Evidence Synthesis to Support the WHO Guidelines on Emergency Risk Communication: How Best to Develop and Sustain Emergency Risk Communication Staff Capacity for Preparedness and Response

PROJECT REPORT

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BACKGROUND

Although training and practices of emergency risk communication (ERC) have been developed and used in the field, little is known about factors that make them more (or less) effective. No evidence-based systems-focused guidance is available to member states of the World Health Organization (WHO). The WHO has proposed developing a set of guidelines about risk communication during public health and humanitarian emergencies. As part of the process of developing the guidelines, the WHO Department of Communications’ Communication Capacity Building Unit issued a request for proposals for systematic reviews of existing evidence addressing questions about 12 aspects of ERC. Conclusions drawn from synthesis of existing evidence will inform the guideline development process.

Existing Systematic Reviews

Although systematic reviews have been conducted on disaster preparedness training for a range of professions including nursing (Hsu, et al., 2004; Jose & Dufrene, 2014), veterinary medicine (Dunning, et al., 2009), healthcare workers (Williams, et al., 2008), and disaster preparedness in general (Beerens, et al., 2016; Gallardo, et al., 2015), only two reviews were located which included a component related to ERC. Citation information is presented in Table 1. Both reviews were narrative reviews.

We used a modified version of the AMSTAR tool (See Appendix A) to appraise the quality of systematic reviews. Two members of the research team coded each review separately. Disagreements were resolved by discussion. Reviews were assigned to low, moderate, or high quality categories with the intention that low quality reviews would not be assessed further. Moderate and high quality reviews were to be assigned to categories of relevance (Lewin et al., 2015): direct relevance (directly maps onto phenomenon of interest); indirect relevance (corresponds with some aspects of the phenomenon of interest); partial relevance (a part of the issue of interest or population is addressed but not all); and unclear relevance (unclear whether underlying data are relevant).

Both systematic reviews were judged to be of low quality. Therefore, although reference lists were combed for relevant primary studies, no further action was taken with the reviews.
Table 1. Quality Appraisal of Existing Reviews

<table>
<thead>
<tr>
<th>AMSTAR Quality Rating</th>
<th>Relevance</th>
<th>Key Findings</th>
</tr>
</thead>
</table>

Despite the absence of relevant existing systematic reviews about ERC training, some sense of the current state of evidence may be inferred from systematic reviews of the broader literature on training in disaster preparedness and response. Researchers have concluded that evaluation of disaster preparedness efforts is usually not scientifically rigorous (Hsu, et al., 2004; Jose & Dufrene, 2014; Williams, Nocera, & Casteel, 2008). Methods used for evaluation are heterogeneous and often not well-described (Beerens & Tehler, 2016). Most studies reviewed in Beerens and Tehler’s scoping review, for example, did not provide an explanation of why the form of their training made sense or why they selected a specific evaluation method over others. Few standardized assessment tools exist (Gallardo, et al., 2015), and control groups are rarely used (Williams, Nocera, & Casteel, 2008). This makes it difficult to determine whether anecdotal success of drills, workshops, courses, and other types of training can translate into actual additional skills and knowledge. Also worth noting in the broader literature is that published evaluations of disaster preparedness training and staff development are very much confined to the United States, meaning that even if research designs were more robust, findings might not necessarily be applicable in other national contexts. This dearth of evidence about training effectiveness is all the more concerning because scholars agree that there is a loss of information that occurs between training and on-the-job performance (Arthur, Bennet, Eden, & Bell, 2003; Chiaburu & Marinova, 2005).

It is not clear whether research on staff development in ERC is characterized by the same weaknesses as disaster preparedness literature in general. Furthermore, although training in ERC may be conducted concurrently with broader disaster simulations, workshops, or courses, it is a distinctive skill set which may require different pedagogies. This leads, therefore, to the objective of this review.
OBJECTIVE

The aim of this review is to support development of guidelines in emergency risk communication by reviewing the available literature related to Question 3 posed by the WHO. Specifically, this systematic review addresses the following question:

How to best develop and sustain emergency risk communication staff capacity for preparedness and response

The question is explicated using the SPICE framework as follows:

- **Setting**: In the context of preparing for and responding to events/emergencies with public health implications in high, low, middle income and fragile states
- **Perspective**: National governments and relevant subnational authorities (e.g., district and local health authorities)
- **Phenomena of interest**: Development and sustained capacity of staff for emergency risk communication
- **Comparison**: Varied tactics: in-service trainings, education, core competency programs, other development opportunities
- **Evaluation**: Impact on number of staff with emergency risk communication skills, breadth/depth of skills, retention of staff
METHOD

Approach to Searching

The systematic review was conducted by a team of three risk communication experts and two information scientists at the University of Central Florida. The team was also advised by an information scientist, a methodologist, and a communication expert at the World Health Organization. The review took place in two phases: 1) a systematic knowledge mapping exercise to identify primary studies and grey literature reports that map against the research question and make clear the geographical spread of evidence. As recommended in the WHO Minimum Methodological Expectations document, the systematic knowledge mapping was conducted in line with SCIE systematic mapping guidance (Clapton, Rutter, Sharif, 2009); 2) quality appraisal and evidence synthesis of relevant studies identified in the knowledge mapping phase.

Data Sources

Literature review for the knowledge map included searches in over 20 academic and grey literature databases. Search strategies were developed with input from an information scientist at WHO and a team member who is the Librarian for the College of Nursing at the University of Central Florida. Nursing is highly represented in health emergency and disaster preparedness research, so the presence on the team of an information scientist who specializes in nursing literature provided additional quality assurance.

Because the guidelines the WHO composes will be complex and draw from multiple disciplines and contexts, WHO librarian Tomas Allen recommended a four-stage approach: 1) building on what others have done; 2) paying special attention to literature from lower and middle income countries; 3) looking beyond the health and medical fields; and 4) searching grey literature.

In order to look beyond the medical and health fields, we searched databases in communication, business, education, psychology, sociology, and public affairs. Academic databases searched were: Applied Social Sciences Indexes and Abstracts (ASSIA), Business Source Premier, CINAHL, Cochrane Central Registry of Controlled Trials, Cochrane Database of Systematic Reviews, Communication and Mass Media Complete (EBSCOhost), Communication and Mass Media Complete (Gale), ERIC, MEDLINE, PAIS, PsycInfo, Sociological Abstracts, Web of Science (SSCI and SSI databases), and the WHO Global Library (LILACS, WPRIM, IMEMR, IMSEAR databases). In order to locate literature from low and middle income countries, we did not restrict the search to specific languages. Additionally, we searched databases in Arabic (Dar Almandumah –Human Index), Chinese (China Academic Journals), Russian (Russian Science Citation Index), French (Cairn.Info communication database), and Spanish (SciELO; LILACS). Altogether records were identified in 16 languages (Arabic, Castilian, Chinese, English, French, German, Italian, Japanese, Moldovan, Portuguese, Romanian, Russian, Serbo-Croatian, Slovak, Spanish, and Turkish).

We also searched the following grey literature sources: Defense Technical Information Center (DTIC), Greylit.org, Open Grey, and PubMed. In addition to grey literature electronic databases,
searches were performed at Booz Allen Hamilton, Communication Initiative, and Milbank Memorial Fund sites. Booz Allen Hamilton is an American management consulting firm headquartered in Tysons Corner, Virginia, in Greater Washington DC, with 80 other offices throughout the United States. Communication Initiative is a web-based clearinghouse for health communication-related research, interventions, and information. Millbank is a foundation with the mission “to improve the health of individuals and populations by applying the findings of the best available research and relevant experiential learning to health policy and practice” (www.milbank.org).

To further ensure representation from low income and fragile states we also reached out to 47 international health, risk, and crisis experts for information on additional resources. Experts were contacted from the following countries: Albania, Belgium, China, Germany, Hungary, India, Indonesia, Italy, Laos, Latvia, Luxembourg, Malaysia, Norway, Philippines, Portugal, Qatar, Romania, Singapore, Slovenia, Spain, Sweden, United Kingdom, United States, and Vietnam. Table 2 lists the experts who provided input into the review. (A full list of experts contacted is provided in Appendix B.) For the most part, experts affirmed that ERC staff training did take place in their countries, but only one provided documents to describe that training (Madden, et al., 2013).

Table 2. Experts Interviewed

<table>
<thead>
<tr>
<th>Expert Name</th>
<th>Organizational Affiliation</th>
<th>Email contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rosemarie Aguirre</td>
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</tr>
</tbody>
</table>

Electronic Search Strategies

The search strategy in English databases was based on a Boolean approach. Three distinctive realms of subjects were searched: a) disaster/emergency preparedness, b) communication/risk communication, and c) staff development/capacity building/training/education. However, these words alone were insufficient, because they have many synonyms and databases employ different subject terms for the same concepts. Therefore, specific search strategies and terms were tailored for each individual database. At the suggestion of WHO subject areas experts we added a subject domain in the WHO Global Library search for "international health regulations."
For each separate database searched we consulted the database thesaurus for subject terms. We also allowed words to be “exploded” to locate additional synonyms and related terms. Exact search strategies for each database are presented in Appendix C, with number of results for each in parentheses to the left.

Grey literature was searched in similar fashion. Exact search strategies for grey literature resources are presented in Appendix D.

In addition to the database searches, ancestry and forward citation searching was performed on all identified relevant articles. Articles that either were cited by such studies or which cited the highly relevant article were located in Web of Science Citation Index or Social Science Citation Index and examined. Those that were not available in Web of Science indexes were located via Google Scholar. Reference lists of systematic reviews were also combed for primary research studies relevant to the objective of the current review.

To ensure that no articles remained uncaptured, additional subject headings and keywords were derived from articles found through ancestry and forward citation searching, as well as previously unexplored controlled vocabulary and keywords located in other core articles. In this way, searches were re-run including new keywords and subject terms in MEDLINE and Communication and Mass Media Complete (EBSCO).

**Study Screening Method**

Before starting the literature selection process, we held multiple calibration exercises for all researchers, as well as four information sessions with librarians. One ERC expert on the team and one librarian conducted academic database searches. A total of 6,181 records were retrieved.

One other team member identified records for further analysis by title from grey literature. A total of 436 records were located in grey literature searches.

Ancestry searches both forward and backward from relevant articles and searches of references of systematic reviews yielded 99 records. Four documents were identified by other means.

Titles of records identified through academic database searches were screened for relevance by two team members—one of them the Librarian for the UCF College of Nursing and one an ERC expert—working independently. For ambiguous cases, decisions were made through discussion. Titles of records identified by grey literature search were screened by two team members—one of them a librarian and the other an ERC expert. Having one librarian work on each of the database search efforts provided added assurance of quality.

Because literature on ERC was limited, we searched broadly across articles addressing staff development and capacity building for emergency risk preparedness in general. We examined all studies in that field with any mention of communication. We did not search training literature on health communication more broadly because ERC is distinct from health communication as a sub-discipline in the field of communication, with separate theorizing and principles (Reynolds
& Seeger, 2005). All articles identified as potentially relevant were screened again by two team members, this time referring to abstracts to determine whether any should be excluded. Articles identified for full text examination were imported into Endnote, both references and full texts, and duplicates were removed. After the citations had been imported and sorted, the “Find Full Text” tool was used to locate available full texts articles for each citation. All full texts found were duplicated and stored on Google Drive and in Dropbox as a precaution, and for additional cross-checking to ensure accurate data transfer. This was done for both academic and grey literature. Four dissertations were not obtainable and one article was not received from interlibrary loan within the time frame available.

Full texts of the remaining articles, both academic and grey literature were identified and characterized as research-based studies or not. Documents that were not research-based were removed from analysis.

Articles were judged for relevancy according to the inclusion and exclusion criteria. Studies that were judged to be directly relevant, indirectly relevant, partially relevant, or uncertainly relevant (Lewin, et al., 2015) were selected for extraction of key findings. Articles judged to be ambiguous after looking at full text were individually read and then discussed by two team members, and decision was made by consensus. Only relevant primary study articles were used to generate the systematic review for this report.

The article selection process is graphically portrayed in Figure 1.
Records identified through academic database searches
\(n = 6,181\)

Records identified through grey literature searches
\(n = 436\)

Records identified by hand searching and other sources
\(n = 103\)

Total records screened
\(n = 6,720\)

Records excluded by title
\(n = 6,411\)

Records excluded because abstracts do not meet criteria
\(n = 118\)

Records screened
\(n = 309\)

Records excluded because full text articles do not meet criteria
\(n = 162\)

Full texts not retrieved
\(n = 5\)

Full texts examined
\(n = 191\)

Records included in synthesis
\(n = 24\)

Identification

Screening

2009

(Moher, Leberati, Tetzlaff, Altman, The PRISMA Group,
Inclusion and Exclusion Criteria

Inclusion Criteria
The following broad inclusion criteria were applied:
- research related to developing or sustaining capacity of ERC staff for preparation and response to disaster, OR
- research that included ERC as part of a larger emergency preparedness training or staff development effort

Exclusion Criteria
The following exclusion criteria were applied:
- research about ERC that did not describe specific training, education, core competencies, or other interventions to develop or sustain staff capacity
- studies involving formative research to identify ERC staff training needs without actual implementation of specific training, education, core competencies, or other interventions to develop or sustain capacity
- research about training in emergency preparedness or related subjects that made no mention of ERC or communicating with the public
- essays, opinion pieces, or descriptions of trainings or education that were not research-based, i.e. did not include some type of data collection designed to assess outcomes
- studies published before 2003

Data Extraction for Knowledge Map

Assurance of Rigor in Coding
After relevant primary research articles were located, key descriptive characteristics were identified for coding. Three members of the team developed the coding instrument through multiple sessions of test coding and revising the coding instrument, and in consultation with WHO personnel (see Appendix E). Additional meetings were held to increase consistency in coding with practice articles. Two team members coded all included articles individually. They then came together and discussed every data point. Disagreements in coding were resolved by discussion.

The following information was recorded for each individual study.

Type of Intervention
The type of activity designed to develop or sustain ERC capacity was recorded, for example: in-service training (includes workshops, courses aimed at professionals, simulation exercises, table-tops, and any other capacity building provided within agency); education (university training provided at undergraduate or graduate level in an institution of higher education); development of lists of core competencies; and development of specific tools for evaluation.

Description of Study Context
Information regarding the country in which the training or education took place and type of agency was coded. Studies reporting results for more than one country were coded multiple times.
Type of Disaster and Phase of Crisis
Type of disaster, including disaster-general training, was coded. In addition to the type of disaster, information was also extracted regarding the phases of crisis on which each study focused. The terms of reference of this review involve only the preparation and response phases of crisis. However, the taxonomy of phases used by WHO assumes that what is sometimes pulled out as the evaluation phase (Reynolds & Seeger, 2005) should be infused through all phases. We therefore also noted whether staff development involved capacity building in evaluation procedures. Note that any research-based study that met inclusion criteria must include some type of evaluation of outcomes. However, the question here is whether the study involved building or sustaining capacity in staff themselves for evaluation activities. A similar distinction must be made with reference to the preparation phase. Although any drill or exercise could be considered a kind of preparation, the concern of this review was to determine whether the training itself focused on tools for the preparation phase. Thus, whereas disaster simulations inevitably focus on the response phase of the disaster, if such a simulation was preceded by a workshop or module in which aspects of preparedness were the focus, that article was coded as involving both preparation and response phases.

Categorization by Research Method
Section 2.2 of the WHO Minimum Methodological Expectations document notes the following categories for data-based primary studies: qualitative (ethnographic research, case studies, process evaluations); mixed-method studies (combining different types of designs to explore a phenomenon of interest); observational and cross-sectional surveys (in communities or populations); and grey literature reports.

Using the above methodological groupings as a starting point, we initially identified five major research methods in the primary studies selected for the review:
- Observational quantitative studies – use of quantitative methods, whether focusing on one particular event/person/location or on communities and populations
- Qualitative – open-ended questionnaire survey, interview, focus group, ethnography/participant observation, and textual analysis whether focusing on one particular event/person/location or on communities and populations
- Mixed-method – use of both quantitative and qualitative methods, where the different methods may address different hypotheses and/or research questions, focusing on communities and populations
- Case study – use of several methods, where usually all methods address the same research question and focus on one particular event/person/location
- Before-after (pre-post) studies with no control group
- Instrument development studies

No published randomized trials on the topic were located.

Quality Appraisal

Appraisal Items
Quality of individual studies was appraised differently depending on study design. Appraisal tools for each type of study were determined in consultation with WHO personnel. When mixed
method studies focused strongly on, or reported results for, only one type of data, these studies were appraised using the instrument appropriate to the type of data reported rather than being appraised as mixed method. The single study in a language other than English was translated and then appraised in the same way. The following tools were used:

- Observational quantitative studies: Modified version of the British Medical Journal Critical Appraisal Checklist for Questionnaire Studies (see Appendix F)
- Qualitative studies: Critical Appraisal Skills Program (CASP)
- Mixed-method studies: Mixed Methods Appraisal Tool (MMAT)
- Case studies: MMAT
- Before-after (pre-post) studies with no control group (National Heart, Lung, and Blood Institute Quality Assessment Tool)
- Instrument development: COSMIN Checklist

**Appraisal Process**

All studies selected for evidence synthesis were appraised individually by two ERC experts on the research team. Researchers compared appraisals for each article and disagreements were resolved by consensus.

**Synthesis of Findings**

Synthesis of findings was done by the three ERC experts on the team. Conclusions were drawn individually and then discussed among all three researchers.

**Study Comparison by Methodological Stream**

As recommended by WHO personnel and in order to be consistent with other commissioned reviews, synthesis was done in two stages. In the first stage, findings from individual studies were synthesized within three methodological streams: mixed method and case studies, qualitative studies, and quantitative studies (questionnaire studies and pretest-posttest studies with no comparison group). Instrument development studies were not synthesized by theme.

Findings within each stream were synthesized using a Framework Synthesis approach. We started with a list of a priori framework categories generated from the review objective. The list was modified as necessary based reading of individual studies. We also employed thematic analysis wherein patterns emerged inductively via repeated content analytic passes through the studies (Lindlof & Taylor, 2002). After patterns were identified, they were combined and catalogued into categories. We also paid attention to sub-groupings within the studies such as type of training, country of training, and presence of vulnerable populations. The last two subgroups allowed consideration of equity in the synthesized findings. We present findings using a narrative approach, which is advised by the *Cochrane Handbook* for reviews that are not meta-analyses.

**Evaluation for Certainty/Confidence**

Synthesized findings were evaluated for certainty/confidence using tools specific to the research method:

- Mixed method and case studies were evaluated with CERQual.
Quantitative-descriptive survey and pretest-posttest studies with no comparison group were appraised by applying the principles of GRADE.

Qualitative studies were evaluated with CERQual.

We assumed the following GRADE principles regarding level of quality of study findings (Lewin, Glenton, Munthe-Kaas, Carlsen, Colvin, Gulmezoglu, et al., 2015):

- **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.

In the second stage of synthesis, findings from all methodological streams were synthesized. Findings within each methodological stream were compared and contrasted with findings from the other streams. These findings were analyzed thematically for potential modifications to the across-method findings. Categories were queried by locating exceptional cases. The evaluation of certainty in the within-method synthesized findings was kept in mind during this process.
RESULTS

Key Characteristics of Selected Studies

Key descriptive characteristics of the studies are presented in Table 3. Studies were coded regarding country in which the study took place, research method, disaster type, organization type, and type of training or intervention. As indicated in Table 3, the largest number of studies reported interventions that took place in the United States. Most of the data on interventions in Asian, African, and Middle Eastern nations were derived from a single article that reported the results of multiple training programs across the three regions. One study in Chinese met inclusion criteria. The rest of the studies were in English.

The largest number of studies described in-service training such as tabletop exercises, simulations, or workshops. A few studies reported evaluations of undergraduate or graduate disaster preparedness curricula. One article reported findings from a survey of risk communication professionals and a content analysis of existing training curricula, and two reported the development of evaluation instruments for training exercises.

Regarding types of disasters, many studies reported on general disaster preparedness training. The most frequent specific disaster examined was infectious disease outbreak. Over half of the studies described training programs that involved multiple types of health-related agencies. Five studies were situated in universities, and these mostly described disaster preparedness curricula. Two studies each involved hospitals, three involved state and local government agencies, and two involved federal/national government agencies.

Given that most studies reported on disaster simulations or drills, it is not surprising that the larger number of studies dealt with the response phase of disasters. However, a substantial number addressed the preparation phase, and five studies dealt with evaluation.

With respect to research method, none of the studies we identified for analysis were randomized control trials, in fact, none used a comparison group. Most were case studies, some of which used questionnaires as the primary data collection tool and others of which used mixed methods. In response to guidance from WHO personnel, studies were placed in three streams for analysis. A complete list of studies analyzed is provided in Appendix G.
Table 3. Key Characteristics of Selected Primary Studies

<table>
<thead>
<tr>
<th>Country Focus*</th>
<th>Africa</th>
<th>Asia</th>
<th>Europe</th>
<th>Middle East</th>
<th>North America</th>
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<tr>
<td></td>
<td>Burundi – 1</td>
<td>Cambodia – 1</td>
<td>Belgium – 1</td>
<td>Israel – 1</td>
<td>United States - 16</td>
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<td></td>
<td>Kenya – 1</td>
<td>China – 2</td>
<td>Europe (general) – 2</td>
<td>Jordan – 1</td>
<td></td>
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<td>Lao PDR – 1</td>
<td>Finland – 1</td>
<td>Palestine – 1</td>
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<td></td>
<td>Uganda – 1</td>
<td>Vietnam – 1</td>
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</tbody>
</table>

| Type of Staff Development* | In-service training - 17 | Education - 5 | Instrument development - 2 |

| Type of Disaster | Infectious disease outbreak - 9 | Bioterrorism - 2 | Food - 2 | Other: Terrorism, Chemical/nuclear, Stadium crush - 3 | General - 8 |

| Organizations Involved | Hospitals - 2 | Universities - 5 | Federal/ national government - 2 | State/local government - 3 | Multiple - 12 |

| Disaster Phase(s)* | Preparation - 12 | Response - 20 | Evaluation - 5 | Unable to determine - 1 |

| Research Method | Case study using Questionnaire – 6 | Mixed methods – 10 | Qualitative - 6 | Instrument development – 2 |

*Numbers in these categories do not add up to 24, because some studies focused on more than one country, type of staff development, or disaster phase.

Relevance and Quality Appraisal of Selected Studies

Relevance was assessed using categories of relevance presented in Lewin et al. (2015): direct relevance, indirect relevance, partial relevance, and unclear relevance. Fewer than one-third of the 24 studies analyzed were directly relevant to the review objective. The remaining studies were classified as indirectly relevant because they described ERC training as a small component
of broader emergency preparedness training for healthcare personnel who were not ERC staff, or they reported development of an evaluative instrument of which one component dealt with ERC.

Although a range of common training methods are available (e.g. large group methods like lectures and discussions, electronic-based training such as the CDC’s CERC module, reference methods like workbooks and manuals, small group training like workshops, and games and simulations; Madden, Worboys, Liu, & Petrun, 2013), in-service trainings described in the studies we examined consisted almost entirely of tabletop exercises or simulations. Tabletop exercises provide opportunities for public and private partners to come together in a low-threat collaborative environment to network with each other, learn about each other’s perspectives, and problem-solve ways to handle a particular disaster scenario (High, Lovelace, Gansneder, Strac, Callahn, & Benson, 2010). Simulations are more complex. Simulations in the studies analyzed lasted anywhere from two hours to six months. The number of people involved in the simulations ranged widely as well, with some including fewer than 20 participants and others involving hundreds, sometimes with actors playing roles as patients or other stakeholders. Simulations in educational contexts were part of larger courses dealing with emergency preparedness or a related issue. Thus, they were combined with lecture, discussion, reading, and sometimes online modules.

Quality of studies varied. A few studies were judged to be of high or moderate quality, but most were assessed as low quality because they depended upon a few self-reported assessments of learning or skills acquisition and did not employ any performance or direct knowledge measures. University courses sometimes assessed knowledge on final exams or projects. No studies we located used comparison or control groups of any type. In addition, many of the quantitative studies did not give any attention to concerns about reliability, validity, or pilot testing. Long term effects were not measured.

Specific information about each study is presented in Table 4. Where inferential statistics and estimates of confidence were supplied, they are included in the table. However, most studies did not provide complete statistics.
### Table 4. Characteristics, Relevance, and Quality of Included Studies

<table>
<thead>
<tr>
<th>Study Citation</th>
<th>Locale</th>
<th>Provider Type and No. of Subjects</th>
<th>Description of Intervention/Training/Education</th>
<th>Method of Evaluation of Effectiveness and Findings*</th>
<th>Relevance to Review Objective</th>
<th>Quality Assessment (appraisal tool used)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mixed Method Studies</strong></td>
<td></td>
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<tr>
<td>Ablah, et al., 2007</td>
<td>6 counties in Kansas, U.S.</td>
<td>65 volunteer employees of local health departments in the Central Kansas Region for Public Health Preparedness</td>
<td><strong>Month-long real-time pilot exercise.</strong> Purpose: to determine whether exercise format would be useful in increasing self-reported abilities with regard to surge capacity, coordination between counties, risk communication, disease investigation protocols and procedures. Also, to encourage participants to coordinate with state and local partners. Conducted using electronic media which allowed participants to work from their health department offices as they would in a real incident. A simulated outbreak of an undisclosed infectious disease. Participants received scenarios and injects and submitted scene answers via a health network.</td>
<td><strong>Pretest-posttest no control group.</strong> Pre- and post-exercise 5-point Likert-type scales. On a single item, respondents rated own abilities to “implement risk communication skill set.” At pre-exercise 46% reported abilities average, 12% good. At post-exercise, 44% reported average, 22% good, and 3% excellent. Findings ns.</td>
<td>Indirect: Not focused on ERC staff, but ERC is one of four objectives of the exercise for public health employees.</td>
<td>(NHLBI tool) Moderate</td>
</tr>
<tr>
<td>Aertsen, et al., 2013</td>
<td>University of Leuven, Belgium</td>
<td>170 MBA students</td>
<td><strong>4-week graduate student project.</strong> Purpose: to give MBA students opportunity to translate theory into practice in a crisis situation. Students were urged to use linguistic and communication</td>
<td><strong>Case study.</strong> Closed-ended 11-item, Likert-type 5-point scale, with 1 = strongly agree to 5 = strongly disagree. For the belief that they had learned more about crisis communication than in a traditional course $M = 1.36$ (95% CI: 1.23,</td>
<td>Indirect: Not focused on ERC staff. Audience is MBA students,</td>
<td>(MMAT) Low</td>
</tr>
</tbody>
</table>
theory to manage communication in a simulated crisis at university. Weeks 1 & 2 theory; week 3 develop action plan; week 4 theory into practice. After week 2 worked in heterogeneous crisis communication teams. 7 roles identified. 4 crises were simulated, one of which was clearly health-related.

1.48. Answers to open-ended questions also recorded. Examined student wiki and discussion board assignments. Although they made errors, the simulation enabled students to move beyond mechanistic use of communication axioms and deepen their understanding of theory.

<table>
<thead>
<tr>
<th>Dausey &amp; Moore, 2014</th>
<th>Middle East, Asia, Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>558 participants from multiple governmental sectors in 14 countries in 12 separate exercises.</td>
<td>Tabletop exercises. Purpose: not clear. Exercises presented participants with a future scenario that involved an unfolding pandemic influenza crisis at different stages. Required to respond with actions they would take if scenario actually occurring. Expert facilitators given discussion points and probes. Each section of exercise ended with participants being asked to make concrete decisions for topic. Concluded with debriefing.</td>
</tr>
<tr>
<td>Mixed method. 6 exercises used 5 Likert-type questions rating on 5-point scale. Percent of participants’ answering was provided by country (overall quality of exercise good or excellent, 59% to 100%; quality of information exchanged good or excellent, 68% to 100%; key gaps identified agree or strongly agree 50% to 77%; better understanding of roles agree or strongly agree 76% to 100%; plan to use knowledge gained agree or strongly agree, 82% to 100%). Other 6 countries were asked to respond to 3 qualitative questions. All did AARs to summarize exercise discussions and highlight key aspects. Health leaders involved later invited to structured face-to-face interviews to discuss how their country followed up. General themes were that exercises raised awareness and understanding, assisted in evaluating plans and identifying priorities for improvement, and enhanced preparedness and response capabilities across sectors and</td>
<td></td>
</tr>
<tr>
<td>Indirect: Not focused on ERC staff. One element of exercise is ERC.</td>
<td>(MMAT) Low</td>
</tr>
<tr>
<td>Study</td>
<td>Location</td>
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<tr>
<td>Freimuth, et al., 2008</td>
<td>Georgia, U.S.</td>
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<tr>
<td>High et al., 2010</td>
<td>North Carolina, U.S.</td>
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<tr>
<td>Study</td>
<td>Location</td>
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<tr>
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<tr>
<td>Madden, et al., 2013</td>
<td>U.S.</td>
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<tr>
<td>Morris, et al., 2012</td>
<td>Public health agencies and academic</td>
</tr>
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</table>

Tabletop focused on chemical release in large convention facility. Scenario took place for a full day and was in 3 modules and focused on 3 critical points in the event.

discussion, have participants bring organizational preparedness plans, disseminate AARs to people involved. 55% of participants said somewhat or much more certain about how public and private sectors would interact after the exercise; 59% somewhat or much more certain how local level would interact with state agencies, 51% somewhat or much more certain about how state agencies would interact with federal; 71% believed their organization needed to make immediate plans to address gaps in planning but only 38% said organizations would do so.

but communication is not an objective.
| **Shao, 2014** | **China** | **88 survey participants from multiple government sectors in 5 states; 44 interview participants from Shaanxi** | **Online training program in ERC.** **Purpose:** to evaluate user perception of a training module translated and adapted from CDC training. Survey focused on user perception of the training’s content/design, readability, innovativeness, practicality/applicability, as well as needs for mixed method. Participants answered yes-no questions about the training. 95.5% agreed training was well designed and easy to understand; 54.5% agreed training was applicable to their work; 77.3% disliked the online training method; 75% agreed that face-to-face training seminars have longer-lasting impact; 72.7% said they preferred more **Mixed method.** Participants answered yes-no questions about the training. 95.5% agreed training was well designed and easy to understand; 54.5% agreed training was applicable to their work; 77.3% disliked the online training method; 75% agreed that face-to-face training seminars have longer-lasting impact, 72.7% said they preferred more | **Direct** | **Mixed method** | **Low** |

**institutions in 7 south-eastern states in U.S.** agencies, 6 universities, 1 nonprofit organization, 1 private corporation. Number of people not stated

Conducted in 9 hours over 2 days. Participants assigned to 1 of 4 multi-agency tables with others from same state. Exercise in 5 modules representing phases of an infectious disease outbreak at a university. Each module had multimedia depiction of simulated conditions in region after which participants discussed at tables. Facilitator provided list of pre-scripted questions.

With quantitative items plus 6 open-ended questions. Plus, After Action Reports. 55% strongly agreed and 45% agreed that their knowledge had increased; 9% strongly agreed and 68% agreed understanding of their role in an emergency event had increased; 45% strongly agreed and 55% agreed exercise helped identify agency strengths and weaknesses; 30% strongly agreed and 55% agreed exercise helped identify gaps in planning; 43% strongly agreed and 48% agreed exercise helped build relationships with participants from other agencies; 45% strongly agreed and 35% agreed helped build relationships with participants from other states. Players affirmed importance of personal relationships and contacts and need for pre-established communication channels. ERC recognized as key component of preparedness. Players saw need to be prepared with a contingency press statement and saw academic institutions have untapped reserves to bring to emergency situations.

Emerged as one of lessons learned, but it was not an objective.
Interviews focused in more detail on the users’ experience of taking such an online training. cases, and 97.7% said face-to-face training would be more effective; 65.9% preferred face-to-face training that can provide field instruction; 63.6% agreed training should be part of required in-service training with continuous education credit. Interview data offered additional support for these patterns. Interviewees also indicated preference for instruction face-to-face from ERC experts.

| Wahl, et al., 2015 | Norway, nationwide | 364 Norwegian Food Safety Authority employees in all offices and organization levels and reps from cooperating governmental and business organizations | Foodborne emergency functional exercise. Purpose: to describe how elements of exercise contributed to learning effect on organization. Scenario was of a salmonellosis outbreak traced to nationally distributed cured salmon seasoned with dill contaminated with *Salmonella*. ERC was included. Role players for lab representatives, epidemiologists, patients, GPs, restaurant representatives. Interviewed NFSA coordinator for foodborne outbreak and NFSA chief of contingency. Tested several new or revised operational systems including new log system and emergency system for routing calls, and new internet-based survey tool for recording patient interviews. | Case study. Primarily evaluated by questionnaire. Surveyed all participants. 5 questions filled out in 6-point Likert-type scale. Also, internal and external monitors observed and commented on course of play and reported on monitor questionnaires. Internet-based recording system labor-intensive and not suitable to maintain sufficient overview. 78% rated relevance 5 or 6 on a 6-point scale; 54% rated media contacts 5 or 6, 29% didn’t know; 39% rated compliance with protocol 5 or 6; 39% rated compliance with contingency plans 5 or 6, 32% didn’t know); 50% rated overall impression of exercise 5 or 6. External monitors said exercise well planned and engaging. Also, said some statements to media were not coherent with communication plans. Key personnel said exercise revealed need for more training in ERC. | Indirect: Not focused on ERC staff. | (MMAT) Moderate |
| Carney, et al., 2011 | Case Western Reserve, University of Colorado, University of Vermont, Harvard Medical School, U.S. | Medical school students, number not provided | **Simulation exercise.** Purpose: to describe and compare pandemic exercises used in four U.S. medical schools, discuss lessons learned, and suggest a framework for curricular development for medical schools considering addition of pandemic exercises to their population health curriculum. Handled differently at each school but preceded in all by a one-hour lecture. Exercises lasted 2 or 3 hours. Pandemic influenza scenario. | **Questionnaire.** Varied by institution. CWRU uses AAR, HMS uses 2 to 3 knowledge questions integrated into exam, plus a single 5-point Likert type item on how well exercises aided understanding of public health system and its response to threats (over 5 years 69% gave rating of excellent or good for self-reported increase in understanding; \( n = 729 \)); CU uses multiple evaluation questions but only one mentioned (20% strongly agree and 62% agree that they better understand emergency preparedness response, \( n = 71 \)); UVM uses 16-item evaluation for knowledge (70.1% correct overall; public health items answered correctly less often than clinical questions related to influenza (61.9% vs. 78.4%, \( p = .06 \)); 56.7% strongly agreed and 43.3% agreed physicians and hospitals need written plans and preparedness exercises. Overall students like exercise and perform well. Lessons learned: initiate planning well in advance, involve state and/or local health departments, prepare students for logistics, roles, and responsibilities. Differences in timing afford advantages and disadvantages. | Indirect: Not focused on ERC staff. But one of competencies is to communicate clearly with other medical staff, community resources, and community at large. (Modified BMJ) Low |
| Dickmann, et al., 2015 | Europe | 14 public health and communication | **Training course.** Purpose: to develop competencies of public health program managers and practitioners to analyze, | **Questionnaire.** Post-course assessment not described in detail but 14 of 15 respondents said expectations had been fully met and | Direct (Modified BMJ) Low |
experts working at European Center for Disease Prevention and Control understand and apply risk communication concepts, principles and approaches to prevention and control of communicable disease threats.

A 2-day training course based on idea that rather than providing detailed guidance and listing steps, better to provide participants with a map, the skills and literacy to read the map, and the ability to design own risk communication strategies for their own realities. Days started with reflection sessions introducing terms, definitions, approaches, and giving time for discussion. Afternoon were used to test ideas, work on scenarios, get feedback from others.

14 of 16 stated understanding of concepts and approaches had increased considerably. Overall appreciated that training was based on reflection and reframing rather than tips and checklists.

| Friedman, et al., 2011 | University of South Carolina, U.S. | 24 public health graduate students | **Curriculum.** Purpose: to assess effectiveness of disaster preparedness communication curriculum for public health graduate students’ understanding and use of communication strategies for reaching vulnerable groups with preparedness messages. Training module on health and risk communication had goal of teaching students to apply principles of developing disaster messages for vulnerable, hard-to-reach or at risk populations. Students had lectures and worked in small groups to develop communication plans for these populations, as well as disaster | **Pretest-posttest no control group.** Pretest-posttest 24-item survey with Likert-type responses from 1 to 6. Statistically significant increase in knowledge for 12 of 20 items. Pretest-posttest comparisons regarding communication: understanding difference between health, risk, and crisis communication, 2.42 vs. 3.61, \( p < .001 \); describing chain of communication responses, 1.79 vs. 3.17, \( p < .001 \); identifying list of communication tools and channels, 2.12 vs. 3.87, \( p < .001 \); understanding communication roles of different agencies, 2.12 vs. 3.48, \( p < .001 \); recognize characteristics of a credible spokesperson, 2.71 vs. 3.96, |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | | | | | | |

**Indirect:** Not focused on ERC staff. Training module for public health graduate students in general. (NHLBI tool) Low
preparedness kits and disaster response plans. $p < .001$, understand responsibilities of media during disaster, 2.67 vs. 3.78, $p < .001$, understand relationship between journalists and public health officials, 2.62 vs. 3.61, $p = .003$; understand importance of tailoring messages, 3.54 vs. 4.27, $p = .029$; applying risk communication principles (1.79 vs. 3.74, $p < .001$; understanding risk perception and responding to public concern about risk, 1.79 vs. 3.61, $p < .001$. Majority of students were moderately to strongly satisfied with the module. Answers to qualitative items indicated students learned key principles.

**Heide man, & Hawley, 2006**

Kansas, U.S.

29 allied health professionals and emergency responders

**Needs Assessment and Workshop.**

Purpose: 1) to introduce agencies to best practices for risk communication message mapping, thereby facilitating a collaborative approach to preparedness and response, 2) to provide participants with skills needed to develop risk messages. Needs assessment and train-the-trainer message mapping workshop. Needs assessed done with 26 volunteers in 3 focus groups from a pool of 199 professionals recommended by KDHE. Follow-up 2-day workshop used role-playing, mock interviews, small group interaction, Q & A sessions to increase ERC knowledge.

**Pretest-posttest no control group.**

7-item pretest-posttest evaluation tool with 5-point Likert-type scale. Self-reported knowledge evaluated on risk communication principles and skills. Means analyzed using Wilcoxon signed rank test. Knowledge about developing message maps, 2.03 vs. 4.45, $z = -6.73, p < .001$; knowledge of other concepts, 2.93 vs. 4.31, $z = -4.20, p < .001$; identifying underlying stakeholder concerns, 2.69 vs. 4.17, $z = -5.15, p < .001$; identifying concerns specific to stakeholder group, 2.72 vs. 4.31, $z = -5.38, p < .001$; developing scripted messages for anticipated questions, 2.28 vs. 4.55, $z = -.610, p < .001$; ensuring central repository of consistent messages, 2.41 vs. 4.48, $z = -5.90, p < .001$. Direct (NHLBI tool) Low
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Location</th>
<th>Population</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaming, et al., 2013</td>
<td>U.S.</td>
<td>155 role-players and trainees</td>
<td>Computer simulation for decision-making in pandemic influenza response scenario. Purpose: to introduce personnel to critical decisions involved in handling a pandemic influenza surge and assess their opinion of current preparedness at home institution. Used a Delphi process to finalize an 8-week scenario exercise. Begins with a pre-workshop session. Simulations took place in conference rooms within hospitals where participants could sit at a desk in front of a simulation computer.</td>
<td>Pretest-posttest no control group. 42-item pretest-posttest questionnaire assessing 7 success factors on a scale of 1 to 5. Post-simulation, trainees indicated a statistically greater likelihood of needing to improve their organization in terms of communication, incident planning, public information and training. They also recognized key factors requiring immediate attention at their home facilities. Some indicators moved downward. Perception of facility preparedness for public information increased but was <em>ns</em>: $M_{\Delta} = .11$, $p = .075$; recognition of importance of preparedness for public information increased, $M_{\Delta} = .30$, $p &lt; .001$; recommendation ratings (meaning not explained) for public information increased, $M_{\Delta} = .24$, $p = .001$</td>
</tr>
<tr>
<td>Orfaly, et al., 2005</td>
<td>Harvard School of Public Health, U.S.</td>
<td>Public health students, number not stated</td>
<td>Description of course: “Bioterrorism Preparedness and Response.” Purpose: to integrate practice and theory in a public health graduate course and provide a model for the integration of a practice-oriented approach to preparedness into an academic curriculum. This course features lectures on specific applications of public health practice in emergency preparedness and response. In Questionnaire. All students completed self-administered anonymous course evaluations on the last day of class. 96% of students reported that they would recommend the course to a classmate with similar interests, and 92% of students considered the course superior to other courses they had taken at HSPH. Additionally, 100% considered the course useful to their profession, and 83% thought there was an appropriate emphasis on</td>
<td>Indirect: Not focused on ERC staff. Public information is one element of the simulation but not described.</td>
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</table>
addition, it provides students the opportunity to operationalize and apply their knowledge during an interactive tabletop exercise. Also, looked at quality of student projects.

| Uddin, et al., 2008 | Johns Hopkins, U.S. | General preventive medicine residency students, number not provided | Formalized competency-based all-hazards curriculum. Purpose: to assess student perception of curriculum. Incorporates didactic learning, practicum sessions, a tabletop exercise, and a final integrating project. ERC component is how to talk to people in a disaster. | Questionnaire. Mean overall student rating of the curriculum improved year by year. Overall program rating $M_{2004} = 3.37$ on Likert-type scale of 1 to 5, where 1 = poor and 5 = excellent; $M_{2005} = 3.67$; $M_{2006} = 4.02$. Students also gave positive qualitative feedback. External stakeholders evaluated projects as high in quality. | CDC but nowhere else in article Indirect: Not focused on ERC staff. For medical residency students. One unit on ERC, but not well described. (Modified BMJ) Low |
| Valesky, et al., 2011 | South Africa | Tabletop exercise. Purpose: to identify vulnerability in safety, security, communications, supplies, incident management, surge capacity. Conducted by SUNY in conjunction with 9 hospitals in Cape Town, South Africa in anticipation of 2010 FIFA World Cup. Simulated stampede and crush-type disaster at stadium. 10-week, scenario-based drill conducted by email. After each scenario was sent, hospitals had 3 days to collect answers and submit responses to drill controllers. | Questionnaire. Questions were sent weekly. Focused on areas of disaster preparedness highlighted in the Hospital Emergency Analysis Tool. Contact persons were each responsible for hospital’s disaster plan. Had to use all resources necessary to answer questions as accurately and promptly as possible. Items encompassed 6 major categories of disaster preparedness via 105 yes/no questions. Also, hospitals’ call-down-lists were submitted as well as a detailed “Hazard Vulnerability Analysis.” Met 72% of overall criteria examined. Highest scores were in areas like equipment, development of a major incident plan. Lowest scores were in public relations/risk communication. % meeting | Indirect: Not focused on ERC staff. ERC is one of the objectives of the study and results are pulled out, though not in detail. (Modified BMJ) High |
Communication capacity requirements (95% CI) at the 9 hospitals were: 85% (57%-97%); 85% (57%-97%); 69% (42%-88%); 46% (23%-71%); 100% (73%-100%); 69% (42%-88%); 54% (29%-77%); 62% (35%-82%); 62% (35%-82%).

### Qualitative Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Population</th>
<th>Exercise Type</th>
<th>Purpose</th>
<th>Findings</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dausey, et al., 2006</td>
<td>Nationwide, U.S.</td>
<td>Not described</td>
<td><strong>Tabletop exercises.</strong></td>
<td>Purpose: exercises focused on at least one of 3 related objectives: training, relationship-building, and evaluation. Lessons from 4 projects, including 31 tabletop exercises in partnership with state and local health departments. Designed with substantial collaboration with representatives from participating health departments to assure scenarios were credible. Focused attention on local preparedness needs and priorities. Exercises varied but were 2 to 8 hours long, had 10 to 40 participants, different agencies attended, different disasters used, different levels of facilitator involvement. All had “hot washes” and AARs.</td>
<td><strong>Qualitative.</strong> Tabletops benefit from collaborative planning with involved stakeholders from participating health departments and exercise developers and facilitators. The exercises identified both strengths and vulnerability in emergency preparedness, but additional work needed to develop reliable metrics to gauge exercise performance, inform follow-up action steps, and develop evaluation exercise designs to assess impact. ERC expertise was identified as needed to improve communication with vulnerable populations. Participants also completed questionnaire with structured and semi-structured questions but results of these were not reported.</td>
<td>Indirect: Not focused on ERC staff. Audience is general public health department workers but communication with vulnerable population cited as recurring issue. (CASP) Low</td>
</tr>
<tr>
<td>Lurie, et al., 2008</td>
<td>VA facilities throughout U.S.</td>
<td>Unspecified number of VA employees</td>
<td><strong>Tabletop exercises.</strong></td>
<td>Purpose: to enhance Veterans Affairs planning and preparedness for pandemic influenza. A series of 6 exercises for</td>
<td><strong>Qualitative.</strong> Immediately after each exercise RAND-VA team reviewed issues identified in exercise. Using checklist to guide discussion discussed strengths and weaknesses of participants’ pandemic</td>
<td>Indirect: Not focused on ERC staff. Audience is policy (CASP) High</td>
</tr>
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</table>
facilities, regions, and the VA Central Office (VACO) piloted for use throughout the Veterans’ Administration system. Involved a 3-step scenario about an unfolding pandemic. Exercise took about 6 to 8 hours and participants played themselves. Involved 3 groups: VACO policy staff, Veterans Integrated Service Networks employees, representative, and individuals charged with coordination of VA health care system emergency response. Followed by decision-making session led by the VA deputy secretary and VHA senior leadership staff.

Preparedness. Because reliable and valid scoring methods for tabletops have not been developed did not rate levels of preparedness for various sites. Also conducted qualitative analysis of observer notes and AARS using content analysis. Existing communication and coordination for pandemic influenza between VA system reps and local and regional emergency planner limited. Need consistent messaging at community level. Large systems may wish to coordinate communication with public health and emergency management agencies.

Malet & Korbitz, 2015  
Pueblo, Colorado, U.S.  
43 local, state, and federal emergency response professionals and public officials  
**6-month risk communication simulation.** Purpose: to investigate attitudes toward risk communication and emergency preparedness over time. Scenario had near-simultaneous release of anthrax spores in recreation area and also regional water supply, as well as foot and mouth disease virus at state fair. Time frame mirrored cleanup of 2001 anthrax attacks. People participated from own offices and spaces. Input via email.  
**Qualitative.** Knowledge was assessed by actions taken. Participants not necessarily familiar with best practices. State and local appeared less prepared than federal employees who assumed they would be sidelined by federal officials anyway in the event. Need to work on trust between agencies. Clear preference for reducing residential risk to zero even when that was extremely disruptive. Also, respondents sense of hopefulness or hopelessness about event affected response. Information related to bioterrorism response should be provided to agencies that do not normally work in public health but would be involved in a crisis.

Sand-Svartedal, Sweden, Three  
**Tabletop exercise to evaluate**  
**Qualitative.** Assessed qualitatively

<table>
<thead>
<tr>
<th>Source</th>
<th>Setting</th>
<th>Participants</th>
<th>Method</th>
<th>Type of Study</th>
<th>Quality Assessment</th>
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</thead>
<tbody>
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<td>Malet &amp; Korbitz, 2015</td>
<td>Pueblo, Colorado, U.S.</td>
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<td>Direct (CASP) Low</td>
</tr>
<tr>
<td>Sand-Svartedal, Sweden, Three</td>
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<td></td>
<td><strong>Tabletop exercise to evaluate</strong></td>
<td><strong>Qualitative.</strong> Assessed qualitatively</td>
<td>Indirect: (CASP) Low</td>
</tr>
<tr>
<td>Study</td>
<td>Region</td>
<td>Participants</td>
<td>Purpose</td>
<td>Setting and Methodology</td>
<td>Findings and Conclusions</td>
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<tr>
<td>ström, et al., 2014</td>
<td>Europe</td>
<td>separate evaluations: 3 healthcare professionals with higher command and control positions, 40 practitioners, 35 international healthcare professionals</td>
<td><strong>tool.</strong> Purpose: to evaluate the tool. Presents a tool for chemical, biological, radiological, or nuclear releases. Risk communication was one component. Set of exercise cards presented and tested with 3 different groups of healthcare professionals of different sizes, nationalities, and background.</td>
<td>by 3 groups of emergency preparedness and healthcare professionals. It is important to have a highly professional exercise director, the concept is highly flexible, but works best with a smaller, homogenous group. In large and heterogeneous forums it can raise awareness. Overall a useful and flexible tool for simplifying tabletop exercises.</td>
<td>Not focused on ERC staff. Small component of ERC mentioned in the exercise but not described.</td>
</tr>
<tr>
<td>Savoia, et al., 2012</td>
<td>U.S.</td>
<td>Content analysis: number of original participants not recorded</td>
<td><strong>After Action Reports.</strong> Purpose: to analyze how lessons learned from the response to real-incidents may be used to maximize knowledge management and quality improvement practices such as the design of public health emergency preparedness exercises. Conducted a structured review of after action reports (AARs). Researchers used as a source of data the &quot;Lessons Learned Information Sharing (LLIS.gov)&quot; system, a joined program of the U. S. Department of Homeland Security, DHS, and FEMA that serves as the national, online repository of lessons learned, best practices, and innovative ideas.</td>
<td><strong>Qualitative.</strong> Suggest a nationally aggregated pool of AARs be used by practitioners. That way people do not need to relearn lessons from other people’s exercise experiences. Multiple themes identified when analyzing content of AARs. Identified weaknesses in the way AARs are developed.</td>
<td>Indirect: Not focused on ERC staff. ERC one element of exercises but not described in findings.</td>
</tr>
<tr>
<td>Palttala &amp; Vos, 2011</td>
<td>Finland</td>
<td>13 expert-practitioners. At least 5</td>
<td><strong>Measurement system with performance indicators for crisis communication in large-</strong></td>
<td><strong>Instrument development.</strong> A series of interviews with experts revealed instrument looked useful and</td>
<td>Direct (COSMIN Checklist) Low</td>
</tr>
</tbody>
</table>

**Instrument Development**
Managers of: 2 ministries, 2 cities' central administrations, 2 rescue departments, 2 hospitals

**Scale emergencies.** Purpose: to test the validity of the measurement system. The instrument was developed inductively by surveying experts. It contains 63 performance indicators (18 for preparation phase, 8 for warning, 20 for response, 12 for reconstruction, 5 for evaluation). Can be used to conduct a preparedness audit, test crisis communication plan, evaluate communication in a preparedness exercise or in actual crisis situation.

Indicators were considered relevant and important but too many in number. Therefore, a possibility to use the instrument in 3 separate parts, relating respectively to the period before, during and after a crisis, should be offered.

| Savoia et al., 2009 | Massachusetts and Maine, U.S. | 179 public health officials | **Performance measurement tool for tabletop exercise participants.** Purpose: to assess reliability and validity of instrument. Instrument addresses 5 public health capacities: 1) leadership and management, 2) mass casualty care, 3) communication, 4) disease control and prevention, and 5) surveillance and epidemiology. Items tested in 3 tabletop exercises with public health officials. | **Instrument development.** Alpha coefficients were .81 or higher for all 5 domains. 5-factor solutions from principal components analysis accounted for 60% of total variance. Inter-rater agreement of expert evaluators good to high. The tool could be useful to provide a standard measure of effectiveness of Tabletop exercises. | Indirect: Does not focus on ERC staff. Although the instrument also assesses other domains, there is an ERC subscale. (COSMIN Checklist) High |

*Note: Many studies with quantitative components did not report inferential statistics, and among those that did, many provided only partial information. All information supplied that is relevant to the objective of the current review is listed in the table.*
Synthesis of Findings Within Research Stream and Evaluation of Certainty/Confidence

Review findings from the first phase of the review synthesis are presented by methodological stream in Table 5. The table displays the CERQual summary of findings for the mixed method/case study and qualitative streams, and the GRADE quality evaluation of the observational quantitative research stream. (See Appendix H for the CERQual evidence profile for mixed method studies, Appendix I for the GRADE evidence profile for quantitative studies, and Appendix J for the CERQual evidence profile for qualitative studies). Note that several findings do not have to do with what makes training effective. Rather they describe what is actually happening in current training programs.

Table 5. CERQual and GRADE Summary of Findings Table by Research Stream

<table>
<thead>
<tr>
<th>Review Finding</th>
<th>CERQual Assessment of Confidence or GRADE Quality of Evidence Rating¹</th>
<th>Explanation of CERQual or GRADE Assessment</th>
<th>Studies Contributing to the Review Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mixed Method/Case Study Research Stream</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency risk communication training should include a focus on coordinating federal, state, local, and community agencies and personnel. This has been shown to be the case in U.S.-based studies with state health departments. The same may be true for multi-national exercises. There is evidence from the Middle East, Asia, and Africa that countries can work together to conduct successful exercises. In fact, participants in these countries said more sectors should have been involved. In a tabletop exercise involving federal and state agencies as well as universities in 7 southeastern U.S. states, it was concluded that inter-agency relationships needed to be established ahead of time to facilitate communication, and ERC was a key component. Other studies situated in the U.S. noted weakness in the exercise due to lack of participation by personnel from other agencies, and also found value in heads of different agencies meeting in an environment that promoted inter-agency cooperation.</td>
<td>Moderate</td>
<td>Moderate concerns about methodological limitations and adequacy of data. Recommendations across studies based on large scale simulations. Indirect relevance in most studies.</td>
<td>Dausey &amp; Moore, 2014; Freimuth et al., 2008; High et al., 2010; Madden et al., 2013; Morris, et al., 2012</td>
</tr>
</tbody>
</table>

¹GRADE principles were adapted for application to descriptive quantitative studies and GRADE CERQual principles were applied to qualitative and mixed-method studies. Neither adaptation has been approved by the tool originators.
Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. This has been suggested in tabletop exercises in the U.S., Norway, and also multi-national exercises conducted across the Middle East, Asia, and Africa. In the Middle Eastern, Asian, and African countries, however, participants rated exercises lowest in revealing gaps in preparedness in their own agencies. In contrast, an exercise involving local health district risk communicators in the U.S. found that participants had greater difficulty following ERC principles under the time pressures of a realistic and stressful simulation than they did in a tabletop exercise. Participants did report highly enhanced awareness, readiness, and knowledge after the real-time simulation. Although most of the exercises in studies synthesized were conducted in the agency context, a Belgian university also found self-reported improvements among masters-level business communication students after a crisis simulation exercise.

Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media. Players in a simulation exercise in the U.S. that included state and federal agencies and universities saw need to be prepared with a contingency press statement. Also in the U.S., a real-time exercise with local health department risk communicators using performance indicators found that participants could not always translate knowledge of principles into actions under time pressure, especially expression of empathy and less use of bureaucratic speech. Talking points were not shared with hospitals and other agencies, and participants did not adequately monitor media developments. Additionally, notification lists were often used indiscriminately and needed auditing for current details, and most would not be able to be used by back-ups in their current format. Researchers with a multi-agency tabletop exercise in the U.S. concluded that one error in the set-up of the exercise had been the failure to have a media presence. Because tabletops attempt to create a comfortable environment, inclusion of media may be perceived as threatening, but without it critical gaps in planning will not be revealed. A

<table>
<thead>
<tr>
<th>Quality</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Some concern about coherence in data about tabletops, and serious methodological limitations. Indirect relevance in most studies.</td>
<td>Aertsen et al., 2013; Dausey &amp; Moore, 2006; Freimuth et al., 2008; High et al., 2010; Morris, et al., 2012; Wahl et al., 2015</td>
</tr>
<tr>
<td>Moderate</td>
<td>Based on two moderate quality and two low quality studies.</td>
<td>Freimuth et al., 2008; High, et al., 2010; Morris, et al., 2012; Wahl et al., 2015</td>
</tr>
</tbody>
</table>
A nationwide foodborne outbreak simulation in Norway found this was an especially critical need in head offices as opposed to regional and local levels, perhaps because those offices have both a more complex task and are more concerned with strategic and political aspects of media relations.

Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension, especially for special needs and vulnerable populations. A real-time risk communication simulation in the U.S., noted that in response to a request from a local pastor for Spanish language material, although most local health departments had material available, only about 1/3 had a process in place for translating English material into Spanish. An exhaustive review of existing risk communication training programs in the U.S. found that little current training is devoted to meeting the informational needs of special needs and vulnerable populations even though risk communication experts recommend that this should be a priority.

Based on two studies with only minor methodological limitations, however, one study is purely descriptive. Freimuth et al., 2008; Madden, et al., 2013

Little current training is offered in blended online-face-to-face formats even though ERC experts largely called for trainings that combine online and offline delivery methods. Only 1 out of 173 trainings content analyzed in the U.S.A. was presented in a blended format. In a study in China, strong preference was indicated by participants in an online modular training for a face-to-face format.

Moderate Minor concerns about methodological limitations and based on a single study. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S. and interviews of 140 risk communication experts across the U.S.A. Madden et al., 2013; Shao

Few current training programs in ERC included instruction on use of social media even though nearly half of ERC experts reported having that type of training. Only 6.5% of trainings analyzed included a unit on using social media to communicate with the public.

Moderate Minor concerns about methodological limitations and based on a single study. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S. and interviews of 140 risk communication experts across the U.S.A. Madden et al., 2013
Only a minority of ERC training is hazard-specific, even though the overwhelming majority of experts agree that messages should differ by hazard type.

Moderate

Minor concerns about methodological limitations and coherence, and based on a single study. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S. and interviews of 140 risk communication experts across the U.S.

Madden et al., 2013

Only a small minority of trainings address ERC evaluation. This was reported both by experts interviewed and also observed in trainings analyzed. Only 25.9% of analyzed trainings taught learners to develop performance assessment measures or discussed the need to evaluate ERC plans and performance.

Moderate

Minor concerns about methodological limitations. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S. and interviews of 140 risk communication experts across the U.S.

Madden et al., 2013

### Quantitative Research Stream

Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. This was the case in a multi-county electronic infectious disease exercise in the U.S., an online simulation of a pandemic influenza outbreak in 7 U.S. hospitals, an emergency preparedness curriculum at Johns Hospital General Preventive Medicine Residency, an electronic tabletop exercise with hospitals in South Africa, pandemic preparedness exercises used in 4 U.S. medical schools, piloting of an ERC curriculum on risk communication, and piloting of a disaster communication curriculum for public health students in the U.S.

+ooo *

Very serious methodological limitations and imprecision in all but one study, serious indirectness

Ablah, et al., 2007; Carney, et al., 2011; Dickmann, et al., 2016; Friedman, et al., 2011; Leaming, et al., 2013; Uddin et al., 2008; Valesky et al., 2011

Evaluation and training for emergency and disaster preparedness should include an

+ooo

Very serious methodological

Carney, et al., 2011; Dickmann et
emphasis on communication with the media. This was an assumption confirmed in a US-based hospital simulation of a pandemic influenza outbreak. Also in the U.S., an assessment of allied health professionals’ most pressing communication needs in the rural state of Kansas pointed at message mapping for media, which was implemented in a pilot train-the-trainer workshop. An assessment of hospital preparedness for the 2010 FIFA World Cup in South Africa found preparedness for risk communication and public relations to be among the lowest areas assessed. Pandemic preparedness exercises in 4 U.S. medical schools include roles for media and public information officers in simulations; similarly, a disaster communication curriculum for public health students in the U.S. has objectives related to understanding media roles in a disaster. The European Center for Disease Control and Prevention has identified ERC as a core competence in infectious disease management and incorporated it into development of a training curriculum and program.

Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension. Pandemic preparedness exercises in 4 U.S. medical schools include roles for special needs populations to interact with other public health, medical, and media personnel. Similarly, a disaster communication curriculum for public health graduate students in the U.S. had an objective related to communication needs of vulnerable populations. Also in the U.S., needs assessment of allied health professionals’ most pressing communication needs in Kansas called out unique needs in communication with rural publics.

Qualitative Research Stream

| ERC training should include a focus on coordinating federal, state, and local agencies and personnel. A report of 31 tabletop exercises conducted with U.S. state and local health departments concludes that exercises should be designed collaboratively with input from health departments and participating outside agencies. However, many of these same agencies did not have established relationships with community         | Moderate | Substantial methodological limitations. Moderate concerns about data adequacy and relevance but data consistent across studies and in a range of contexts. | Dausey et al., 2006; Lurie, et al., 2011; Malet & Korbitz, 2015 |
| +ooo Very serious methodological limitations and imprecision in all but one study, serious indirectness | Carney, et al., 2011; Friedman et al., 2011; Heideman & Hawley, 2007 |
leaders or organizations that could serve as messengers or communication channels. In several states, law enforcement and EMS personnel had greater familiarity and were more trusted. Similarly, in the U.S., joint planning between Veterans Affairs (VA) offices and community agencies is needed for consistency in messaging at the community level. The VA is a federal system, but integrated at other levels as well. This finding was suggested to be relevant to other integrated health care systems because coordination of messages between federal, state, local, and community agencies may be challenging in a pandemic. Also in the U.S.A., in a 6-month risk communication exercise local and state government agency personnel were not as familiar with risk communication protocol as federal officials, tended to defer to federal officials but also distrust them. A tabletop exercise bringing together U.S. federal and local public health agencies and universities in 7 southeastern states concluded that universities could be leveraged in case of a foodborne outbreak because universities have unique assets.

Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. Self-reported gains in a health department and university joint exercise included increased understanding of own role and that of others, identification of agency strengths, weaknesses, gaps in planning, increased ability to build relationships across agencies. A report on a specific tabletop tool tested in Sweden drew similar conclusions. A study of multiple tabletop exercises in multiple U.S. states concluded that exercises should be as realistic as possible, designed to achieve a specific objective, have a limited number of participants, and have forced and time delineated decision making.

Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media. In a set of tabletop exercises held in several U.S. states with state and local health departments, few departments were proactive in their contacts with media. Most waited until they were contact to start communicating with the public, meaning they often responded.
defensively and had trouble quickly formulating an initial message that was clear, informative, and alleviated anxiety.

Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension. State and local health departments in various U.S. states expressed uncertainty about how to effectively communicate with vulnerable or underrepresented population groups in their jurisdictions. Some departments did not even have language capabilities to communicate with these groups. In a 6-month simulation exercise in the U.S.A., both federal and state officials had difficulty working with rural populations who have been found to be less receptive to what they view as external interventions.

Typical After Action Reports use vague, non-specific statements about exercise failure areas and lack root causes analysis of response challenges. They are also typically accessible only in the immediate geographic region. All of this makes it difficult to aggregate lessons learned from this type of training to other agencies.

*Key to GRADE quality indicators: +ooo = very low quality, ++oo = low quality; +++o = moderate quality; ++++= high quality

**Instrument Development Articles**

Two articles in the review focused on the development of instruments to evaluate training results. These instruments are intended to be adaptable for training activities in a variety of crisis contexts. Because instrument development pieces do not lend themselves to thematic analysis across studies, we briefly describe each article here. These two articles are, however, incorporated into themes in the final synthesis.

Palttala and Vos (2011) developed and tested an instrument for promoting organizational learning. Organizational learning in response to crises is recognized as an essential step in building resilience for future crises. The instrument is designed to provide a framework (scorecards) for evaluating organizational performance. Thus, the instrument creates an efficient means for establishing lessons learned.

Savoia et al.’s (2011) article presents an instrument for testing an organization’s capacity for responding to a crisis, including ERC networks. This type of instrument gives organizations a sense of their strengths and weakness before an actual crisis occurs. If organizations heed the warnings of these pre-event assessments, they have the potential to enhance both their response capacity and resilience before experiencing an actual crisis.
Synthesis of Data Across Methodological Streams

The greatest portion of literature identified consists of single case interventions without comparison groups, evaluated in various ways. In most of these studies, evaluation seems to be intuitive, i.e., “We know this works because we saw it.” Rigor of evaluation was mostly poor and only vaguely described. It is perhaps not surprising that findings across methodological streams for this type of study are similar. Table 6 presents a synthesis across streams for all findings.

Table 6. Findings Synthesized Across Methodological Streams

<table>
<thead>
<tr>
<th>Review Finding</th>
<th>Studies Contributing to Finding</th>
<th>Across Methods Certainty/Confidence Evaluation of Synthesized Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency risk communication training should include a focus on coordinating federal, state, local, and community agencies and personnel. This message was consistent across a range of exercise and agency types, and is one of the most frequent themes appearing across methodological streams, though sometimes the point was made in after-exercise debriefings, when lack of collaborative opportunities was cited as a weakness of exercise design. This has been shown to be the case in U.S.-based studies with local, state, and federal health department participants. One U.S.-based study also found that universities brought unique resources to collaborative preparedness efforts, but most studies focused on the need for coordination of messages between federal, state, and local agencies. Levels of knowledge have been found in several U.S.-based studies to differ between local, state, and federal agencies. A few studies also added a focus on collaboration with community agencies, organizations, and leaders, although these actors were more commonly viewed as a target of communication rather than a partner. In one U.S.-based study it was noted that law enforcement and EMS personnel had great familiarity and were more trusted by the community than public health personnel. Several studies concluded that inter-agency relationships needed to be established ahead of time to facilitate communication and that ERC was a key component. This type of collaboration has been urged in both tabletop exercises and more complex real-time simulations. The same may be true for multi-national exercises. There is evidence from the Middle East, Asia, and Africa that countries can work together to conduct successful exercises. In fact, participants in these nations gave feedback that more governmental sectors should have been involved in exercises.</td>
<td>Ablah, et al., 2007; Daisey &amp; Moore, 2014; Daisey et al., 2006; Freimuth et al., 2008; High et al., 2010; Lurie, et al., 2011; Madden et al., 2013; Malet &amp; Korbitz, 2015; Morris, et al., 2012</td>
<td>CERQual Multi-method studies: Moderate CERQual Qualitative studies: Moderate OVERALL: Moderate</td>
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</tbody>
</table>
Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. It is important to note that the outcome measures in this theme are all self-reported; the most common measurement of success across the studies analyzed was simply asking participants if they thought they had benefitted from the experience. This finding has been reported in tabletop exercises in the U.S.A., Norway, Sweden, and in simulations in U.S. hospitals, medical schools. The same self-reported improvement has been demonstrated in multinational exercises conducted across the Middle East, Asia, and Africa. In the Middle Eastern, Asian, and African countries, however, participants rated exercises lowest in revealing gaps in preparedness in their own agencies. A few qualitative studies used behavioral performance indicators rather than self-report measures, and a number used reports by trained observers. Little information is available about what characteristics make exercises successful, however. A study of multiple tabletop exercises in multiple U.S. states concluded that exercises should be as realistic as possible, designed to achieve a specific objective, have a limited number of participants, and have forced and time delineated decision making, although these conclusions were not tested as such. Among the few specific findings about key factors in successful training, an exercise involving 17 local health district risk communicators in Georgia, U.S.A., found that participants had much greater difficulty following risk communication principles under the time pressures of a realistic and stressful simulation than they did in a tabletop exercise. Participants did report highly enhanced awareness, readiness, and knowledge after the real-time simulation but they also made many errors.

Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media. Because tabletops attempt to create a comfortable environment, inclusion of media may be perceived as threatening, but without it critical gaps in planning will not be revealed. In other studies training and assessment in media and communication with the public were included as objectives, but found to be areas in which preparation was wanting. Issues identified in U.S.-based exercises include: participants not always able to translate knowledge of principles into actions under time pressure; forgetting to include expression of empathy and using too much bureaucratic speech; media talking points not shared with hospitals and other agencies; participants not adequately monitoring media developments; notification lists often used indiscriminately, needing auditing for current details, and not usable by back-ups in their current format; departments not being proactive in their contacts with media but waiting until they were contacted to start communicating with the public, meaning they often responded defensively and had trouble quickly formulating an initial message that was clear, informative, and alleviated anxiety. In South Africa, hospital preparedness for risk communication and public relations was found to be among the lowest preparedness of areas assessed. Evidence from Norway found training in media use in a foodborne outbreak simulation was an

| Ablah, et al., 2007; Aertsen et al., 2013; Carney, et al., 2011; Dausey et al., 2006; Dausey & Moore, 2014; Dickmann et al., 2016; Freimuth et al., 2008; Friedman, et al., 2011; High et al., 2010; Leaming, et al., 2013; Morris, et al., 2012; Sandstrom et al., 2014; Uddin et al., 2008; Valesky et al., 2011; Wahl et al., 2015 |
| Carney, et al., 2011; Dausey et al., 2014; Dickmann et al., 2016; Freimuth et al., 2008; Friedman et al., 2011; Heideman & Hawley, 2007; High, et al., 2010; Leaming, et al., 2013; Malet & Korbitz, 2015; Morris, et al., 2012; Valesky, et al., 2011; Wahl, et al., 2015 |

CERQual Multi-Method studies: Low
GRADE: Very low
CERQual Qualitative studies: Low
OVERALL: Low to Moderate
especially critical need in head offices as opposed to regional and local levels, perhaps because those offices have both a more complex task and are more concerned with strategic and political aspects of media relations. The need for inclusion of media in training is also assumed by curricula in several U.S. medical schools, a graduate program in public health, and a training curriculum and program in ERC developed by the European Center for Disease Control and Prevention.

<table>
<thead>
<tr>
<th>Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension. An exhaustive review of existing risk communication training programs in the U.S.A. found that little current training is devoted to meeting the informational needs of special needs and vulnerable populations even though risk communication experts recommend that this should be a priority. This issue was generally a secondary rather than a primary theme in synthesized studies, and appeared only in U.S.-based trainings. It was briefly mentioned in medical school and graduate public health curricula. Local health departments in various U.S. states have expressed uncertainty in exercises and tabletops about how to effectively communicate with vulnerable or underrepresented population groups in their jurisdictions. Some departments did not even have language capabilities to communicate with these groups. In the U.S., rural populations were sometimes considered to be special needs. Both federal and state officials had difficulty working with rural populations, who have been found to be less receptive to what they view as external interventions.</th>
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<tr>
<td>Carney, et al., 2011; Dausey et al., 2014; Dickmann et al., 2016; Freimuth et al., 2008; Friedman et al., 2011; Heideman &amp; Hawley, 2007; Madden, et al., 2013; Malet &amp; Korbitz, 2015</td>
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<tr>
<th>Typical After Action Reports in the U.S. use vague, non-specific statements about exercise failure areas and lack root causes analysis of response challenges. They are also typically accessible only in the immediate geographic region. All of this makes it difficult to aggregate lessons learned from this type of training to other agencies. Although only 1 study investigated this issue specifically, authors of another study reached the same conclusion after assessing their own results. Both concluded that it would be helpful to ensure that compilation reports of best practices are actively disseminated to local government agency heads and public information officers, although the outcome of doing so was not tested.</th>
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<tr>
<td>Malet &amp; Korbitz, 2015; Savoia, et al., 2012</td>
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<tr>
<th>Little current training is offered in blended online and face-to-face formats even though ERC experts largely called for trainings that combine online and offline delivery methods. Only 1 out of 173 trainings content analyzed in the U.S. was presented in a blended format. However, we observed mixed modal formats in the graduate level disaster preparedness courses. Yet format may make a difference. Participants in an online training program in China expressed a strong preference for face-to-face training.</th>
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<tr>
<td>Madden et al., 2013; Shao, 2014</td>
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<tr>
<th>Few current training programs in ERC included instruction on use of social media even though nearly half of risk communication experts reported having that type of training. Only 6.5% of trainings</th>
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<tr>
<td>Madden et al., 2013; Malet &amp; Korbitz, 2015</td>
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analyzed included a unit on using social media to communicate with the public. This is confirmed in a 6-month exercise involving federal, state, and local agencies in the U.S.; many state and local officials were not familiar with social media platforms or did not find them relevant to their job roles. Most studies did not mention social media one way or another, which may be an indication that it had a low or non-existent priority for exercise facilitators.

| Only a minority of risk communication training is hazard-specific, even though the overwhelming majority of experts agree that messages should differ by hazard type. This description of the state of U.S.-based emergency risk communication was derived from an exhaustive analysis of content of existing training programs. Concern that messaging differs by hazard was a driving factor in the development by a group of Swedish researchers of a tabletop exercise tool using cards which specifically dealt with threat posed by releases of chemical, biological, radiological, or nuclear materials. | Madden et al., 2013; Sandstrom, et al., 2012 | CERQual Multi-method studies: Moderate OVERALL: Moderate |

| Few training programs include training in evaluation. Only a small minority of trainings address ERC evaluation. This was reported both by experts interviewed and also observed in trainings analyzed. Only 25.9% of analyzed trainings taught learners to develop performance assessment measures or discussed the need to evaluate ERC plans and performance. This theme emerged only in the multi-method stream, however single studies in other streams and the presence of two instrument development articles also reinforce the point. The paucity of evaluation tools has been noted not only in the U.S., where most studies have been conducted, but also in the Middle East, Asia, and Africa. One particular aspect of lack of evaluation noted is that U.S. local and state health departments in multiple tabletop exercises were found to have identified gaps in preparedness in previous studies but never have addressed them after the exercise ended because of lack of time, or lack of knowledge about how to make changes. Authors of two U.S.-based studies assert that exercises should always conclude by having health departments prioritize challenges identified and create action plans to address up to 3 of them. | Dausey et al., 2006; Dausey & Moore, 2014; High et al., 2010; Madden et al., 2013; Palttala & Vos, 2011; Savoia, et al., 2011 | CERQual Multi-method studies: Moderate OVERALL: Moderate |
DISCUSSION

Summary of Findings

This WHO-commissioned evidence synthesis of research on effectively communicating risk during health emergencies focused specifically on developing and sustaining ERC staff capacity for preparedness and response. A total of 24 relevant studies were identified, appraised for quality, and used for data extraction. Findings statements were formulated within methodological streams, and then synthesized across methods to provide an overview of available information and its relevance to best practices for establishing and maintaining staff capacity to respond to crisis events.

The majority of studies found were based on exercises involving tabletops, simulations, and, in a few cases, coursework or workshops. Findings synthesized across methodological streams indicate these exercises should be focused on coordinating across agencies, building skills in dealing with media, and designing messages sensitive to audience needs and comprehension. The general consensus in the literature is that tabletop and simulation exercises can and often do improve awareness and understanding.

These findings, however, come with major caveats. Limitations in methodological rigor, relevance, and adequacy of data for most findings were moderate to severe. Among the prescriptive findings identified in the review, only the suggestions that exercises should focus on coordination across agencies and incorporate training in media can be held with even a moderate level of confidence.

Some confidence can be placed in descriptive findings about current norms in ERC training. Synthesis across all methodological streams indicates that current trainings generally do not employ after action reports in a way that can promote generalized learning, contain little instruction on using social media, are mostly disaster-general, almost never employ blended online and face-to-face formats, and rarely include training in evaluation. Because these findings are descriptive, however, they can only suggest directions for future research. Separate investigations will have to be undertaken to determine what influence each of these factors has on ERC skills.

In sum, large gaps are evident in the knowledge base regarding the objective of this systematic review. We conclude that insufficient evidence exists to determine what interventions or practices are most effective in developing and sustaining capacity of ERC staff. Few studies address the issue, and most of those that do suffer from serious methodological imprecision.

Results Compared to Findings of Literature in General Disaster Preparedness

No moderate or high quality existing systematic reviews were identified that were directly, indirectly, or partially relevant to training for emergency risk communication staff capacity. However, it is worth noting that scholars in emergency preparedness training and development more broadly have identified a general lack of rigor in studies of emergency preparedness
training. They have observed that few standardized assessment tools exist (Gallardo, et al., 2015) and control groups are rarely used (Beerens & Teyler, 2016). This makes it difficult to determine whether anecdotal success of drills, workshops, courses, and other types of training translate into actual additional skills and knowledge (Williams, Nocera, & Castel, 2008). Also worth noting in the broader literature is that published evaluations of disaster preparedness training and staff development are mostly confined to the United States, meaning that even if research designs were more robust, findings might not necessarily be applicable to other national contexts. The present review noted similar shortcomings in ERC training literature.

**Limitations**

Although considerable effort was dedicated to searching grey literature and international data bases for this review, as well as contacting international experts, the possibility remains that some description of efforts to enhance staff ERC capacity exists in low and middle income countries using formats not discovered in this review. However, it is worth citing one of the few studies we located that reported results from other than high-income nations: “The results [of exercises outside of the United States] may be reported directly to exercise participants but often don’t make it to the scientific literature. If the results from exercises are published in any systematic way, they often get published in in-house publications for domestic audiences. . . The incentives, financial or otherwise, for researchers to turn these in-house publications into scientific papers are limited” (Dausey & Moore, 2014, p. 476).

**Gaps in Existing Research**

The main gap evident in the reviewed literature is an overwhelming lack of focus on emergency risk communication. That is, emergency, risk, and crisis research may include communication as a single piece of a much broader analysis, but rarely treats it as the primary dimension of research interest. Thus, existing evidence on how best to develop and sustain capacity in ERC staff is thin, and it is difficult to avoid concluding there has been a lack of interest in determining factors that contribute to training effectiveness. Beyond this, gaps in the currently available evidence can be categorized into two major issues: lack of diversity in context and lack of methodological rigor.

**Diversity of Context Issues**

*Insufficient consideration of equity issues*

There is a lack of research focus on diverse populations (e.g., international, cultural, religious, underserved). Research is primarily from the United States, and secondarily from Europe. This is a serious loss to our knowledge base. Low and middle income nations are increasingly recognizing the importance of being able to respond quickly and effectively to public health emergencies, and evidence about training techniques gathered in high-income contexts may not transfer well. Even in U.S.-based studies attention is seldom focused on vulnerable populations. The notable exception to this is residents of rural areas.
Inadequate diversity of organizational contexts
Our findings indicate that a focus on collaboration between agencies is an important element of training, and indeed many studies reported on ERC preparedness training that involved multiple organizations. However, there is an anemic spread across organizations types. Many studies were hospital-based, or included hospital personnel. A substantial number included participants from state and local health departments. Fewer included involvement of federal agencies. Very few incorporated participation of community- or faith-based organizations on the ground.

Little diversity of hazard specific trainings
The bulk of studies identified either focused on infectious disease outbreaks or were disaster-general in nature. Exercises centered on other hazards with implications for public health, such as terrorist incidents and chemical and nuclear threats were much less common. Natural disasters such as fires, floods, hurricanes, tornados, and volcanos were not represented at all in the studies synthesized.

Methodological Issues

Few behavioral outcome measures
By far the largest proportion of studies used self-reported measures of changes in awareness, knowledge or skills to evaluate the success of the interventions. Most were in the form of Likert-type items, sometimes observed both pre- and post-exercise, often post-exercise only. Performance indicators were rarely used and few attempts were made at developing assessment rubrics.

No long-term or comparative outcome assessment
Existing research is short term and cross sectional. Long-term changes in ERC skills were not measured, even though the ultimate goal of training in ERC must be to increase skills and resources for the long haul. Furthermore, no studies identified in this review employed any type of comparative design.

Little organizational-level assessment
The preponderance of studies assessed in this review measured individual gains in ERC preparedness. Gains in ERC capacity at the organizational level were rarely assessed, although some exercises did report identifying gaps in organizational preparedness via self-report of individual members. Organizational-level indicators like staff satisfaction, turnover, and retention were not investigated in any of the studies.

Lack of purposeful/actionable recommendations
Attention was given to describing activities rather than to designing studies that would produce generalizable, actionable recommendations for similar training exercises. Evaluation of any sort frequently appeared to be an afterthought. A few
studies evaluated the pedagogical value of the exercises they used and made generalizable recommendations, but they were the exception.

Recommendations

Given the insufficiency of evidence we conclude that additional research must be conducted before guidelines for how to most effectively train ERC staff can be established. We recommend the following directions for future research, based on gaps identified in existing research as well as the findings from the evidence synthesis which can be held with a moderate degree of confidence.

Diversity of Context Recommendations

Expand diversity to improve equity considerations
Existing research focuses largely on Europe and the United States. Additional research should account for variance in available resources, cultural sensitivity, range in infrastructure, and others by situating research in low and middle income nations as well as focusing on vulnerable populations in high income nations. Without this expanded view, guidance for maintaining staff capacity and resilience will likely be ill-fitting for a notable segment of the world population.

Account for all organizational contexts involved in emergency risk communication
Most existing research prioritizes inter-agency collaboration. Considerable research on hospitals and coordination among local and state health departments exists. Less is known, however, about the role of organizations in other contexts such as governing bodies, non-profit organizations, international organizations, and community-based and faith-based organizations. Expanding research to include these contexts will provide a more complete view of the resources available for maintaining staff capacity.

Add diversity of potential hazards to research, preparation, and trainings
Training exercises and preparation priorities currently focus primarily on infectious disease and general disaster preparedness. Consideration of other potential health hazards within the purview of the World Health Organization is warranted.
**Methodological Rigor Recommendations**

*Include learning and behavioral outcome assessment*
Although challenging to design and complete, studies that focus on actual learning and behavioral change rather than relying solely on self-report and attitudinal measures would provide a more accurate assessment of which training approaches and content are most effective in promoting ideal behavior.

*Add long term and studies with comparison groups to the body of literature*
Most of what is known about staff capacity for preparedness and response is based on data points for a single period of time with no comparison group. The degree to which the planning or training makes a lasting change for both organizations and individuals is largely unknown, nor is it clear which aspects of interventions are most useful. The paucity of research in this area is likely due to the fact that long-term research is both costly and time-consuming, and establishing comparison groups for disaster preparedness training is logistically difficult. Support should be provided for researchers to conduct long-term, longitudinal research and clinical trials.

*Establish a focus that provides organizational level assessment*
Overall, the existing literature does little to provide insight into how, at the organizational level, leaders can build staff readiness, retention, and job satisfaction. Future investigation is needed that views organizational-level response as a primary outcome in research and training, and emergency planning.

*Providing purposeful/actionable recommendations as implications of research*
Much of the existing research provides conclusions based on the specific planning, debriefing, or training activity completed. Although this descriptive research is helpful, it does little to build support for a series of tangible recommendations for building and staff capacity and resilience. Research is need to develop and test specific generalizable recommendations for training activities.

*Develop standardized metrics to assess emergency risk communication performance*
Weakness in evaluation design of existing studies may be in part due to the lack of standardized instrumentation. Development of reliable metrics to gauge exercise performance should be prioritized.

**Content of Training Recommendations**

*Investigate costs and benefits of different modalities of delivery*
Existing research includes studies that deliver content face-to-face, others that delivery content electronically, and some university courses that take a mixed modal approach. However, these studies offer little or no explanation about the strengths and weaknesses of their chosen modality, or in what situations each would be the most effective choice. Studies should be designed to test advantages
and limitations of face-to-face, electronic, and mixed modal delivery of training material.

Incorporate and evaluate training about using traditional and social media to communicate emergency risk messages
Multiple studies in this review identified skills in interaction with media and formulating appropriate messages for specific audiences as weak points in overall emergency preparedness of hospitals, state and local health departments, and other agencies. However, many of these studies did not specifically design components of training to inculcate these skills. Those that did provide specific training in these areas did not articulate rationales about why the technique they used was preferable to others. Evidence is needed regarding how best to train in these specific topic areas.

Incorporate and evaluate training about how to evaluate emergency risk communication capacity
Few training programs include a component that teaches participants how to evaluate ERC capacity. Without such tools, participants are less likely to implement lessons they have learned from training opportunities. Studies should be designed to test how best to train participants in evaluation.

Conclusion
This report provided an overview of extant research focused on effectively building emergency risk communication staff capacity for preparedness and response. Unfortunately, a considerable amount of the research on this topic fails to focus on communication processes and the literature suffers from serious contextual and methodological limitations. However, this review has used existing literature to parse out meaningful findings, identify priority research gaps, and outline specific recommendations for future research. These recommendations may provide pathways to more meaningful, broadly applicable, and diverse research to positively affect global public health.

GRADE principles were adapted for application to descriptive quantitative studies and GRADE CERQual principles were applied to mixed-method studies. Neither adaptation has been approved by the tool originators.
APPENDIX A
Modified AMSTAR Checklist

Final Quality Computation
Add all the “Yes”s
Low quality = 0-3; Moderate quality = 4-7; High quality = 8-11

1. Was an “a priori” design provided?
The research question and inclusion criteria should be established before the conduct of the review. The question(s) of interest is clear and/or there is a focused literature search.
Note: need to refer to a protocol, ethics approval, or pre-determined/a priori published research objectives to score a “yes.”
   Yes
   No
   Can’t answer
   Not applicable

2. Was there duplicate study selection and data extraction?
There should be at least two independent data extractors and a consensus procedure for disagreements should be in place.
Note: 2 people do study selection, 2 people do data extraction, consensus process or one person checks the other’s work.
   Yes
   No
   Can’t answer
   Not applicable

3. Was a comprehensive literature search performed?
At least two electronic sources should be searched. The report must include years and databases used (e.g. Central, EMBASE, and MEDLINE). Key words and/or MeSH terms must be stated and where feasible the search strategy should be provided. All searches should be supplemented by consulting current contents, reviews, textbooks, specialized registers, or experts in the particular field of study, and by reviewing the references in the studies found.
Note: If at least 2 sources + one supplementary strategy used select “yes” (Cochrane register/Central counts as 2 sources; a grey literature search counts as supplementary).
   Yes
   No
   Can’t answer
   Not applicable

4. Was the status of publication (i.e. grey literature) used as an inclusion criterion?
The authors should state that they searched for reports regardless of their publication type. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status, language, etc.
Note: If the review indicates that there was a search for “grey literature” or “unpublished literature” indicate “yes.” SIGLE database, dissertations, conference proceedings, and trial registries are all considered grey for this purpose. If searching a source that contains both grey and no-grey, must specify that they were searching for grey/unpublished literature.
  Yes
  No
  Can’t answer
  Not applicable

5. Was a list of studies (included and excluded) provided?
A list of included and excluded studies should be provided.
Note: Acceptable if the excluded studies are references. If there is an electronic link to the list but the link is dead, select “no.”
  Yes
  No
  Can’t answer
  Not applicable

6. Were the characteristics of the included studies provided?
In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions, and outcomes. The ranges of characteristics in all the studies analyzed, e.g. age, race, sex, relevant socioeconomic data, disease status, duration, severity, or other diseases should be reported.
Note: Acceptable if not in table format as long as they are described as above; can be in-text as well. This must be salient. A list of references does not indicate “yes.”
  Yes
  No
  Can’t answer
  Not applicable

7. Was the scientific quality of the included studies assessed and documented?
“A priori” methods of assessment should be provided (e.g., for effectiveness studies if the author(s) chose to include only randomized, double-blind, placebo controlled suited, of allocation concealment as inclusion criteria; for other types of studies alternative items will be relevant).
Note: Can include use of a quality scoring too or checklist, e.g. Jadad scale, risk of bias, sensitivity analysis, etc., or a description of quality items, with some kind of result for EACH study (“low” or “high” is fine, as long as it is clear which studies scored “low” and which scored “high”; a summary score/range for all studies is not acceptable.
  Yes
  No
  Can’t answer
  Not applicable

8. Was the scientific quality of the included studies used appropriately in formulating conclusions?
The results of the methodological rigor and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations. 

*Note: Might say something such as “the results should be interpreted with caution due to the poor quality of included studies,” or identifying gaps in primary studies’ methods, etc. Cannot score “yes” for this question if scored “no” for question 7.*

- Yes
- No
- Can’t answer
- Not applicable

9. **Were the methods used to combine the findings of studies appropriate?**

For the pooled results, a test should be done to ensure the studies were combinable, to assess their homogeneity (i.e., Chi squared test for homogeneity). If heterogeneity exists a random effects model should be used and/or the clinical appropriateness of combining should be taken into consideration (i.e., is it sensible to combine?)

*Note: indicate “yes” if they mention or describe heterogeneity, i.e. if they explain that they cannot pool because of heterogeneity/variability between interventions.*

*Note: Only for quantitative meta-analysis; all others mark “Not applicable.”*

- Yes
- No
- Can’t answer
- Not applicable

10. **Was the likelihood of publication bias assessed?**

An assessment of publication bias should include a combination of graphical aids (e.g. funnel plots, other available tests) and/or statistical tests (e.g. Egger regression test, Hedges-Olken).

*Note: If no test values or funnel plot included, score “no.” Score “yes” if mentions that publication bias could not be assessed because there were fewer than 10 included studies.*

*Note: For narrative synthesis review (see 12 below) put “Not applicable,” unless there is some explicit mention of publication bias.*

- Yes
- No
- Can’t answer
- Not applicable

11. **Was the conflict of interest included?**

Potential sources of support should be clearly acknowledged in the systematic review. Must be explicitly noted.

*Note: To get a “yes,” must indicate source of funding or support for the systematic review.*

12. **What was the method of the review [Not to be used for quality assessment]**

- Quantitative meta-analysis
- Narrative synthesis
- Can’t answer
- Not applicable
APPENDIX B  
Expert Contact List by Source  

The following international experts in health, risk, crisis, and disaster were contacted and asked to share any potentially relevant publications, work in progress, dissertations, or unpublished works that could be relevant to the guiding question.

Key experts found in the following report:  

- Roza Adany (Hungary)- Department of Preventive Medicine, Faculty of Public Health, University of Debrecen, adany.roza@sph.unideb.hu
- Tit Albreht (Slovenia)- National Institute of Public Health of Slovenia, tit.albreht@ivz-rs.si
- Antonio G. de Belvis (Italy)- Faculty of Medicine and Surgery, Public Institute of Health, Rome, antonio.debelvis@unicatt.it
- Lieven de Raedt (Belgium)- Attaché Relations Internationales, SPF Santé publique, Sécurité de la Chaîne alimentaire et Environnement Brussels, lieven.deraedt@health.fgov.be

Experts from WHO Workshop on Risk Communications for Public Health Emergencies  
(November 15-17, 2011, Manila, Philippines)

- May Elenor de Guzman, Supervising Administrative Officer Media Relations Unit-OSEC Manila, Phillipines mayelenor@yahoo.com
- Dong-Woo Lee, Epidemic Intelligence Service Officer Korea Centers for Disease Control and Prevention, aryumput2@gmail.com
- Joshua Woo, Manager, Media Relations, Ministry of Health, College of Medicine, Singapore joshua_woo@moh.gov.sg
- Van Hien Nguyen, Head, Communication-Network Direction Division, Hanoi, Vietnam hienytdp@yahoo.com
- Thi Kim Lien Nguyen, Deputy Director National Center for Health Education and Communications Hanoi, Vietnam kimlien1001@gmail.com ; lienxbyh@yahoo.com
- Hikmandari Abudari, Head, General Affairs Public Communication Centre Ministry of Health Indonesia Jl., Jakarta, Indonesia hikmandari@yahoo.com
- Utami Murti, Head, Public Communication Centre, Ministry of Health Indonesia Jl., Jakarta, Indonesia, murti_utami@yahoo.com
- Husnina Ibrahim, Public Health Specialist and Senior Principal Assistant Director, Surveillance Section Disease Control Division, Department of Public Health, Ministry of Putrajaya, Malaysia husnina@moh.gov.my
- Mui Leng Bey, Director, Corporate Communications/ Press Secretary to Minister of Health, Ministry of Health College of Medicine Singapore bey_mui_leng@moh.gov.sg
- Thomas Abraham, Director, Public Health Communication Project, Journalism and Media Studies Centre, Eliot Hall, The University of Hong Kong thomas@hku.hk

- Ahamad Jusoh, Head of Outbreak and Disaster Sector, Disease Control Division, Ministry of Health, Malaysia, ahmadj@managment.utm.my
- Andre Peralta-Santos, Medical doctor, Public Health Specialist, Centre for Disease Prevention and Control, Latvia, prese@spke.gov.lv (general email)
- Daniel Schmidt, Advisor, Norwegian Institute of Public Health, danschmi@gmail.com
- Denisa Georgiana, Epidemiologist, National Centre of Communicable Diseases Surveillance and Control, National Institute of Public Health, Romania, denisa_janita@yahoo.com, georgiana.hanta@gmail.com
- Don Eliseo Lucero-Prisno III, Associate Professor, Xi’an Jiaotong-Liverpool University, China, Lucero-PrisnoE@cf.ac.uk
- Fernanda Falero, Health Promotion and Anthropology Advisor, Médecins Sans Frontières Spain, fernanda.falero@barcelona.msf.org
- Girts Brigis, Professor, Department of Public Health and Epidemiology, Riga Stradins University, Latvia, (emailed general email at Riga Stradins University)
- Hanae Hanzawa, Project Officer, Public Health Network, Asia-Europe Foundation, hanae.hanzawa@asef.org
- Khamphithoun Somsamouth, Deputy Director, Ministry of Health, Lao PDR, ksomsamut@hotmail.com
- Massimo Ciotti, Deputy Head of Unit Preparedness and Response, European Centre for Disease Prevention and Control, Stockholm, Sweden massimo.ciotti@ecdc.eu.int

Experts from Harvard Systematic Review

- Massimo Ciotti, Deputy Head of Unit, Public Health Capacity and Communication, Head of Section Country Preparedness Support, European Centre for Disease Prevention and Control, massimo.ciotti@ecdc.europa.eu
- Mohammed Nour, Public Health Physician, Supreme Council of Health, Doha, Qatar
- Chris Nelson, Senior Political Scientist, RAND Corporation, U.S.A.
- Germain Thinus, Policy Officer, DE SANTE - Health Threat Unit, European Commission, Luxembourg
- Aphaluck Bhatiasevi, Technical Officer (Risk Communication), World Health Organization
- Andrew Black, Exercise Manager, Emergency Response Department, Health Protection and Medical Directorate, Public Health England
- Andrea Bernasconi, Consultant, MSF (Barcelona)
- Mihir Bhatt, Director, All India Disaster Mitigation Institute, Gujarat, India
- Arnold Howitt, Executive Director of the Ash Center, Harvard Kennedy School, Boston, MA, U.S.A.
- Virginia Murray, Consultant in Global Disaster Risk Reduction, Public Health, England
- Ute Rexroth, Medical Specialist, Surveillance Unit, Koch Institut, Germany
- Silvia Bino, Associate Professor of Infectious Diseases, Head, Control of Infectious Diseases Department, Institute of Public Health, Tirana, Albania
Paula Vasconcelos, Direção-Geral de Saúde, Ministry of Health, Libson, Portugal
Eva Beneli, Journalist, Zadig, Ltd. (ASSET Project), Italy

Additional Experts

- Esther Chernak, Center for Public Health Readiness and Communication, Drexel University, School of Public Health
- Benjamin Lozare, Director of Training and Capacity Building, John Hopkins University, blozare1@jhu.edu
- Uttara Bharath Kumar, Director, Capacity Implementation, John Hopkins University, ubharat@jhu.edu
- William Glass, Director of Strategic Communication Programs, John Hopkins University, wglass@jhu.edu
- Kojo Lokko, Deputy Director, Health Communication Capacity Collaborative, John Hopkins University, klokko@jhu.edu
- Ann Turner, Faculty, Northwest Center for Public Health Practice, University of Washington, amturner@u.washington.edu
- Mark Oberle, Principal Investigator for the Northwest Preparedness and Emergency Response Research Center, Northwest Center for Public Health Practice, University of Washington, moberle@u.washington.edu
- Randal Beaton, Faculty, Northwest Center for Public Health Practice, University of Washington, randyb@u.washington.edu
- Rosemarie Aguirre, Health Education and Promotion Officer V National Center Manila, Philippines rgaguirre@yahoo.com
## APPENDIX C
Search Strategies of Academic Literature by Database

<table>
<thead>
<tr>
<th>Database (# of results)</th>
<th>Search Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Social Sciences Indexes and Abstracts (ASSIA) (N = 26)</td>
<td>(SU.EXACT(&quot;Avalanches&quot; OR &quot;Cyclones&quot; OR &quot;Disasters&quot; OR &quot;Drought&quot; OR &quot;Earthquakes&quot; OR &quot;Ecological disasters&quot; OR &quot;Famine&quot; OR &quot;Firestorms&quot; OR &quot;Floods&quot; OR &quot;Hurricanes&quot; OR &quot;Natural disasters&quot; OR &quot;Tornadoes&quot; OR &quot;Volcanoes&quot; OR &quot;Disaster management&quot;) OR kw(outbreak* OR epidemic* OR pandemic* OR disaster* OR &quot;emergency planning&quot; OR &quot;emergency preparedness&quot;) OR ti (outbreak* OR epidemic* OR pandemic* OR disaster* OR &quot;emergency planning&quot; OR &quot;emergency preparedness&quot;) OR ab(outbreak* OR epidemic* OR pandemic* OR disaster* OR &quot;emergency planning&quot; OR &quot;emergency preparedness&quot;) OR kw(outbreak* OR epidemic* OR pandemic* OR disaster* OR &quot;emergency planning&quot; OR &quot;emergency preparedness&quot;)) AND (SU.EXACT(&quot;Communication&quot; OR &quot;Risk communication&quot;) OR ti(communicat*) OR ab(communicat*)) AND (SU.EXACT(&quot;training&quot; OR &quot;staff development&quot; OR &quot;team building&quot;) OR ti(training OR &quot;capacity building&quot; OR &quot;core competencies&quot; OR &quot;team building&quot; OR &quot;employee training&quot;) OR ab(training OR &quot;core competencies&quot; OR &quot;capacity building&quot; OR &quot;team building&quot; OR &quot;employee training&quot;))</td>
</tr>
<tr>
<td>Business Source Premier (N = 114)</td>
<td>(SU (&quot;emergency management&quot; OR disasters OR “crisis management” OR emergency management – communication systems&quot;) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc*) OR KW (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc*)) AND (SU (&quot;employee training” or “team building”) OR TI (training OR “capacity building” OR &quot;core competencies” OR “team building” OR “employee training”) OR AB (training OR “core competencies” OR “capacity building” OR “team building” OR “employee training”) OR KW (training OR “core competencies” OR “capacity building” OR “team building” OR “employee training”)) AND (SU (communication) OR TI communicat* OR AB communicat* OR KW communicat*)</td>
</tr>
<tr>
<td>China Academic Journals (N = 10)</td>
<td>KY = (风险沟通+风险传播+风险信息+危机传播+危机沟通+危机信息+危机管理+应急传播+应急沟通+应急预案+应急处理+突发公共事件+H1N1+ SARS+危机事件+</td>
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</table>
CINAHL  
(N = 1128)  
(SU (disasters OR “disaster planning” OR “mass casualty incidents” OR “natural disasters” OR fires OR “disease outbreaks” OR emergencies OR “crisis intervention”) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) OR KW (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response)) AND  
(SU “health personnel—education” OR “staff development” OR “communication skills training”) OR TI (“core competencies” OR training OR “team building” OR in-service) OR AB (“core competencies” OR training OR “team building” OR in-service) OR KW (“core competencies” OR training OR “team building” OR in-service)) AND  
(SU communication OR “communication skills”) OR TI communicat* OR AB communicat* OR KW communicat*)

Cochrane Central Registry of Controlled Trials  
(N = 318)  
(SU (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) OR (AB (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) OR (TI (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) ) AND (SU (staff OR work* OR employee OR “health care personnel”) OR TI (staff OR work* OR employee OR “health care personnel”) OR AB (staff OR work* OR employee OR “health care personnel”)) AND  
(SU (training OR “staff development”) OR TI (training OR in-service OR “employee development” OR “staff development”) OR AB (training OR in-service OR “employee development” OR “staff development”) OR KW (training OR in-service OR “employee development” OR “staff development”)) AND  
(SU (communicat* OR “interpersonal communication”) OR TI (communicat* OR “mass media” OR “mass communication”) OR AB (communicat* OR “mass media” OR “mass communication) OR KW (communicat* OR “mass media” OR “mass communication))

Cochrane Database of Systematic Reviews  
(N = 21)  
(SU (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) OR (AB (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) OR (TI (disaster* OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc* OR prepar*) ) AND  
(SU (communicat* OR “interpersonal communication”) OR TI (communicat* OR “mass media” OR “mass communication”) OR AB (communicat* OR “mass media” OR “mass communication” OR “emergency risk communication”) OR TI communicat* OR “mass
media” OR “mass communication”)) OR (AB communicat* OR “mass media” OR “mass communication”)) AND (SU (training OR “staff development”) OR TI (training OR in-service OR “employee development” OR “staff development”) OR AB (training OR in-service OR “employee development” OR “staff development”) OR KW (training OR in-service OR “employee development” OR “staff development”))

| Communication and Mass Media Complete (EBSCOhost) | SU ("crisis management" OR “crisis communication” OR “emergency communication systems”) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar*OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc*)) AND (SU (training OR “staff development” OR “team building” OR team*) OR TI (training OR in-service OR “capacity building” OR “core competencies” OR “team building”) OR AB (training OR in-service OR “capacity building” OR “core competencies” OR “team building”)) AND (SU ("risk communication” OR “crisis communication”) OR TI ("emergency risk communication” OR “crisis communication” OR “risk communication”) AB ("emergency risk communication” OR “crisis communication” OR “risk communication”) OR KW ("emergency risk communication” OR “crisis communication” OR “risk communication”)) Additional search strategy:

("*Communication in organizations" OR "COMMUNICATION in health education" OR SU "CRISIS communication" OR SU "HEALTH risk communication" OR SU "SITUATIONAL crisis communication theory" OR "CRISIS communication" OR "risk communication" OR "COMMUNICAT* w3 risk* OR information w3 disseminat* OR disseminat* w4 public OR "Emergency management" OR “Emergency and Other Relief Services”) AND (disaster? OR crisis OR outbreak? OR terrorism OR pandemic? OR emergenc* w3 management OR emergenc* w3 prepar* OR "emergency communication" OR virus OR disease? OR EPIDEMIC*) AND (staffing OR retention OR turnover)

| Communication and Mass Media Complete (Gale) | (Subject (“disaster relief” OR “drought relief” OR “emergency mass feeding” OR “flood relief” OR “war relief” OR “emergency assistance” OR “disaster planning” OR disasters OR “mass casualties” OR “crisis management”)) AND (Subject ("on-the-job training” or teams)) AND (Subject (“health risk communication” OR “risk communication”)) Additional search strategy:

(Basic Search (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc*)) AND (Basic Search (training OR “core competencies” OR “capacity building” OR “team building” OR “employee training”))
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<th>الدالة</th>
<th>البيانات: قائعة معلومات العلوم الإنسانية - المنظومة مصطلحات البحث الموضوعية:</th>
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<tr>
<td>1</td>
<td>تقييم إدارة الأزمات، النتيجة 52 بحث</td>
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<td>إدارة الاتصال في الأزمات - النتيجة 24 بحث</td>
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<td>4</td>
<td>التدريب على إدارة الأزمات - النتيجة 23 بحث</td>
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<tr>
<td>5</td>
<td>إدارة الأزمات الإرهابية - النتيجة 4 بحث</td>
</tr>
<tr>
<td></td>
<td>مجموع نتيجة البحوث من هذه المصطلحات هي</td>
</tr>
</tbody>
</table>

**ERIC**

(N = 171)

(SU ( "crisis management" OR “crisis communication” OR “emergency communication systems”) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response)) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) OR KW (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response)

AND

(SU (workshops OR “capacity building” OR “team building” OR team* ) OR TI (training OR “capacity building” OR “team building”) OR AB (training OR “capacity building” OR “team building”) OR KW (training OR “capacity building” OR “team building”)

AND

(SU (communication OR “interpersonal communication” OR “risk communication” OR “health risk communication” OR “terrorism risk communication” OR “crisis communication” ) OR TI communica* OR AB communica* OR KW communica*)

**MEDLINE**

(N = 1265)

(MeSH ( “disaster planning” OR disasters OR “disease outbreak” OR epidemic OR emergencies OR terrorism OR “civil defense”) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response)) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar* OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response)

AND

(MeSH (“staff development” OR “in service training”) OR TI (training OR “capacity building” OR “core competencies” OR “team building”) OR AB (training OR “core competencies” OR “capacity building” OR “team building”) OR KW (training OR “core competencies” OR “capacity building” OR “team building”))

AND

(MeSH (communication OR “health communication” ) OR TI communica* OR AB)
communicat* OR KW communicat*)

Additional Search Strategy:

((MH "Disasters") OR Disaster? OR (MH "Disaster Planning+") OR (MH "Emergencies") OR (MH "Emergency Shelter") OR (MH "Mass Casualty Incidents") OR "Mass Casualty Incidents" OR (MH "Relief Work") OR "Relief Work*" OR (MH "Rescue Work") OR "Rescue Work*" OR "outbreak?" OR (MH "Disease Outbreaks+") OR (MH "Epidemics+") OR Epidemic* OR (MH "Pandemics") OR Pandemic* OR (MH "Bioterrorism") OR "bioterror*" OR (MH "Biological Warfare Agents") OR "Biological Warfare" OR (MH "Chemical Warfare Agents") OR "Chemical Warfare OR (MH "Nuclear Weapons") OR (MH "SARS Virus") OR SARS OR (MH "Ebola virus") OR ebola* OR (MH "Hemorrhagic Fever, Ebola")

AND

("risk communication?" OR “health communication” OR "CRISIS communication" OR COMMUNICATION w3 planning OR “risk communication” OR COMMUNICAT* w3 public OR COMMUNICAT* w3 risk* OR information w3 disseminat* OR disseminat* w4 public OR public w3 communicat* or messaging OR "Emergency communication" OR information w3 prepar* OR "media monitoring” OR "media statement*“ OR "message development" OR public w3 notif*)

AND

((MH "Health Manpower") OR “staff development” OR “Task Performance and Analysis” OR “in-service?” OR in-service? OR “team building” OR training OR “capacity building” OR manpower OR education* or learn* OR simulation? OR exercise* OR drill? OR "crisis management program" OR "field experiment" OR tabletop OR "table top" OR "surge capacity” OR "organization & administration" OR turnover OR retention)

PAIS

(N = 417)

(SU(communication) OR "COMMUNICATION planning" OR "CRISIS management" OR "COMMUNICATION Strategies" OR "CRISIS communication" OR COMMUNICATION N/3 planning OR "risk communication" OR COMMUNICAT* N/3 public OR COMMUNICAT* N/3 risk* OR information N/3 disseminat* OR disseminat* N/4 public OR public N/3 communicat* OR messaging OR "Emergency communication" OR "media monitoring" OR "media statement**" OR "message development" OR public N/3 notif*) AND (disaster? OR crisis OR outbreak? OR terrorism OR pandemic? OR bioterror* OR emergenc* NEAR/3 management OR emergenc* NEAR/3 prepar* OR "emergency communication” OR virus OR disease* OR EPIDEMIC*)

AND

(educat* OR learn* OR training OR SIMULATION OR exercise*)

Limiter: Scholarly Journals

PsycInfo

(N = 502)

(SU (disasters OR “disaster planning” OR “mass casualty incidents” OR “natural disasters” OR fires OR “disease outbreaks” OR emergencies OR “crisis intervention”) OR AB (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar*OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) OR TI (disaster* OR crisis OR outbreak OR terrorism OR pandemic OR emergenc* OR emergency w3 prepar* OR disaster w3 prepar*OR disaster w3 management OR disaster w3 planning OR crisis w3 management OR disaster w3 relief OR disaster w3 recovery OR disaster w3 planning OR disaster w3 response) )
AND
(SU “staff development” OR “communication skills training”) OR TI (“core competencies” OR training OR “in-service training” OR “team building” OR “mas casualty training”) OR AB (“core competencies” OR training OR “capacity building” OR “in-service training” OR “team building”) OR KW ((“core competencies” OR “capacity building” OR training OR “in-service training” OR “team building”))
AND
(SU communication OR “communication skills”) OR TI communicat* OR AB communicat* OR KW communicat*)

Russian Science Citation Index (N= 11)

TOPIC: (disaster* OR crisis OR outbreak OR terrorism OR pandemic* OR emergence* OR emergency NEAR/3 prepar* OR disaster NEAR/3 prepar* OR disaster NEAR/3 management OR disaster NEAR/3 planning OR crisis NEAR/3 management OR disaster NEAR/3 relief OR disaster NEAR/3 recovery OR disaster NEAR/3 planning OR disaster NEAR/3 response)
AND
TOPIC: (training OR “capacity building” OR “core competencies” OR “team building” OR “employee training” OR "staff development" OR "employee development" OR "in-service training")
AND
TOPIC: (communicat* OR “risk communication” OR “crisis communication”)

SciELO (N = 509)

TOPIC: (disaster* OR crisis OR outbreak OR terrorism OR pandemic* OR emergence* OR emergency NEAR/3 prepar* OR disaster NEAR/3 prepar* OR disaster NEAR/3 management OR disaster NEAR/3 planning OR crisis NEAR/3 management OR disaster NEAR/3 relief OR disaster NEAR/3 recovery OR disaster NEAR/3 planning OR disaster NEAR/3 response)
AND
TOPIC: (training OR “capacity building” OR “core competencies” OR “team building” OR “employee training” OR "staff development" OR "employee development" OR "in-service training")
AND
TOPIC: (communicat* OR “risk communication” OR “crisis communication”)

Sociological Abstracts (N = 28)

(SU.EXACT("Disasters" OR "Natural Disasters" OR "Disaster Preparedness" OR "Epidemics" OR "Disaster Relief") OR ti(outbreak* OR epidemic* OR pandemic* OR disaster* OR "emergency planning" OR "emergency preparedness") OR kw(outbreak* OR epidemic* OR pandemic* OR disaster* OR "emergency planning" OR "emergency preparedness") OR ab(outbreak* OR epidemic* OR pandemic* OR disaster* OR "emergency planning" OR "emergency preparedness"))
AND
(SU.EXACT("Communication" OR "Risk communication") OR ti(communication) OR ab(communication) OR kw(communication))
AND
(SU.EXACT("training" OR "staff development" OR "team building") OR ti(training OR "capacity building" OR "core competencies" OR "team building" OR "employee training") OR ab(training OR "core competencies" OR "capacity building" OR "team building" OR "employee training"))

Web of Science Indexes Searched SCI- (crisis or disaster? or outbreak? or pandemic or "emergency preparedness" or Terrorism preparedness or "emergency readiness" or "emergency planning" or bioterrorism)
AND
(medical or health or clinician* or nurs* or first responder* or intern? or hospital?) and (plan* or preparedness or readiness)
AND
Expanded, SSCI, A&HCI, ESCI
\( (N = 413 \text{ SSI}; 348 \text{ SSCI}) \)

(risk communicat* or knowledge or perception* or competenc*) and (education* or teaching or simulat* or training)

WHO Global Library
Indices Searched
LILACS
WPRIM
IMEMR
IMSEAR
\( (N = 108) \)

(disaster OR disasters OR dengue OR crisis OR outbreak OR outbreaks OR terrorism OR bioterrorism OR bioterror OR pandemic OR pandemics OR emergency OR emergencies OR virus OR disease OR diseases OR epidemic OR epidemics OR "Mass Casualty Incidents" OR "Relief Work" OR "rescue work" OR "Relief Worker" OR "rescue worker" OR "relief Workers" OR "rescue workers" OR SARS OR influenza OR Ebola OR terrorism OR flood OR earthquake OR hurricane OR cyclone OR floods OR earthquakes OR hurricanes OR cyclones)

AND
preparedness
AND
(Communication OR information OR dissemination OR message OR messaging OR notification)

Exclude: MEDLINE

Additional Search Strategy:
("international health regulations" OR "disease outbreaks" OR disasters) AND ("capacity building" OR "risk management" OR "risk communication")

Exclude: MEDLINE
### APPENDIX D
Search Strategies of Grey Literature by Resource

<table>
<thead>
<tr>
<th>Resource (# of results)</th>
<th>Search Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booz Allen Hamilton (N = 15)</td>
<td>Booz Allen’s white papers are limited, so we searched broadly by using the search term “risk communication”</td>
</tr>
<tr>
<td>Communication Initiative (N = 37)</td>
<td>Disaster OR emergency OR crisis OR terrorism OR risk OR epidemic OR emergency AND communication AND training AND “public health”</td>
</tr>
<tr>
<td>Defense Technical Information Center (DTIC) (N = 148)</td>
<td>(disaster OR crisis OR terrorism OR risk OR pandemic OR emergenc*) OR (mass communication” OR &quot;emergency risk communication&quot;) AND (training OR &quot;staff development&quot;) AND “public health”</td>
</tr>
<tr>
<td>Greylit.org (N = 40)</td>
<td>Emergency AND disaster AND communication AND training</td>
</tr>
<tr>
<td>OpenGrey (N = 56)</td>
<td>(disaster OR crisis OR outbreak OR terrorism OR risk OR pandemic OR emergenc*) AND communication AND training</td>
</tr>
</tbody>
</table>
APPENDIX E
Knowledge Map Codebook

Q3: How to best develop and sustain emergency risk communication staff capacity for preparedness and response

- **Setting:** In the context of preparing for and responding to events/emergencies with public health implications in high-, low-, middle-income and fragile states.
- **Perspective:** National governments and relevant subnational authorities (e.g., district and local health authorities)
- **Phenomena of interest:** Development and sustained capacity of staff for emergency risk communication.
- **Comparison:** Varied tactics: in-service training, education, core competency programs, other development opportunities
- **Evaluation:** Impact on number of staff with emergency risk communication skills, breadth/depth of skills, retention of staff
- **Time scope:** 2003 to the present

[article number] Number of article in Google Drive file IF no access to full text of article DO NOT CODE, make note to get ILL or contact author

[Does the article describe a specific effort to develop or sustain capacity of staff for emergency risk communication?] (0=no, 1=yes, 2=uncertain) **If no or uncertain, DO NOT CODE until after discussing with other coder**

[researchorcommentary] What is the nature of the piece? (1=research study, 2=essay/commentary) **If essay/commentary DO NOT CODE**

(Key question for phases: Will this information help us to train people/build capacity for ____ phase?)

[phase:readiness/preparedness] Is the crisis communication focused on the preparation phase? (0=no, 1=yes, 2=uncertain)

[phase:prevention] Is the crisis communication focused on the onset phase? (0=no, 1=yes, 2=uncertain)

[phase:response] Is the crisis communication focused on the containment phase? (0=no, 1=yes, 2=uncertain)

[phase:recovery] Is the crisis communication focused on the recovery phase? (0=no, 1=yes, 2=uncertain)

[phase:evaluation] Is evaluation integrated? (0=no, 1=yes, 2=uncertain)

[type of training] (1 = in-service; 2 = education; 3 = core competencies; 4 = other)
[traininggeneralvsspecific] Is training specific to a particular type of disaster? (0=no, 1=yes, 2=uncertain)

[specificitools] Specific tools (i.e. available for public download or purchase) are used in the research (0=no, 1=yes, 2=uncertain)

[specificitoolID] Identify the specific tool(s) used (enter open ended response)

[organizationtype] Type of organization or context
(1=hospital, 2=school k-12, 3=university, 4=other health facility, 5=federal government agency, 6=state or local government agency, 7=non-government agency, non-profit, 8=multiple, 9=other, 10=uncertain)

[nation] Nation or geographic location (enter open ended response)

[authorprimarydiscipline] Discipline of lead author (enter open ended response). If working in a department different than their training, go with training.

[year] Year of publication (enter open ended response in XXXX format – e.g., 2014)

[researchmethod] If research, primary method used
(0=none, 1=randomized or non-randomized group experiment, 2=survey, 3=focus group, 4= interviews, 5=content analysis, 6=observation or ethnography, 7=discourse or textual analysis, 8=systematic review, 9=case study, 10=multi-method, 11=other, 12=uncertain, 13=general qualitative/best practice)

[disastertype]
(1 = bioterrorism; 2=terrorism; 3=nuclear crisis, 4-radiological or chemical incident, 5=infectious diseases, 6=earthquake, 7=flood, 8=hurricane, tornado, cyclone, typhoon, 9=volcano, 10=water emergency, 11=wildfires, 12=drought, 13=food, 14=general, 15=other, 16=uncertain, 17=active shooter)
APPENDIX F
Modified Version of British Medical Journal Quality Appraisal Checklist for Questionnaire Studies

Was a questionnaire the most appropriate method and if not, what design might have been more appropriate?

Were there any existing measures (questionnaires) that the researchers could have used? If so, why was a new one developed and was this justified?

What claims for validity have been made, and are they justified? (In other words, what evidence is there that the instrument measures what it sets out to measure?)

What claims for reliability have been made, and are they justified? (In other words, what evidence is there that the instrument provides stable responses over time and between researchers?)

Was the questionnaire adequately piloted in terms of the method and means of administration, on people who were representative of the study population?

What was the sampling frame for the definitive study and was it sufficiently large and representative?

Were the response rates reported fully, including details of participants who were unsuitable for the research or refused to take part?

Have any potential response biases been discussed?

What sort of analysis was carried out and was this appropriate? (e.g. correct statistical tests for quantitative answers, qualitative analysis for open ended questions)

What measures were in place to maintain the accuracy of the data, and were these adequate?

Are quantitative results definitive (significant), and are relevant non-significant results also reported?

What do the results mean and have the researchers drawn an appropriate link between the data and their conclusions?
APPENDIX G
List of Articles Included in Evidence Synthesis


<table>
<thead>
<tr>
<th>Review Finding</th>
<th>Studies Contributing to the Review Finding</th>
<th>Assessment of Methodological Limitations</th>
<th>Assessment of Relevance</th>
<th>Assessment of Coherence</th>
<th>Assessment of Adequacy</th>
<th>Overall CERQual Assessment of Confidence</th>
<th>Explanation of Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency risk communication training should include a focus on coordinating federal, state, local, and community agencies and personnel.</td>
<td>Dausey &amp; Moore, 2014; Freimuth et al., 2008; High et al., 2010; Madden et al., 2013; Morris, et al., 2012</td>
<td>Moderate methodological limitations (one study with major and one study with minor methodological limitations)</td>
<td>Minor concerns about relevance (One study direct; one indirect. The most directly relevant study is specific to Georgia, U.S.A.)</td>
<td>Minimal concerns about coherence (Strong consistency across studies)</td>
<td>Moderate adequacy of data. (Data in one study is thin; only two studies)</td>
<td>Moderate</td>
<td>Moderate concerns about methodological limitations and adequacy of data. Recommendations across studies based on large scale simulations. Indirect relevance in most studies.</td>
</tr>
<tr>
<td>Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media.</td>
<td>Freimuth et al., 2008; High, et al., 2010; Morris, et al., 2012; Wahl, et al., 2015</td>
<td>minimal methodological limitations (more information about measures needed)</td>
<td>Minor concerns about relevance (The single study is situated in the U.S.A., but it is highly relevant)</td>
<td>No concerns about coherence</td>
<td>Moderate concerns about extent of data (one study, though data in the article are thick)</td>
<td>Moderate</td>
<td>Based on two moderate quality and two low quality studies.</td>
</tr>
<tr>
<td>Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and</td>
<td>Freimuth et al., 2008; Madden, et al., 2013</td>
<td>minimal methodological limitations (more information about measures needed)</td>
<td>Minor concerns about relevance (The single study is situated in the U.S.A., but it is highly relevant)</td>
<td>No concerns about coherence</td>
<td>Substantial concerns about extent of data (one study, though data in the article are thick)</td>
<td>Low</td>
<td>Based on two studies with only minor methodological limitations, however, one study is purely descriptive.</td>
</tr>
</tbody>
</table>
Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. Aertsen et al., 2013; Dausey & Moore, 2006; Freimuth et al., 2008; High et al., 2010; Morris, et al., 2012; Wahl et al., 2015

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodological Limitations</th>
<th>Coherence</th>
<th>Adequacy</th>
<th>Methodological Limitations</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Moderate concerns about relevance (only one study directly relevant; however, three studies situated outside of U.S.A.)</td>
<td>Moderate concerns about coherence (Consistency across various contexts, but highest quality study expresses limitations to the value of tabletop exercises.)</td>
<td>Moderate concerns about adequacy (five studies in various contexts with moderately rich data overall)</td>
<td>Moderate concern about coherence in data about tabletops, and serious methodological limitations. Indirect relevance in most studies.</td>
<td></td>
</tr>
<tr>
<td>Little current training is offered in blended online-face-to-face formats. Madden et al., 2013</td>
<td>Minor concerns about methodological limitations</td>
<td>Minor concerns about relevance (directly relevant but describes only practices in the U.S.A.)</td>
<td>No concerns about coherence (single study)</td>
<td>Substantial concerns about data (theme derived from content analysis of trainings and comparison to responses of ERC experts. Moderate concern about methodological limitations and based on a single study. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S.A. and interviews of 140 risk communication experts across the U.S.A.)</td>
<td></td>
</tr>
<tr>
<td>Only a minority of risk communication training is hazard-specific, even though the overwhelming majority of experts agree that messages should</td>
<td>No notable methodological limitations</td>
<td>Minor concerns about relevance (directly relevant but describes only practices in the U.S.A.)</td>
<td>No concerns about coherence (single study)</td>
<td>Moderate concerns about adequacy (only one study, though extensive)</td>
<td>Moderate concern about methodological limitations and coherence, and based on a single study. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S.A.)</td>
</tr>
</tbody>
</table>
There is a need to develop reliable metrics to gauge exercise performance, and to incorporate training for staff in emergency risk communication evaluation. Although based on only one study, method, relevance, and coherence are good, data based on exhaustive content analysis of existing training in U.S.A. and interviews of experts.

| Few training programs include training in evaluation. | Madden et al., 2013 | No notable methodological limitations | Minor concerns about relevance (directly relevant but describes only practices in the U.S.A.) | No concerns about coherence (single study) | Moderate concerns about adequacy (only one study, though extensive) | Moderate | Minor concerns about methodological limitations. Nevertheless, the data are derived from an exhaustive content analysis of existing training in U.S.A. and interviews of 140 risk communication experts across the U.S.A. |
## APPENDIX I

### Modified GRADE Evidence Profile: Quantitative Studies

<table>
<thead>
<tr>
<th>Review Finding</th>
<th>Studies Contributing to the Review Finding</th>
<th>Limitations in Study Design or Execution</th>
<th>Inconsistency of Results</th>
<th>Indirectness of Evidence</th>
<th>Imprecision of Results</th>
<th>Publication Bias</th>
<th>Overall GRADE Assessment of Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media.</td>
<td>Carney, et al., 2011; Dickmann et al., 2016; Friedman et al., 2011; Heideman &amp; Hawley, 2007; Leaming, et al., 2013; Valesky, et al., 2011</td>
<td>Very serious limitations</td>
<td>No serious inconsistency</td>
<td>Serious indirectness</td>
<td>Very serious imprecision</td>
<td>Undetected</td>
<td>+000</td>
</tr>
<tr>
<td>Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension.</td>
<td>Carney, et al., 2011; Friedman et al., 2011; Heideman &amp; Hawley, 2007</td>
<td>Very serious limitations</td>
<td>No serious inconsistency</td>
<td>Serious indirectness</td>
<td>Very serious imprecision</td>
<td>Undetected</td>
<td>+000</td>
</tr>
<tr>
<td>Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication.</td>
<td>Ablah, et al., 2007; Carney, et al., 2011; Dickmann, et al., 2016; Friedman, et al., 2011; Leaming, et al., 2013;</td>
<td>Very serious limitations</td>
<td>No serious inconsistency</td>
<td>Serious indirectness</td>
<td>Very serious imprecision</td>
<td>Undetected</td>
<td>+000</td>
</tr>
</tbody>
</table>
Uddin et al.,
2008; Valesky et al., 2011

*+ooo = very low quality, ++oo = low quality, +++o = moderate quality, ++++ = high quality
## APPENDIX J

**CERQual Evidence Profile: Findings within Qualitative Methodological Stream**

<table>
<thead>
<tr>
<th>Review Finding</th>
<th>Studies Contributing to the Review Finding</th>
<th>Assessment of Methodological Limitations</th>
<th>Assessment of Relevance</th>
<th>Assessment of Coherence</th>
<th>Assessment of Adequacy</th>
<th>Overall CERQual Assessment of Confidence</th>
<th>Explanation of Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical After Action Reports use vague, non-specific statements about exercise failure areas and lack root causes analysis of response challenges.</td>
<td>Savoia, et al., 2012</td>
<td>Very minor methodological limitations (Potential researcher influence not assessed.)</td>
<td>Minor concerns about relevance (Relevance indirect with some of the AARs examined having risk communication components, some not. Observations are not direct specifically at ERC staff.)</td>
<td>Coherence is strong. (This stream consists of a single study.)</td>
<td>Substantial concerns about adequacy of data. (Data are rich but supported by a single study.)</td>
<td>Low</td>
<td>Relevance is indirect and data limited to single descriptive study</td>
</tr>
<tr>
<td>Evaluation and training for emergency and disaster preparedness should include an emphasis on communication with the media.</td>
<td>Dausey et al., 2006; Malet &amp; Korbiz, 2015</td>
<td>Substantial methodological limitations in both studies</td>
<td>Moderate concerns about relevance (Both studies situated in U.S.A.)</td>
<td>No concerns about coherence</td>
<td>Substantial concerns about adequacy of data (data thin in both studies; only one study very broad)</td>
<td>Low</td>
<td>Substantial concerns about methodological limitations, adequacy of data, and minor concerns about relevance</td>
</tr>
<tr>
<td>Emergency risk communication training should include a focus on leveraging the capacity through coordinating</td>
<td>Dausey et al., 2006; Lurie, et al., 2011; Malet &amp; Korbiz, 2015</td>
<td>Substantial methodological limitations (three studies with major methodological limitations)</td>
<td>Substantial concerns about relevance (ERC is only small component and not much detailed information; All</td>
<td>Good coherence (Data consistent across studies despite variations in</td>
<td>Moderate adequacy of data. (Different contexts but difference in data quality)</td>
<td>Moderate</td>
<td>Substantial methodological limitations. Moderate concerns about data adequacy and relevance but data</td>
</tr>
</tbody>
</table>
| Tabletop exercises and simulation for training can enhance awareness, readiness, and knowledge about emergency risk communication. | Dausey et al., 2006; Morris, et al., 2012; Sandström, et al., 2014 | Substantial methodological limitations (both have methodological limitations) | Major concerns about relevance (neither study directly relevant) | Coherence is strong | Moderate concerns about adequacy of data (data thin) | Low | Substantial concerns about methodological limitations, relevance, and adequacy of data

| Training should include preparation for designing messages to be communicated to the media that are sensitive to audience needs and comprehension. | Dausey et al., 2014; Malet & Korbitz, 2015 | Substantial methodological limitations (both studies have methodological limitations) | Moderate concerns about relevance (Studies mention audience needs as an outcome but do not investigate) | Minor concerns about coherence (Some studies place heavy emphasis; some minor emphasis) | Substantial concerns about adequacy of data (data thin in both studies) | Low | Substantial concerns about methodological limitations, data adequacy and minor concerns about relevance and coherence |
REFERENCES


Tong, A., Flemming, K., McInnes, E., Oliver, S., & Craig, J. (2012). Enhancing transparency in reporting the synthesis of qualitative research. *BMC Medical Research Methodology, 12,* 181.
