

How Best to Develop and Sustain Emergency Risk Communication Staff Capacity for Preparedness and Response

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BACKGROUND

Although training for emergency risk communication (ERC) has been developed and used in the field, little is known about factors that make such training more (or less) effective. Relevant existing reviews on the topic are of low quality. Systematic reviews of the broader literature on training in disaster preparedness and response conclude that evaluation of disaster preparedness efforts is usually not scientifically rigorous; methods used for evaluation are heterogeneous and often not well-described; and 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 to other national contexts.

OBJECTIVE

The objective of this review was to identify, appraise, and synthesize research evidence on how to best develop and sustain emergency risk communication staff capacity for preparedness and response.

METHODS

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; 2) qualitative appraisal and synthesis of evidence.

We searched the following electronic databases for eligible studies: Applied Social Sciences Indexes and Abstracts (ASSIA), Business Source Premier, Cairn.Info communication database, China Academic Journals, CINAHL, Cochrane Central Registry of Controlled Trials, Cochrane Database of Systematic Reviews, Communication and Mass Media Complete (EBSCOhost), Dar Almandumah –Human Index, ERIC, MEDLINE, PAIS, PsycInfo, Russian Science Citation Index, SciELO, Social Science Citation Index, Sociological Abstracts, Web of Science, and the WHO Global Library (LILACS, WPRIM, IMEMR, IMSEAR databases). Altogether records were identified in 16 languages (Arabic, English, French, German, Italian, Spanish, Romanian, Moldovan, Castilian Serbo-Croatian, Japanese, Portuguese, Chinese, Slovak, Turkish, and Russian). Of the studies that met inclusion criteria, one was in Chinese, the remainder were in English. In addition to electronic searches, we contacted international experts in risk communication, performed ancestry and forward citation searching on all identified relevant articles, and searched reference lists of indirectly relevant systematic reviews. We also searched the following grey literature sources: Booz Allen Hamilton, Communication Initiative, Defense

Technical Information Center (DTIC), GreyLit.org, Milbank Memorial Fund, Open Grey, and PubMed.

Inclusion and Exclusion 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

The following exclusion criteria were applied:

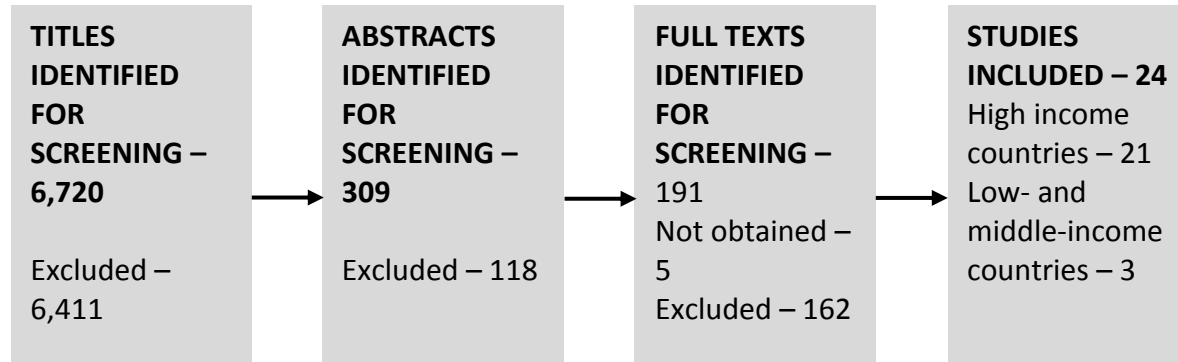
- research about ERC that did not describe specific training, education, core competencies, or other interventions to develop or sustain staff capacity
- studies involving formative research to identify ERC staff training needs without actual implementation of specific training, education, core competencies, or other interventions to develop or sustain capacity
- research about training in emergency preparedness or related subjects that made no mention of ERC or public communication
- 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

All potential study abstracts were read and assessed by at least two authors. Disagreements about inclusion were resolved via discussion.

We assessed the quality of included studies at the beginning of the review using a modified version of the British Medical Journal Critical Appraisal Checklist (observational quantitative studies), the Critical Appraisal Skills Program (CASP; qualitative studies), the Mixed Methods Appraisal Tool (MMAT; mixed methods and case studies), the COSMIN Checklist (scale development), and a National Heart, Lung, and Blood Institute Quality Assessment Tool (pre-post intervention studies with no control group). No clinical trials about the topic were located.

Evidence was analyzed in three methodological streams—quantitative, qualitative, and mixed methods—informed by a Framework Synthesis approach and following a thematic analysis perspective. Quality of evidence in the qualitative and mixed methods streams was appraised using the CERQual tool. Quality of evidence in the quantitative stream was appraised using a modified version of the GRADE tool. All quality appraisals were conducted independently by two authors and disagreements were resolved by discussion.

Figure 1. STUDY SELECTION FLOW DIAGRAM



RESULTS

A total of 6,720 titles were assessed. 24 papers met our inclusion criteria. 21 were based in high-income countries and 3 were based in low- and middle-income countries. Findings are reported in Table 1.

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

Review Finding	CERQual Assessment of Confidence or GRADE Quality of Evidence Rating	Explanation of CERQual or GRADE Assessment	Studies Contributing to the Review Finding
Mixed Method/Case Study Research Stream			
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	Moderate	Moderate concerns about methodological limitations and adequacy of data. Recommendations across studies based	Dausey & Moore, 2014; Freimuth et al., 2008; High et al., 2010; Madden et al.,

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.		on large scale simulations. Indirect relevance in most studies.	2013; Morris, et al., 2012
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.	Low	Some concern about coherence in data about tabletops, and serious methodological limitations. Indirect relevance in most studies.	Aertsen et al., 2013; Dausey & Moore, 2006; Freimuth et al., 2008; High et al., 2010; Morris, et al., 2012; Wahl et al., 2015
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	Moderate	Based on two moderate quality and two low quality studies.	Freimuth et al., 2008; High, et al., 2010; Morris, et al., 2012; Wahl, et al., 2015

contingency press statements. 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 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.	Low	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 coherence of data, 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 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	Moderate	Minor concerns about methodological limitations. Nevertheless, the data are derived from	Madden et al., 2013

assessment measures or discussed the need to evaluate ERC plans and performance.		an exhaustive content analysis of existing training in U.S. and interviews of 140 risk communication experts across the U.S.	
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.	+000 *	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 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	+000	Very serious methodological limitations and imprecision in all but one study, serious indirectness	Carney, et al., 2011; Dickmann et al., 2016; Friedman et al., 2011; Heideman & Hawley, 2007; Leaming, et al., 2013; Valesky, et al., 2011

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.	+000	Very serious methodological limitations and imprecision, serious indirectness	Carney, et al., 2011; Friedman et al., 2011; Heideman & Hawley, 2007
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 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	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

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.	Low	Substantial concerns about methodological limitations, relevance, and adequacy of data.	Dausey et al., 2006; Morris, et al., 2012; Sandström, et al., 2014
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.	Low	Substantial concerns about methodological limitations, adequacy of data, and minor concerns about relevance.	Dausey et al., 2006; Malet & Korbitz, 2015
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	Low	Substantial concerns about methodological limitations, and data adequacy and minor concerns about relevance and coherence.	Dausey et al., 2006; Malet & Korbitz, 2015

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.	Low	Relevance indirect and data are limited to a single study.	Savoia, et al., 2012

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

Two articles in the review focused on the development of instruments to evaluate training results. These were not synthesized by methodological stream but are included in the final synthesis in Table 2. Palttala and Vos (2011) developed and tested an instrument for promoting organizational learning. The instrument is designed to provide a framework (scorecards) for evaluating organizational performance. 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.

Synthesis of Data Across Methodological Streams

Table 2 presents a synthesis across streams for all findings.

Table 2. SUMMARY OF FINDINGS TABLE

Review Finding	Studies Contributing to Finding	Across Methods Certainty/ Confidence Evaluation of Synthesized Finding
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	Ablah, et al., 2007; Dausey & Moore, 2014;	CERQual Multi-method studies:

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. Researchers consistently noted that coordination of messages between federal, state, local, and community agencies may be challenging in a pandemic. Levels of knowledge have been found in several U.S.-based studies to differ between local, state, and federal agencies. Some studies also added a focus on collaboration with community agencies, organizations, and leaders. 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 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.	Dausey et al., 2006; Freimuth et al., 2008; High et al., 2010; Lurie, et al., 2011; Madden et al., 2013; Malet & Korbitz, 2015; Morris, et al., 2012	Moderate CERQual Qualitative studies: Moderate OVERALL: Moderate
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 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. A few studies use behavioral performance indicators rather than self-report measures, and a number use reports by trained observers. Little information is available about what characteristics make exercises successful. 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	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	CERQual Multi-method studies: Low GRADE: Very low CERQual Qualitative studies: Low OVERALL: Low

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 are included, but found to be areas in which preparation is 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 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.	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: Moderate GRADE: Very low CERQual Qualitative studies: Low OVERALL: Low to Moderate
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	Carney, et al., 2011; Dausey et al., 2014; Dickmann et al., 2016; Freimuth et al., 2008; Friedman et al., 2011; Heideman & Hawley, 2007; Madden, et al.,	CERQual Multi-Method studies: Low GRADE: Very low CERQual Qualitative studies: Low OVERALL: Low

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.	2013; Malet & Korbitz, 2015	
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. 2 studies 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.	Malet & Korbitz, 2015; Savoia, et al., 2012	CERQual Qualitative studies: Low OVERALL: Low
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. In this review the only blended formats for training were in university courses. Yet format may make a difference. Participants in an online training program in China expressed a strong preference for face-to-face training.	Madden et al., 2013; Shao, 2014	CERQual Multi-method studies: Moderate OVERALL: Moderate
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 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.	Madden et al., 2013; Malet & Korbitz, 2015	CERQual Multi-method studies: Moderate OVERALL: Moderate
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
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The majority of studies found were based on exercises involving tabletops, simulations, and, occasionally, courses 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. 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.

Gaps in Existing Research

Reviewed literature exhibits an overwhelming lack of focus on emergency risk communication. That is, emergency, risk, and crisis research often includes communication as a single piece of a much broader analysis, but not as the primary dimension of research interest. Beyond this, the following specific gaps in literature were observed:

1. ***Lack of research focus on diverse populations*** (e.g., international, cultural, religious, underserved). Research is primarily from the United States, and secondarily from

Europe. Even in U.S.-based studies attention is seldom focused on vulnerable populations.

2. **Inadequate diversity of organizational contexts.** Many studies reported on preparedness training that involved multiple organizations. However, there is an anemic spread across organizations types. Few studies incorporated participation of non-governmental organizations, or community- or faith-based organizations.
3. **Little diversity in 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 were rare or non-existent.
4. **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. Performance indicators were rarely used and few attempts were made at developing assessment rubrics.
5. **No long-term or comparative outcome assessment.** Existing research is short term and cross sectional. Long-term changes in ERC skills were not measured and no studies identified in this review employed any type of comparative design.
6. **Little organizational-level assessment.** The preponderance of studies measured individual gains in ERC preparedness. Organizational-level indicators like staff satisfaction, turnover, and retention were not investigated in any of the studies.
7. **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.

Authors' Conclusion

We conclude that insufficient evidence exists to determine what interventions or practices are most effective in developing and sustaining capacity of ERC staff.

List of Articles Included in Evidence Synthesis

- Ablah, E., Nickels, D., Hodle, A., Wolfe, D. J., Orr, S., Tenbrink, J., et al. (2007). "Public Health Investigation": A pilot, multi-county, electronic infectious disease exercise. *AJIC: American Journal of Infection Control*, 35, 382-386.
- Aertsen, T., Jaspaert, K., & Van Gorp, B. (2013). From Theory to Practice: A Crisis Simulation Exercise. *Business Communication Quarterly*, 76(3), 322-338.
- Carney, J. K., Schilling, L. M., Frank, S. H., Biddinger, P. D., Bertsch, T. F., Grace, C. J., et al. (2011). Planning and Incorporating Public Health Preparedness Into the Medical Curriculum. *American Journal of Preventive Medicine*, 41(4), S193-S199.

- Dausey, D. J., Buehler, J. W., & Lurie, N. (2007). Designing and conducting tabletop exercises to assess public health preparedness for manmade and naturally occurring biological threats. *BMC Public Health*, 7, 92-99.
- Dausey, D. J., & Moore, M. (2014). Using exercises to improve public health preparedness in Asia, the Middle East and Africa. *BMC Research Notes*, 7, 474-480.
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