Israel, USA) across numerous types of disaster (avalanches, earthquakes, EID, environmental, floods)</p>

		<p>attending to message framing for differing audiences usually makes a difference on awareness, knowledge acquisition, and action. Risk communication has a large effect on individual response actions, especially among prevention-focused people.</p> <p>Message dissemination via (trusted) mainstream media can aid in yielding higher individual engagement and response to disasters in the context of earthquakes, floods, avalanches, and nuclear disasters.</p>	<p>Shenhar (2015)</p> <p>Su (2008) CH; Baggio (2006) FR; Glatron (2009) FR; WHO (2004) FR</p>		<p>contribute to this synthesized finding</p>
Activities	QN-DS	<p>Risk perception depends on socio-demographic variables (personal, social, economic) and experience. Perception of high risk is usually associated with increased preparedness/response action; however, not always and a risk paradox may occur.</p> <p>Although most studied during the preparation phase, two studies also look at the onset and containment phases.</p>	<p>Perko (2013); Perry (2008); Shenhar (2015); Strawderman (2012); Terpstra (2011)</p> <p>Kurtovaya (2014) RU</p>	Moderate	<p>Studies of focus are the USA, Israel, and from Western Europe. The natural disasters studied include earthquakes, floods, volcanoes, and wildfires. The evidence reveals the import of socio-demographic variables and the difficulty of generalizing to larger populations.</p>
Activities	QL	<p>Including community individuals in pre-event development and outreach efforts helps with engagement in activities for preparedness/response actions. One study (Falconi, 2012) specially addressed the needs of individuals with functional limitations. Two studies (Gondard-Delacroix, 2004; Tamru, 2002) looked at low SES.</p>	<p>Falconi (2012)</p> <p>Al-Shahri (2014) AR; Xie (2013) CH; Chahraoui (2003) FR; Duchene (2004) FR; Gondard-Delacroix (2004) FR; Tamru (2002) FR; Gabrichidze (2013) RU</p>	Moderate	<p>Although the one English language study is of low quality, the many other UN Language studies meaningfully add to the quality of this synthesized finding.</p>

Activities	QL	Pre-event information and public education may engage the community more than similar efforts during an event. Priority groups need special emphasis.	Falconi (2012); Linnell (2014)	Moderate	One study appraised to be of moderate quality and one to be of high quality. One study placed extra focus on those with functional disabilities.
Activities	QL	Social connectedness, formal and informal, is important for collaboration during response. Canadian professional and volunteers reflected on preparation for potential H1N1 pandemic.	Falconi (2012)	Moderate	One study appraised as moderate. It sampled previously affected emergency officials and volunteers ($n = 48$) in Canada. It placed focus on needs of those with functional disabilities.
Activities	QL	Effective risk communication needs to incorporate locality and experience; for example, in the preparation for wildfires in Australia.	Prior (2008)	Low	The one study was individually appraised as very low in quality. Regardless of two sampling techniques, only five participants.
Activities	QL	Resources for institutional innovation/learning and infrastructure/capacity will best prepare communities for events.	Falconi (2012); Serra (2011) Chahraoui (2003) FR	Low	Two studies appraised as moderate and one as very low quality.
Activities	MM, CS	When leaders, with formal responsibilities related to emergencies, include community individuals (as planners and attendees) in meetings for 1) plan/s development, 2) information/education dissemination, 3) training on who is responsible for what and what to do—social responsibility, 4) conducting preparedness actions, and 5) relationship bonding/building, there are increases in preparedness and response actions. This was studied among individuals of low SES and at-risk populations.	Asharose (2015); Karan (2007); Mitchell (2013) Al-Tuwairqi (2003) AR; Affletranger (2003) FR; Gaillard (2002) FR; Gaillard (2008) FR; Heitz (2013) FR; Rode (2008) FR; Setbon (2009) FR; Vinet (2005) FR; Podkorytov (2014) RU	Moderate	Many studies of strong and moderate quality. Numerous countries of focus (Australia, Egypt, China, France, Iran, Morocco, Saudi Arabia, USA) across numerous types of disaster (earthquakes, EID, environmental, fire, floods, food safety, general, H*N*, wildfire, and volcano) contribute to this synthesized finding.
Activities	MM, CS	Community strategies for coordination and shared education/exercises prior	Kapucu (2008); Mei (2013)	Moderate	Studies appraised to be of moderate (2) and high (1) quality.

		to an event improves response actions.	Kurtovaya (2015) RU		Samples from community leaders and emergency officials.
Activities	MM, CS	Local contexts and culture are very important to consider for disaster preparedness and response. Some local contexts included local traditions, class, children, gender, immigrants, disabled, and rural geographical areas.	Asharose (2015); Masuda (2006); Mei (2013) Roder (2016); Winters (2014) Al-Tuwairqi (2003) AR; Affletranger (2003) FR; Bouaouli (2006) FR; D'Ercole (2002) FR; Erlich (2000) FR; Gaillard (2002) FR; Gaillard (2008) FR; Heitz (2013) FR; Durnev (2008) RU; Kutovaya (2015); Coronado-Salas (2012) SP; Francescutti (2007) SP	Moderate	Majority of studies individually appraised to be of moderate quality. Samples included emergency-event affected populations.
Activities	MM, CS	Access to resources, such as social media before and during floods in Australia, and evacuation vehicles, such as motorbikes during volcano-induced evacuation in Indonesia, can affect knowledge of and participation in activities for preparedness/response and real-time response actions.	Bird (2012); Mei (2013)	Moderate	Both studies individually appraised to be of moderate quality. One sampled from community leaders and emergency officials and one from affected and potentially affected populations.
Activities	MM, CS	Messages disseminated through a myriad of media channels usually increase knowledge and preparedness/response actions..	Mei (2013); Roder (2008) Al-Tuwairqi (2003) AR; Affletranger	Moderate	Studies appraised to be of high (3), moderate (3), and low (1) quality. Majority sampled from affected populations.

			(2003) FR; Gaillard (2002) FR; Gaillard (2008) FR; Heitz (2013) FR; Rode (2008) FR; Setbon (2009) FR; Vinet (2005) FR; Durnev (2008) RU; Podkorytov (2014) RU		
Activities	MM, CS	Risk perception, throughout the phases of an emergency event but especially during the preparation phase, depends on socio-demographic variables (personal, social, economic) and experience. Perception of high risk is usually associated with increased preparedness/response actions; however, not always since a risk paradox may occur. Illustrative studies focus on general disasters in India earthquakes in Thailand, and floods in Taiwan.	Asharose (2015); Muttarak (2013); Roder (2016)	Moderate	All three studies individually appraised to be of moderate quality. One sampled from an affected population, one from a potentially affected population, and one sampled from community leaders and emergency officials.

Synthesized findings emerged through thematic analysis for each method stream (quantitative comparison groups – QN-CG; quantitative descriptive survey - QN-DS; qualitative - QL; and mixed method/ case study – MM, CS). The syntheses included studies in English and other UN Languages. Although each synthesized finding is supported by individual, empirical research, some are supported by more individual studies than others as indicated by the citation column. Additionally, the evaluation certainties range from very low to strong.

There are four (4) themes in the synthesized findings for QN-CG studies (English and other UN Language). First, participation in activities related to intervention increases earthquake and flood preparedness actions (Ardalan 2010; Ardalan, 2013) as well as general disaster preparedness actions (Glik, 2014). The supporting studies focused on the prevention phase in Iran, Taiwan, and Los Angeles, U.S. Developing plans for vulnerable members figured into the intervention in Iran. The intervention in the U.S. was conducted among low-income Latinos. Second, and partially related to the objective of this review, the presence and utilization of social networks among U.S. Latino households increased disaster preparedness actions among difficult-to-reach populations such as Latino households (Eisenman, 2009). Third, and indirectly related to the objective of this review, risk perception appears positively related to preparedness actions (Ardalan,

2010; Ardalan 2014). This finding corresponds to studies focused on flood and earthquakes in Iran and in regards to the prevention phase. Fourth, clear and congruent messages that are tailored and targeted to defined publics are associated with increased participation in emergency event-related activities and actions (Glik, 2014; Yen, 2009). One study focused on the prevention phase, the other also included onset and containment phases.

The synthesized findings for the quantitative comparison group studies represented Iran (2), Taiwan (1), and the U.S. (2). Disaster types included: emerging infectious disease (1), flood (1), and general (3). All focused on the preparation phase with only one of the studies also including onset and containment phases. One study was with Latino households in the U.S. and considered to be a vulnerable population.

There are five synthesized findings for the quantitative descriptive studies (English and other UN Language). First, the inclusion of community individuals as attendees (and as planners) in meetings of varied purpose and nature suggests increases in preparedness and response actions (strong certainty). This also appears to occur at the community-sector and community level. Second, meetings headed by credible public officials and subject matter experts serve to build constructive relationships that are associated with positive perceptions and behaviors in relation to emergency-related activities and actions (low certainty). Third, local context plays an important role; this ranges from local leaders to current dynamics and past experiences. Similar to themes in the quantitative comparison group stream, risk perception (moderate certainty) and messages (moderate certainty) are found to be related to emergency event-related activities and actions.

The synthesized findings for the quantitative descriptive studies represented Australia (1), Belgium (1), China (2), Egypt (4), France (2), Iran (1), Israel (1), Japan (1), Kingdom of Morocco (1), the Netherlands (1), Russia (1), U.S. (5), and not specified (2). Disaster types included: earthquake (5), electromagnetic fields (1), emerging infectious disease (3), flood (4), food safety (1), general (6), natural disaster (1), storm (1), volcano (1), and wildfire (2). Of note, 13 of the 23 studies included a focus on the preparation phase (five exclusively focused on the preparation phase). Two studies identified the study of vulnerable individuals/households, specifically low-SES.

There are five synthesized findings for the qualitative studies. The two with moderate certainty suggest that activities prior to an emergency event engage community and participation in activities corresponds to preparedness/response actions. The other three findings, of low certainty within this methodological stream, stress 1) social connectedness, 2) communication that incorporates local context and experience, and 3) community resources for innovation/learning and infrastructure/capacity.

The synthesized findings for the qualitative studies represented Australia (1), Canada (1), China (1), Ethiopia (1), France (2), Kingdom of Saudi Arabia (1), Madagascar (1), Russia (1), Spain (1), and Sweden (1). Disaster types included: bushfire (1), flood (4), emerging infectious disease (2), general (3), and illegal immigrants (1). Three of the 11 studies exclusively pertained to the preparation phase, one on containment, and one on evaluation. The remaining pertained to a combination of phases. Three studies studied low SES groups, one focused on rural households, and one included specific consideration of the needs of those with functional limitation and the capacity to respond to them.

There are six synthesized findings for the mixed method and case study stream, all of moderate certainty. First, community strategies focused on coordination and shared education/exercises prior to an emergency event improve response actions. Second, activities should emphasize roles and responsibilities of various sectors and members in the community. Third, local context and experience greatly influence preparedness and response actions. Fourth, access to resources, informational and material, affect knowledge and participation in activities and real-time response. Fifth, clear and congruent messages that are tailored and

targeted to defined publics are associated with increased participation in emergency event-related activities and actions. Sixth, risk perception is found to be related to emergency event-related activities and actions; however, there is not a single, linear relationship.

The synthesized findings for the mixed method and case studies represented Algeria (1), Australia (1), Canada (1), Czech Republic (1), El Salvador (1), France (6), Germany (1), India (2), Japan (1), Kingdom of Saudi Arabia (1), Mexico (1), Philippines (2), Poland (1), Russia (3), Singapore (1), Spain (1), Taiwan (1), and U.S. (4). Disaster types included: arsenic/lead (1), flood (8), earthquake (1), emerging infectious disease (2), general (7), hurricane (1), industrial (1), natural disasters (2), nuclear (1), and volcano (3). Seven of the 25 studies pertained to one the preparation phase, one to the onset phase, and three to the evaluation phase. The remaining pertained to a combination of phases. Some studies included a focus on vulnerable and at-risk groups: children (2), indigenous (1), low SES (four), older adults (2), and rural individuals/households (2).

4.6 Synthesis of Findings Across Methodological Streams

4.6.1 Synthesis of Findings Across all Four Methodological Streams

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 (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

<i>Phenomenon of Interest/ Outcome</i>	<i>Synthesized Finding Across All Four Method Streams (with country, type and phase of disaster, vulnerable population contexts)</i>	<i>Citations (first author) Supporting Synthesized Finding Across Method Stream</i>	<i>Evaluation of Certainty/ Confidence</i> <i>Note: Only English language studies from Section 4.5 considered</i>
Activities	Meetings prior to an emergency event appear to be more effective than meetings during an emergency event. [This synthesized finding emerges when separating out from the following two synthesized findings the aspect that the activities/ gatherings are directed towards outcomes of preparedness rather than response.]	Ardalan (2010); Ardalan (2013); Cretikos (2008); Falconi (2012); Jahangiri (2010); Kapucu (2008); Linnell (2014); McComas (2003); Mei (2013); Perry (2008); Tuerk (2013) Al-Shahri (2014) AR; Al-Tuwairqi (2003) AR; Xie (2013) CH; Affletranger (2003) FR; Chahraoui (2003) FR; Duchene (2004) FR; Gaillard (2002) FR; Gaillard (2008) FR; Gondard-	<i>QN-CG (GRADE):</i> Moderate <i>QN-DS (GRADE Adapted):</i> Moderate to Low <i>QL (CERQual):</i> Moderate to Low <i>MM, CS (as appropriate):</i> Moderate

		Delacroix FR; Heitz (2013) FR; Rode (2008) FR; Setbon (2009) FR; Tamru (2002) FR; Vinet (2005) FR; Gabrichidze (2013) RU, Podkorytov (2014) RU	
Activities	When leaders, with formal responsibilities related to emergencies, include community individuals (as planners and attendees) in pre-event meetings for 1) plan/s development, 2) information dissemination, 3) training on who is responsible for what and what to do—social responsibility, 2) conducting preparedness actions, and 5) relationship bonding/building, there are increases in preparedness and response actions.	Ardalan (2010); Ardalan (2013); Asharose (2015); Cretikos (2008); Falconi (2012); Jahangiri (2010); Karan (2007); McComas (2003); Mei (2013); Mitchell (2013); Perry (2008); Tuerk, (2013) Al-Sayed (2010) AR; Al-Shahri (2014) AR; Al-Tuwairqi (2003) AR; Ouda (2010) AR; Zahraan (2006) AR; Xie (2013) CH; Affletranger (2003) FR; Chahraoui (2003) FR; Duchene (2004) FR; ; Gaillard (2002) FR; Gaillard (2008) FR; Gondard-Delacroix (2004) FR; Heitz (2013) FR; Kingdom of Morocco (2005) FR; Rode (2008) FR; Setbon (2009) FR; Tamru (2002) FR; Vinet (2005) FR; Gabrichidze (2013) RU; Podkorytov (2014) RU	<i>QN-CG (GRADE):</i> Moderate <i>QN-DS (GRADE Adapted):</i> Moderate to Low <i>QL (CERQual):</i> Moderate <i>MM, CS (as appropriate):</i> Moderate
Activities	Events with credible public officials and experts help to build relationships of trust and confidence that transfers into coordination and social connectedness. High levels of trust (and similarly low levels of trust) may be associated with increased and/or decreased risk perception, participation in and satisfaction with activities, and preparedness/response actions.	Eisenman (2009); Falconi (2012); Kapucu (2008); McComas (2003); Mei (2013); Paek (2010); Perko (2013); Terpstra (2011) Kurtovaya (2015) RU	<i>QN-CG (GRADE):</i> Low <i>QN-DS (GRADE Adapted):</i> Low <i>QL (CERQual):</i> Low <i>MM, CS (as appropriate):</i> Moderate

Three related synthesized findings represent findings across all four methodological streams. First, meetings prior to an event appear more effective than meetings during or after an event in regards to participation in meetings and actions of preparedness and response. Second, many studies emphasize and conclude the importance of including community individuals in meetings, as planners and attendees. The purpose of the meetings varied across studies, including plan/s development, information dissemination, training on roles and responsibilities, and conducting preparedness activities. Third, social relationships and networks stand out in its importance on preparedness and response/recovery actions and also become a positive outcome of any effective meetings. Meetings may secondarily help to develop and sustain

relationships characterized by perceptions of credibility, trust, role responsibilities and actions characterized by collaboration and coordination.

4.6.2 Synthesis of Findings Across Three Methodological Streams

Key to Table

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

Phenomenon of Interest/ Outcome	Synthesized Finding Across Three Method Streams (with country, type and phase of disaster, vulnerable population contexts)	Citations (first author) Supporting Synthesized Finding Across Method Stream	Evaluation of Certainty/ Confidence <i>Note: Only English language studies from Section 4.5 considered</i>
Activities	Local contexts and culture are very important and may impact willingness to participate in activities and engage in actions for disaster preparedness and response.	Asharose (2015); Masuda (2006); Mei (2013); Prior (2008); Roder (2016); Winters (2014) Al-Sayed (2010) AR; Al-Tuwairqi (2003) AR; LuftAllah (2010) AR; Ouda (2010) AR; Zaharan (2006) AR; Lu (2010) CH; Affletranger (2003) FR; Baggio (2006) FR; Bouaouli (2006) FR; D’Ercole (2002)FR; Erlich (2000) FR; Gaillard (2002) FR; Gaillard (2008) FR; Heitz (2013) FR; Kingdom of Morocco (2005) FR; Maret (2008) FR; WHO (2004) FR; WHO (2011) FR; Kingdom of Morocco (2005) FR; Maret (2008) FR; Kutovaya (2015) RU; Coronado-Salas (2012) SP; Francescutti (2007) SP	<i>QN-CG (GRADE):</i> --- <i>QN-DS (GRADE Adapted):</i> --- <i>QL (CERQual):</i> Low <i>MM, CS (as appropriate):</i> Moderate
Activities	Perception of risk associates with many socio-demographic and geographic variables as well as past experiences. A perception of high risk is usually positively associated with preparedness actions; however, there are many instances of risk paradoxes.	Ardalan (2010); Ardalan (2013); Ashrose (2015); Muttarak (2013); Perko (2013); Perry (2008); Roder (2016); Shenhar (2015); Strawderman (2012); Terpstra (2011) Kurtovaya (2014) RU	<i>QN-CG (GRADE):</i> Moderate <i>QN-DS (GRADE Adapted):</i> Moderate <i>QL (CERQual):</i> --- <i>MM, CS (as appropriate):</i>

			Moderate to Low
Activities	Congruent messages (not simply repetitive use of same message) disseminated many times and through a myriad of media channels empower community individuals by enhancing knowledge and promoting preparedness/response actions. Targeting by attending to message framing for different audiences usually makes a difference on awareness, knowledge acquisition, and actions. Risk communication has a large impact on individual response actions, especially among prevention-focused people.	Chan (2007); Clerveaux (2010); Cretikos (2008); Glik (2014); Heath (2009); Jahangiri (2010); Paek (2010); Mei (2013); Roder (2008); Roess (2011); Shenhar (2015); Yen (2009) Al-Tuwairqi (2003) AR; Su (2008) CH; Affletranger (2003) FR; Baggio (2006) FR; Gaillard (2002) FR; Gaillard (2008) FR; Glatron (2009) FR; Heitz (2013) FR; Rode (2008) FR; Setbon (2009) FR; (2004) FR; Vinet (2005) FR; WHO (2004) FR; Durnev (2008) RU; Podkorytov (2014) RU	<i>QN-CG (GRADE):</i> Moderate <i>QN-DS (GRADE Adapted):</i> Moderate <i>QL (CERQual):</i> --- <i>MM, CS (as appropriate):</i> Moderate to Low

There are three synthesized findings across three of four methodological streams. First, disaster/emergency events happen locally. This shared finding highlights the relevance and importance of the local context (QN-DS; QL; MM,CS). While true for engaging communities in activities, local context also needs to be considered throughout all phases and features of an event and at all levels of perspective. Second, risk perception corresponds to individual actions of preparedness for and response to disasters/emergency events. Although the correspondence is frequently positive, there do exist inverse relationships for individuals within a community (QN-CG; QN-DS; MM,CS). Third, when communicating messages to individuals about potential/actual events, the messages are more likely to be persuasive if they are framed and targeted for a specific public, congruent in content, and disseminated through many channels (QN-CG; QN-DS; MM,CS). This appears to apply similarly to messages that encourage publics to attend meetings related to potential/actual events.

4.6.3 Synthesis of Findings Across Two Methodological Streams

Key to Table

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

Phenomenon of Interest/ Outcome	Synthesized Finding Across Two Method Streams (with country, type and phase of disaster, vulnerable population contexts)	Citations (first author) Supporting Synthesized Finding Across Method Stream	Evaluation of Certainty/ Confidence
Activities	Access to material resources and technologies impact	Bird (2012); Falconi (2012); Mei (2013); Serra (2011)	<i>QN-CG (GRADE):</i> ---

	infrastructure/capacity of communities-at-large for preparedness, knowledge and activities of individuals for preparedness and response, and innovation and learning from past events.	Chahraoui (2003) FR	<i>QN-DS (GRADE Adapted):</i> --- <i>QL (CERQual):</i> Moderate to Low <i>MM, CS (as appropriate):</i> Moderate
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One synthesized finding across two of four methodological streams (QL and MM/CS) relates partially to the question for the present review. Access to material resources and technologies impact infrastructure/capacity, participation in activities as well as preparedness and response actions, and innovation/ learning from past events.

4.7 Typology of Community Level by Type of Action

As discussed in Section 1.3.4, there is ambiguity in pertaining to what constitutes community and how community relates to outcomes of interest in the extant literature. Similarly, action behavior terminology differs among disciplines and between disciplines and actions. This ambiguity may obfuscate precise recommendations. The following typology, according to methodological stream, maps English language articles by community type: community-at-large as a designated geographical area governed by officials with formal leadership responsibilities; community-sectors as professional, and in some cases volunteer, groups with planning, preparedness, and response action responsibilities in coordination with leaders and other sectors; and as community individuals consisting of individuals/households—by specific action—planning, preparedness, and response.

4.7.1 Typology of Community Level by Type of Action for Quantitative Studies

Action	Community-at-Large Citations (first author)	Community Sectors Citations (first author)	Individuals/ Households Citations (first author)
Planning	Jahagiri (2010); McComas (2003)	---	Clerveaux (2010)
Preparedness	[Eisenman (2014)*]; Heath (2009)	Heath (2009)	Ardalan (2010, 2013); Clerveaux (2010); Creikos (2008); Eisenman (2009); Glik (2014); Heath (2009); Perko (2013), Perry (2008); Roess (2011); Shenhar (2015); Terpstra (2011)
Response	[Eisenman (2014)]* (*Empirical design but no empirical findings)	---	Chan (2007); Clerveaux (2010); Creikos (2008); Strawderman (2012); Tuerk (2013); Yen (2009)

4.7.2 Typology of Community Level by Type of Action for Qualitative Studies

<i>Action</i>	<i>Community-at-Large Citations (first author)</i>	<i>Community Sectors Citations (first author)</i>	<i>Individuals/ Households Citations (first author)</i>
Planning	Serra (2011)	Falconi (2012); Serra (2011)	---
Preparedness	---	---	Prior (2008)
Response	---	Linnell (2014)	Linnell (2014)

4.7.3 Typology of Community Level by Type of Action for Mixed-Method/ Case Study Studies

<i>Action</i>	<i>Community-at-Large Citations (first author)</i>	<i>Community Sectors Citations (first author)</i>	<i>Individuals/ Households Citations (first author)</i>
Planning	Mitchell (2013); Roder (2016)	Masuda (2006)	Ashrose (2015); Mitchell (2013); Roder (2016)
Preparedness	Ashrose (2015)	Kapucu (2008)	Mei (2013); Mitchell (2013); Muttarak (2013)
Response	Karan (2007)	---	Ashrose (2015); Bird (2012); Karan (2007); Mei (2013); Winters (2014)

When mapping the community level by the type of action for the English language studies, two patterns appear. For the QN studies, the most frequently studied phenomenon is that of preparedness actions by individuals/households. For the MM/CS studies, individuals/households rather than other levels are also more frequently studied, yet planning, preparedness, and response actions are all studied.

Coordination among many community levels, including individuals/households, community sectors, and communities-at-large, as well regional, national, and international levels is a crucial part of emergency-event management. Without acknowledging the distinctions, the generalization and/or transferability of evidence-based knowledge will be problematic.

4.8 Media Reports

No media reports were included in the review for lack of empirical findings. Six media reports were identified for the review objective in the search for English-language news stories. Of these six reports, four were press releases, one a lengthy article from the China Daily and the second an article in the Nikkei Weekly. The Chinese report disproportionately provided top-down information and assurance about nuclear safety, the other reports emphasized resiliency and community bonds by leveraging past examples of citizen behaviors during events such as community violence, earthquakes, Ebola, and nuclear disasters to prompt prevention and preparedness actions.

5.0 DISCUSSION

5.1 Summary of Results

5.1.1 Overall Summary

For the synthesis evidence for the present review on ways to engage communities in emergency risk communication activities to respond to events/contexts, 34 English-language studies and 37 studies in other UN languages were included, appraised for quality, used for data extraction and formulating synthesized statements within methodological streams, which in turn were evaluated for certainty, and then synthesized across methodological streams. The studies focus on countries distributed throughout the world, which widen the geographical scope, and extend to disaster/emergency events with public health implications. The studies also focus on multiple configurations of phases, although the preparedness phase predominates.

In this process it was found that studies rarely studied which strategies or tactics are most effective for engaging community participation. Sometimes studied, yet even more often emphasized, was the importance of community participation in meetings of varied purpose in relation to emergency events. Such meeting purposes included: a) planning design and development; b) information dissemination; c) training on roles, responsibilities, tasks; d) conducting preparedness actions; and e) relationship building/bonding. In addition to engagement as attendees, it may also be important to be a planning member of activities/meetings. Of note, training on the roles and responsibilities appears to beneficially include factors of community level, local context, and past experience, which not only aids in cooperation and collaboration but may address the issue of risk paradox tied to perception and experience. Relationship building and bonding not only serves to create trust and confidence in leaders, it also serves to create social connectedness and networks. There is some clear indication that activities prior to an event will more successfully engage communities than those attempted during an evolving event.

Studies that focused on at-risk populations looked at indigenous communities (1); immigrants (2), one of which on internally displaced persons, Latinos (1), and children (2). Some of the non-children studies emphasized the importance of participatory action/ community-based community research) techniques, at the same time noting the strengths and challenges of such approaches. For at-risk groups, high risk perceptions of natural disasters yet with low levels of preparedness may be due to an absence of community participation in decision making. Children and youth may not be sufficiently acknowledged as actors in disasters, including their role as informants. Disaster awareness among children in multicultural societies may be promoted through computer games.

5.1.2 Results Vis a Vis Findings from Existing Reviews

The present review in comparison to the seven existing ones reveals an increased scope in relation to the geographical countries of disaster/emergency onset. Most of the studies cited in this review were done in the context of general/multiple types of events (25) or floods (19). All of the event types in the existing reviews and more are represented in this review. There is clearly more specifics about the phase(s) of the events studied and multiple configurations of the phases. Like the existing reviews, the studies cited in this review usually approached risk communication as a multi-disciplinary phenomenon. The consideration of high-risk and vulnerable populations is more evident in the articles yet still limited.

5.2 Research Gaps

The most apparent gap is the paucity of studies fully related to the phenomenon of interest, effective ways to engage communities in planning activities and activities for preparedness and response actions. This applies to activities before, during, and after disaster/emergency events.

As indicated by the developed typology, strategies and tactics for different communities—communities-at-large, community sectors, and community individuals/households—may differ. The paucity of studies becomes even more problematic if recommendations would differ for different community levels. Also, the strategies and tactics that may work for planning activities may differ for preparedness and response-related activities. The absence of such distinctions in the literature reveals gaps that require separate attention.

Although disasters/emergencies always happen locally, the possibility of activities that engage communities at the state, regional, national, and international level. No study examined how communities (in its many definitions) could play a role in activities conducted at the more distant level. Similarly, how communities negotiate participation at different levels or resultant recommendations, that may not be congruent.

5.3 Limitations of the Present Review

As noted, there is a paucity of studies fully relevant to the purpose of studying the best ways to engage communities in activities related to disaster/ emergency events with public health implications. Therefore, much of the search for literature entailed identifying articles partially or indirectly relevant. Three factors clearly obfuscate such a search. One, as already indicated, the more detailed explanation of the objective for this review, which is provided by the SPICE. extensions of the question, introduced more rather than less ambiguity to what the question's essence is. By adding the word "planning," the overlap between Q9 and Q7 increased and prompted considerations of the difference of design/ conceptualization and actions/ behaviors. Whether this parsing of the question and its meaning transfer to any theoretical utility in this review or practical utility for practice are uncertain. Two, when searching for partially and indirectly related literature, the keywords contain and continue, even with the addition of more key words, to include those keywords considered most likely to uncover the initial phenomenon of interest. Thus, partially or indirectly related bodies of literature may or may not be identified if they have a unique and distinct nomenclature. Finally, the identification/ selection of partially or indirectly related bodies of literature is impacted by the researchers' judgement as to what constitute an indirect relationship. For example, the body of accumulating research on the concept and utility of resilience is arguably indirectly related and potentially as insightful to the objective of this review as those of risk perception and risk communication messaging. Additionally, research in other disciplines regarding community-based participatory research and engaged scholarship are similarly not included. By conducting and reporting on this review in a transparent manner, these limitations are made explicit.

If the objective of this review were written from a practitioner perspective, some of the difficulties in identifying and reviewing relevant literature may indicate a lack of translational fluency in phenomenon of interest and approaches to address it between practitioners and researchers. Moreover, to the extent that researchers examine problems and phenomenon emergent from the field, they may be adding to the problem by code switching in ways that do not improve the two-way transfer of knowledge.

5.4 Authors' Conclusions

Emergency events with public health implications always happen locally. Including communities, whether communities-at-large (official leaders), community sectors (formal or informal), or community individuals/households. To include these levels as planners of activities or as attendees in the enacted activities seems best practice and has general support in the extant research reviews and articles. As to what are the best ways to gather various communities, there is little study in the disaster/emergency event literature. This translates into a call for future research in the context of emergency events with public health implications. To begin, a targeted search for strategies and tactics to engage communities in other contexts of public interest would be helpful.

When parsing the question and the phenomenon of interest, it became apparent that concept and word choice matter. Conceptual and semantic differences exist between disciplines as well as research and practice paradigms. The creation/use of a typology, prompting more precise classification of the extant research, would 1) provide a visual perspective of the framing of the phenomenon(s) of interest, 2) reveal the current knowledge findings/claims, and 3) identify areas for needed and future research. Movement towards shared typologies would facilitate more effective and efficient transfer of knowledge and recommendations.

The objective of this review does not disclose “who” is trying to engage communities in said activities and facilitate the learning. Presumably they are organizations and subject matter experts with formal responsibility, authority, and accountability regarding emergency planning, preparedness, and response. This presumption and the literature on emergency events with public health implications reveals a disregard of learning from community-based participatory research, action research, community organizing, and bottom-up strategies.

The paucity of fully relevant and high quality studies likely relates to the preference of publishing outcomes related to community actions after engagement in activities. If only those studies that have had sufficient success in engaging communities and thus report on action outcomes are published, there is little information about the many ways to engage communities and associated effectiveness/efficiencies between them. Engaging communities needs to be an outcome of interest in order to insightfully and richly respond to the objective of this review.

Of the partially-related studies—those that emphasized the importance of engaged community in activities—one aspect found that bears note is the effectiveness of doing the desired behavior during the activity. This appears to facilitate the transfer of the behavioral action from the meeting place to the place within the geographical community where action is hoped to occur. More studies are needed on effective activities and ones that utilize pre/post-tests would assess enacted learning of behavioral action rather than behavioral intention, a more commonly measured outcome.

Although variables, such as risk perception, communication and message characteristics, socio-demographic characteristics, past experiences, etc., may be helpful in predicting who might gather, there are some variables that have been shown to have paradoxical relationships. Examples are pre-existing relationships among the community levels; local risk perception and context, and past experience. A mix of quantitative and qualitative research approaches facilitate predictability and understanding, both needed when working with communities.

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7.0 FULL LIST OF INCLUDED STUDIES, EXISTING REVIEWS, AND OTHER REFERENCES

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8.0 APPENDIXES

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

A. Levels of quality of study findings

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

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

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

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

B. Factors that can reduce the quality of study findings

1. Limitations in study design or execution

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

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

2. Inconsistency of results

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

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

3. Indirectness of evidence

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

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

4. Imprecision of results

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

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

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

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

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

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

Citation (first author); Method; Relevancy; Quality Appraisal Rating	Study Description; Findings	Statistical Information
<p>Citation: Ardalan (2010)</p> <p>Method: QN-CG</p> <p>Relevancy: Partial</p> <p>Quality Appraisal Rating: Moderate/ Minor Risk of Bias</p>	<p><i>Study Description:</i> A community intervention for flash flood preparedness using village disaster taskforces and family training in randomly selected intervention and control villages in Iran showed statistically significant improvement on all outcome measures of preparedness in the intervention villages relative to the control villages.</p> <p><i>Findings:</i> Participation in flood intervention events—family preparedness meetings, risk mapping, preparation of emergency supplies, planning to assist vulnerable member of the household, and participation in evacuation drills—increased overall flood preparedness. Risk perception had a positive association with taking all preparedness actions.</p>	<p>The adjusted (for sex, age, education, family economic status, experience with floods, and risk perception) odds ratio (OR) and 95% Confidence Interval (95% CI) showed higher OR for the treatment villages compared to the control villages for all outcome measures and the differences in all cases were statistically significant ($p < .0001$)</p> <p>The OR and 95% CI for interventions vs. control villages were as follows. Family preparedness meeting: 10.27 (8.32-12.68) vs 1.83 (1.52-2.19) Risk mapping: 49.98 (21.97-113.72) vs. 0.44 (0.13-1.45) Emergency supplies: 27.69 (21.95-34.93) vs. 1.26 (1.46-2.33) Plan for vulnerable people: 6.13 (5.03-7.47) vs. 1.12 (0.82-1.27) Evacuation drill: 29.05 (21.77-38.76) vs. 2.69 (1.96-3.70)</p>
<p>Citation: Ardalan (2013)</p> <p>Method: QN-CG</p> <p>Relevancy: Partial</p> <p>Quality Appraisal Rating: Moderate/ Minor Risk of Bias</p>	<p><i>Study Description:</i> A community educational intervention using primary health care workers in Iran covering awareness and preparedness regarding earthquakes and floods. The study was conducted in a randomly selected intervention and control region and had a pre-post design. Pre- to post-intervention relative change in scores on disaster awareness and preparedness showed statistically significant greater improvement in the intervention households compared to the control households.</p> <p><i>Findings:</i> Compared with rural households, urban households need more intervention in improving awareness of and preparedness for disasters</p>	<p>Pre- and post-intervention mean (<i>M</i>) and standard deviation (<i>SD</i>) (on a 100-point scale) for intervention versus control for outcomes awareness and readiness were as follows.</p> <p>Awareness <i>M</i> (<i>SD</i>): Intervention pre 5.43 (3.11) – post 21.40 (11.37) vs. Control pre 6.94 (4.63) – post 6.36 (4.48)</p> <p>Readiness <i>M</i> (<i>SD</i>): Intervention pre 7.90 (13.29) – post 51.52 (35.02) vs. Control pre 5.09 (10.57) – post 7.95 (13.42)</p>

	Household preparedness meeting increases preparedness action	<p>Pre and post-intervention relative change scores $(\text{[Postscore} - \text{Prescore]} / \text{Prescore})$ between intervention versus control for outcomes awareness and readiness were as follows.</p> <p>Awareness change score: Intervention 2.94 vs. Control -0.08, $p < .001$</p> <p>Readiness change score: Intervention 5.52 vs. Control 0.56, $p < .001$</p>
<p><i>Citation:</i> Eisenman (2009)</p> <p><i>Method:</i> QN-CG</p> <p><i>Relevancy:</i> Direct</p> <p><i>Quality Appraisal Rating:</i> Low/ Some Risk of Bias</p>	<p><i>Study Description:</i> An intervention for enhancing disaster preparedness using randomized block design with two experimental conditions, community health worker led discussion groups versus culturally tailored mailed information only, showed that both conditions improved purchase of disaster supplies and creation of a communication plan, but the discussion group condition showed statistically significant greater improvement than the mailed information condition.</p> <p><i>Findings</i> Radio is an important source of storm information and reported to be more useful than television. Many individuals are not aware of the local government's designated communication role during and after a natural disaster. Broadcast media in general plays a large role in community information sources before and after this storm.</p>	<p>Pre- and post-intervention percent (%) for discussion group (treatment) and mailed media (control) for outcomes prepare plan and purchase supplies were as follows.</p> <p>Prepare communication plan %: Discussion Group pre 37.9 % vs post 75.9 %, $p < .001$. Mailed Media pre 29.0 % vs. 52.0 %, $p < .001$.</p> <p>Purchase supplies % (only significant results noted here):</p> <p>Water – Discussion Group pre 69.0% vs. post 95.4 %, $p < .001$. Mailed Media pre 55.0% vs. post 80.0%, $p < .001$.</p> <p>Food- Discussion Group pre 72.4% vs. post 95.4%, $p < .001$. Mailed Media, n.s.</p> <p>Battery- Discussion Group pre 51.7% vs. post 78.2%, $p < .001$. Mailed Media, n.s.</p> <p>First-aid Kit- Discussion Group pre 47.1% vs. 71.3%, $p < .001$ Mailed Media, n.s.</p> <p>Extra Batteries- Discussion Group pre 48.3% vs. post 74.7%, $p < .001$ Mailed Media pre 47.0% vs. post 69.0%, $p < .001$</p>

<p><i>Citation:</i> Glik (2014)</p> <p><i>Method:</i> QN-CG</p> <p><i>Relevancy:</i> Direct</p> <p><i>Quality Appraisal Rating:</i> Low/ Some Risk of Bias</p>	<p><i>Study Description:</i> 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.</p> <p><i>Findings:</i> 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).</p>	<p>Overall Change to Higher Decision Making Stages Within Each Condition</p> <p>Disaster Supplies: Discussion Group pre to post, Chi-square = 45.63, $p = 0.000$ Mailed pre to post, Chi-square = 49.27, $p = 0.000$</p> <p>Communication Plan: Discussion Group pre to post, Chi-square = 82.24, $p = 0.000$ Mailed pre to post, Chi-square = 37.74, $p = 0.000$</p> <p>Change to Higher Decision Making Stages Across Conditions</p> <p>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, $p = 0.248$</p> <p>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, $p = 0.000$</p>
<p><i>Citation:</i> Yen (2009)</p> <p><i>Method:</i> QN-CG</p> <p><i>Relevancy:</i> Indirect</p> <p><i>Quality Appraisal Rating:</i> Moderate/ Minor Risk of Bias</p>	<p><i>Study Description:</i> In an outbreak of acute hemorrhagic conjunctivitis (AHC) infectious disease in Taiwan, the study compared the cities of Taipei, which received an integrated risk communication program that included short messaging service (SMS) messages sent to all citizens with mobile phones, and Keelung, which did not receive such a program. The analysis showed that the intervention program was successful.</p> <p><i>Findings:</i> SMS interventions are able to reach large populations timely and directly, helping to public response and engagement (with the exception of low SES population). Communication-based health interventions that incorporate SMS are an effective alternative to traditional mass media dissemination of health information.</p>	<p>Non-randomized treatment city (received an integrated communication program that included SMS) and control city (did not receive program), where both cities were experiencing outbreak of an infectious disease.</p> <p>Overall, results showed that the treatment city had a shorter epidemic duration (13 vs. 34 days) and shorter attack rate (5 vs. 14 days) compared to the control city. The crude attack rate of infectious disease in the treatment city was significantly lower than in the control city (1.95% vs. 14.92%, $p < 0.001$).</p> <p>Overall disease incidence in the treatment city decreased significantly (0.093% before program vs. 0.056% after program, $p < 0.001$) while the incidence rates in the control city continued to increase in the same time period.</p> <p>Parents who received the SMS communication felt more satisfied (on a 5-point scale) with this method as a means of public health communication than those who did not receive SMS messages (3.89 vs. 3.01, $p < 0.05$).</p>

8.3 Quality Appraisal of and Extracted Findings from English Language Individual Data-based Primary Studies (Quantitative-Descriptive Survey, Qualitative, and Mixed-Method/ Vase 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

<i>Citation (first author)</i>	<i>Method</i>	<i>Relevancy</i>	<i>Quality Appraisal Rating</i>	<i>Findings</i>
Chan (2007)	QN-DS	Direct	Strong	Telephone health education increases health knowledge among older adults.
Clerveaux (2010)	QN-DS	Indirect	Low	It is necessary to consider the specific characteristic of at-risk populations when disseminating disaster information in order to increase engagement with activities for preparedness and response.
Cretikos (2008)	QN-DS	Indirect	Strong	Radio is an important source of storm information and reported to be more useful than television. Many individuals are not aware of the local government's designated communication role during and after a natural disaster. Broadcast media in general plays a large role in community information sources before and after this storm.
Heath (2009)	QN-DS	Indirect	Moderate	Citizens prefer expert advice before and during a crisis event. Similarity and message sensitivity of source or communicator correlate positively to self-efficacy of residents.
Jahagiri (2010)	QN-DS	Direct	Moderate	People rely on media such as TV and radio to prepare for an earthquake (see p. 90, 3rd para.) Education materials empower the local community to prepare for an earthquake (see p.90, 4th para.).
McComas (2003)	QN-DS	Direct	Moderate	Public meetings attendees are more satisfied with the meeting if it offers relational/informational communication elements. If meeting organizers are perceived as lacking credibility, public meeting attendees are less satisfied. Risk perceptions strongly predict satisfactions with public meetings. Attendance at previous public meetings does not differ among citizens who've attend them before and those who have not.
Paek (2010)	QN-DS	Indirect	Strong	Individuals that engage in higher stages of emergency preparedness have greater self-efficacy to handle emergencies. The more individuals believed that significant others thought they should be prepared for emergencies, the more likely they were to engage in emergency planning. The more attentive individuals were to news about

				emergencies—via TV, radio, newspaper, and Internet—the greater likelihood they engage in emergency preparedness.
Perko (2013)	QN-DS	Indirect	Moderate	Communicated messages about nuclear emergencies may not be received if the audience has insufficient knowledge previous to the crisis context (i.e., preparation). Lower levels of education were correlated with lower recollection of (crisis) information. People with a high perception of radiation risks from nuclear elements were less attentive to information about protective actions. People with little confidence in authorities were more likely to have low reception of information.
Perry (2008)	QN-DS	Indirect	Moderate/Weak	Risk perception was not a statistically significant predictor of number of adjustments made for volcanos, earthquakes, or wild fires. Sense of responsibility for self-protection and experience of property damage from volcanos, earthquakes, and/or wild fires were significant predictors of adjustments made for all three natural hazards.
Roess (2011)	QN-DS	Direct	Moderate	Film-based educational activities can be effective in enhancing disease-specific knowledge. Film-based educational activities encourage individuals to seek out health workers when the disease is suspected.
Shenhar (2015)	QN-DS	Indirect	Strong	Exposure to earthquake-related triggers increases an individual's likelihood to react to corresponding awareness campaigns. Earthquake awareness campaigns have a significant effect on respondent knowledge, which has an even stronger influence with long-term exposure.
Strawderman (2012)	QN-DS	Indirect	Moderate	Credible sources of warnings, the use of multiple sources, and early delivery of warnings prior to disasters increase public's engagement in preparedness and response. Authorities should ensure that delivery of these warnings are mostly targeted at at-risk and directly affected population to avoid unnecessary large scale response and panic amongst unaffected individuals.
Terpstra (2011)	QN-DS	Indirect	Strong	Negative feelings decreased trust in flood protection and increased risk perception; positive feelings had the opposite effect. Perceptions of flood consequences play a marginal role in flood preparedness. Cognitive and affective mechanisms influence citizen preparedness intentions. Higher levels of trust reduce perceptions of flood likelihood and the amount of dread evoked by flood risk, which hampers flood preparedness intentions.
Tuerk (2013)	QN-DS	Partial	Moderate	Post-disaster screenings can be an effective response for mental health engagement, outreach, way for victims to ask medical professionals for help, and PTSD screening.

Falconi (2002)	QL	Indirect	Moderate	Professionals and volunteers working in emergency, health and social services see connectedness as important between and within communities to facilitate better collaboration of pandemic management, unified response(s), and resource/support management. In pandemics, information must be accessible for high-risk populations, public education must be emphasized, and vaccines for priority groups needs to communicated effectively. Coordination of resources, workers, accommodations for individuals at high-risk, and groups that have high priority vaccine needs are seen as essential during a pandemic to workers in in emergency, health and social services.
Linnell (2014)	QL	Partial	High	Pre-event information is consumed more in Sweden than collective collaboration and production of information in the response phase.
Nepal (2010)	QL	Indirect	Moderate	In immigrant communities, the senior community member have a significant influence over the acceptance and rejection of new community members.
Prior (2008)	QL	Indirect	Very Low	In immigrant communities, the senior community member have a significant influence over the acceptance and rejection of new community members.
Serra (2011)	QL	Indirect	Very Low	Resources for preparedness ought to focus on the long-term institutional innovation and learning. Lack of adequate means to inform the population in time constrains the credibility in the process of disaster risk reduction.
Asharose (2015)	MM/CS	Partial	Moderate	Educational tools such as awareness and training programs can bring a positive change in the level of understanding about disasters and disaster risk reduction measures. Local context is important when shaping and conveying knowledge. Radio is perceived as the most effective media for disaster updates and information in publics that are trained in disaster awareness.
Bird (2012)	MM/CS	Partial	Moderate	Facebook can effectively be used to increase community involvement engagement with activities for preparedness and response, with the need to verify the accuracy of information shared by verified sources.
Kapucu (2008)	MM/CS	Indirect	Moderate	Public response to hurricanes is increased when emergency managers use community coordination strategies. Emergency managers believe that development of strategies to counter rumors, a plan to alert all agencies of a threat, and the use of IT to improve communication and coordination among agencies are effective coordination strategies.
Karan (2007)	MM/CS	Partial	Very Low	Public education can be utilized to emphasize the importance of social responsibility which increases engagement with activities for preparedness and response.
Masuda	MM/CS	Partial	High	Cultural views, place attachments, and others' place

(2006)				attachments contribute to individual risk amplification and attenuation.
Mei (2013)	MM/CS	Partial	Moderate	Multiple modes of communication are needed to rely warnings evacuation details. Public hazard and evacuation education previous to hazard-onset is effective. During a crisis period, concern for livestock care or not wanting to abandon livestock are reasons why individuals return to their homes in dangers zones. Motorbikes played an important role during the 2010 Merapi evacuation.
Mitchell (2008)	MM/CS	Partial	Very Low	Children and youth are effective communicators and translators in certain communities at times of disasters, as they are trusted and may aid in the increase of engagement with activities for preparedness and response.
Muttarak (2013)	MM/CS	Indirect	Moderate	Educated people with previous disaster experience are more likely to take disaster preparation actions. Individuals with at least a secondary education that participate in disaster education and evacuation drills have an increased likelihood of taking disaster preparation actions. Villages with greater proportions of women have lower personal disaster preparedness.
Roder (2016)	MM/CS	Indirect	Moderate	Indigenous members with lower levels of education were more likely to overestimate and worry about natural hazards. Moving away from their indigenous land—even in hazard-exposed locations—was not something indigenous participants wanted to do. The youngest participants did not know what to do about managing a future hazard and they felt no need to cope with such an event. It is important to consider socioeconomic factors when developing risk communication messages, preventive practices, and management.
Winters (2014)	MM/CS	Direct	Low	Local cultural agents and locality are important elements in communication to rural residents experiencing a disaster.