

WORKING P A P E R

Enhancing Emergency Preparedness, Response, and Recovery Management for Vulnerable Populations

Task 3: Literature Review

ELLEN BURKE BECKJORD, STEFANIE STERN,
LISA S. MEREDITH, LISA R. SHUGARMAN,
ANITA CHANDRA, TERRI TANIELIAN,
STEPHANIE L. TAYLOR, & ANDREW M. PARKER

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BACKGROUND

Risk communication plays a critical role in preparing for, responding to, and recovering from public health emergencies [1]. For example, in a chemical spill or radiological incident, exposed individuals need to be informed of decontamination requirements. In natural disasters, individuals need to have information about potential dangers and how and where they can seek safe shelter, while in emergencies with a contagious agent, communication related to isolation and quarantine procedures is required. In general, risk communication in the context of public health emergencies is a complex process. Messages must be communicated in the appropriate languages, at the right reading level, and disseminated in multiple ways amid significant stress and uncertainty. With the goal of keeping the public safe, to be effective, risk communication must achieve the following goals: individuals must be able to *access* information, *process* information, and be able to *act upon* information provided about the risk.

Vulnerable populations may have special needs related to each of these goals. For the purposes of this review, **vulnerable populations** include individuals who have disabilities, are institutionalized, are elderly, are from diverse cultures, have limited English proficiency or are non-English speaking, are children, are transportation disadvantaged, pregnant, have chronic medical disorders, or have pharmacological dependency (i.e., chemical dependency/addiction). The definition of vulnerable populations used here has been adopted by the Department of Health and Human Services and was determined by recommendations of the Interagency Coordinating Council on Emergency Preparedness and Individuals with Disabilities, the draft implementation plan for the Pandemic and All Hazards Preparedness Act (PAHPA), and the draft revisions to the National Response Plan.

It is critical that public health emergency risk communication is nondiscriminatory [2] and that all individuals have equal and ample access to information about the nature of the emergency and particularly about how to respond given the event circumstances. Thus, comprehensive emergency preparedness plans as well as response and recovery guidelines will include provisions for how to best inform and educate vulnerable populations. Vulnerable populations are often “not able to access and use the standard resources offered in disaster preparedness, response, and recovery” [3]. For example, people with physical disabilities may have mobility limitations and special needs related to access to emergency preparedness communications. Children have less developed communication skills and require differently worded messages to be effectively informed. Children may also be separated from parents or other family members who would typically serve as translators for them. Pregnant women may face physical limitations and communications would need to be sensitive to the needs of their children. Senior citizens may have difficulties with mobility, and with regard to communication, could have hearing limitations and visual impairments suggesting that communication medium and format must be taken into account. Individuals with hearing limitations and visual impairment will require alternate communication strategies suggesting that medium and format also should be taken into account. Those with serious mental illness may have cognitive deficits that limit their ability to comprehend messages. Low literacy is another limitation that may be a communication obstacle for children, the mentally impaired, individuals with poor literacy, and non-English speaking populations.

While much is known generally about risk perception and communication [4], these topics have been less well addressed for vulnerable populations, particularly as they relate to emergency preparedness [1]. Yet the outcomes of recent public health events and other emergencies suggest that the unique characteristics of vulnerable populations and the special needs of these groups are not being adequately addressed by traditional emergency preparedness plans. For example, Hurricane Katrina left 5,000 children without their families [5]. In addition, less than 30% of a sheltered population had access to American Sign Language interpreters so that individuals with hearing impairment had no ability to receive information about risks and recovery [6]. These circumstances highlight the need for special attention to vulnerable populations before, during, and after public health emergencies [7].

To support the efforts of public health emergency planners and responders working to successfully address the communication-related needs of vulnerable populations, we conducted a literature review in response to Task Order 07EASPE000074 ***to identify promising risk communication approaches and messaging strategies that address the communication limitations or barriers facing vulnerable populations before, during, and after a public health emergency.*** Our review (Task 3) had three aims:

1. **Describe promising communication strategies** for public health emergency risk communication with vulnerable populations;
2. **Summarize the quality and content of the peer reviewed literature and relevant statutes and regulations** addressing public health emergency risk communication with vulnerable populations for all stages of emergency preparedness; and
3. **Identify gaps in the literature.**

For the purposes of this project, we focus on risk communication that includes actionable information related to public health emergency preparedness, response, and recovery for vulnerable populations. That is, in keeping with previous definitions of risk communication (e.g., [8]) this review addressed public health emergency communication for vulnerable populations that does not simply describe the nature or consequences of a risk, but rather that provides information on how to prepare for, protect against, or respond to the risk. Such risk communication may include press releases, emergency-related print materials, interactive preparedness websites, and other communications that convey actionable risk-related information.

This literature review informed the development of a compendium of communication materials (Task 4) and case studies of sites with promising approaches to risk communication for vulnerable populations (Task 5). In addition, this review lays a foundation for the final report for this project.

METHODS

Peer Reviewed Literature

We conducted a review of the literature pertaining to the use of risk communication strategies for vulnerable populations in any stages of emergency preparedness, response, or recovery. Our review included peer-reviewed citations published in English since January 1, 2000. Forty citations were deemed relevant for inclusion in this review; for a detailed description of our inclusion criteria, please see **Appendix A**.

Statutes and Regulations

In addition to peer reviewed literature, we also reviewed selected statutes, regulations, and other related government or organizational reports [2, 6, 9-16]. Because statutes and regulations are primarily intended as guidance documents for states and localities, they are traditionally not found in the on-line databases for published, peer reviewed literature, and it is therefore difficult to conduct a systematic search of these documents. To identify relevant guidance documents and other reports, we relied upon direction from the Task Order Monitor (TOM) and a targeted web search (federal government sites and sites of organizations focused on vulnerable populations) to identify appropriate statutes, regulations, and other reports for review. In addition to the documents requested for review in the Task Order (The Joint Commission's "Standing Together: An Emergency Planning Guide for America's Communities" and the Commission on the Accreditation of Rehabilitation Facilities' "CARF Guide to Accessibility"), the following documents were included in the review:

- The National Response Plan (retrieved from the Department of Homeland Security website)
- Chapter 68 (Disaster Relief) of Title 42 (The Public Health and Welfare) (retrieved from the US House of Representatives Downloadable US Code website)
- "The Federal Response to Hurricane Katrina: Lessons Learned" (retrieved from the White House website)
- Post-Katrina Emergency Management Reform Act of 2006 (retrieved from the Library of Congress)
- The Report on Special Needs Assessment for Katrina Evacuees Project (retrieved from the National Organization on Disability website)
- "Ready or Not? Protecting the Public's Health from Diseases, Disasters, and Bioterrorism" (retrieved from the Trust for America's Health website)
- Executive Order 13347: "Individuals with Disabilities in Emergency Preparedness" (retrieved from the White House website)
- "Just in Case: Emergency Readiness for Older Adults and Caregivers" (retrieved from the Administration on Aging website)

Literature Search Methods

We used a Data Abstraction Form (DAF) to facilitate a systematic evaluation of each document reviewed. Specifically, the DAF was used to record information from the citations included in the review (peer reviewed literature and statutes/regulations). The DAF was developed by the research team to capture standard elements regarding quality and content (e.g., type of vulnerable population addressed). For a detailed description of the development of the DAF, a complete copy of the form, and our analytic strategy, please see **Appendix B**.

For most DAF items, more than one category within each item could be selected to characterize the literature (e.g., one citation could address more than one vulnerable population); therefore, count data are presented in the Results, rather than percentages. This strategy makes it possible to have more counts across categories than citations reviewed; that is, because one citation could address more than one vulnerable population, the count of vulnerable populations addressed within all 40 citations reviewed could be greater than 40. Once the review research team conducted a pilot test of the DAF to ensure inter-rater reliability regarding consistency of data abstraction and to determine whether the categories adequately captured data from the literature, the remaining citations were divided among the team for full review. The DAF

enabled quantitative analyses (frequencies and crosstabs) to characterize the literature as well as qualitative analyses of the content of each citation included in the review.

RESULTS

From the literature on public health emergency risk communication, we reviewed the relatively small portion (20%) that specifically addresses vulnerable populations. Most of these citations were primarily descriptive and qualitative in nature, with an emphasis on emergency response to natural disasters (as opposed to emergency preparedness or recovery related to other types of public health emergencies). Thus, the state of the literature to date offers limited empirical support for specific public health messaging interventions. However, several common themes emerged in the citations we reviewed such that we were able to identify promising strategies for public health emergency risk communication with vulnerable populations.

Our results are presented in three sections. First, regarding the primary goal of this task, we provide a detailed report of the **promising strategies** for public health emergency risk communication with vulnerable populations that were identified in the review. Next, we outline a more general **summary of the quality and content** of the existing literature on public health emergency risk communication with vulnerable populations, including the main issues addressed by relevant statutes, regulations, and other related government or organizational reports. Finally, we describe **gaps in the literature** related to the methodological approaches of and the vulnerable populations addressed in the literature.

Promising Strategies for Public Health Emergency Risk Communication with Vulnerable Populations

The larger literature on risk communication – beyond that which addresses public health emergencies and vulnerable populations – offers several recommendations for how to develop and deliver successful messages. Good risk communication has been described as decision-relevant, two-way, and interactive [17-19]. Effective risk communication can promote trust, awareness, understanding, and motivation to act [20].

The literature reviewed here, specific to public health emergency risk communication with vulnerable populations, echoed these general recommendations. Additionally, each of the reviewed references addressed the broad points that early and consistent risk communication is key in public health emergencies (e.g., [21]) and that risk communication must take into account the special needs of vulnerable populations (e.g., [10, 22]). Several themes emerged from the literature that highlight promising communication strategies for public health emergency risk communication with vulnerable populations. These themes are summarized below.

Offer Frequent Communication in Multiple Modes that are Locally and Personally Relevant

A major challenge in public health emergency risk communication is providing timely, accessible information that is locally and personally relevant about an event, which is often broad in scope and characterized by some degree of uncertainty. For vulnerable populations, there are additional considerations related to their special needs that must be taken into account when developing a messaging strategy [22, 23]. Several of the references in this review suggested that risk communication with vulnerable populations is most likely to succeed when messages are provided early, often, in multiple formats (e.g., television, print (verbal and pictorial), audio, Internet, interpersonal), and when the content of messages and their presentation are tailored to be locally and personally (including linguistically) relevant [6, 7, 9, 13, 21, 24-41]. Thus, ideally, the information contained within public health emergency risk communication is presented to the

public early and often, via multiple sources that individuals find trustworthy, accessible, and credible. This is true for the public generally (e.g., [42]), and for vulnerable populations in particular, who may need additional time or specific accommodations to adequately follow emergency instructions.

This first theme represents an overarching conclusion of all the references we reviewed. Achieving timely, frequent, tailored risk communication presented in multiple formats and delivered by trusted sources requires considerable resources and organizational infrastructure. More specific themes regarding how to do this follow.

A Community-Based Participatory Approach is Promising

Several studies [7, 10, 12, 14, 29, 31, 35, 37, 41, 43-47] highlighted the potential of **community-based participatory approaches** to improving risk communication for vulnerable populations. Community-based participatory approaches [48] are increasingly common in public health, with good evidence of success in intervention development and delivery [49]. Further, in areas of public health outside of emergency preparedness, community-based strategies such as use of community or lay health advisors are increasingly used to motivate health behavior (e.g., [50, 51]). The evidence suggests that community members want to be involved in public health emergency preparedness, response, and recovery [7, 29, 47] and would therefore be amenable to participating in risk communication efforts for vulnerable populations. In many communities, local Citizen Corps programs may provide the infrastructure around which to organize community-based efforts [14].

Community involvement may help emergency risk communications overcome common barriers to success related to trust and available resources for communication dissemination [31, 35, 37, 43]. Further, with appropriate training, community-based risk communicators would be well positioned to provide information tailored to local cultural norms. This type of tailoring has been shown to be important to the success of risk communication with vulnerable populations [41], and may be especially useful for the elderly [37], individuals from diverse cultures [43], and those living in geographically isolated or rural settings [35, 45]. Specific community-based risk communication approaches mentioned in the literature include use of churches [31], knowledge centers (hubs where 1 or 2 trained community members facilitate access to communication technology is available; [35]), and lay advisors to deliver neighborhood- and peer-delivered communication [37].

Implications for Tasks 4 and 5: Continued work should determine whether available outreach and education materials have been developed in a community-based participatory way (Task 4), and to what degree community members are involved with the development and execution of public health emergency risk communication efforts, as recommended by JACHO [10] (Task 5).

The Internet Is a Successful Delivery Method – for Those Who Have Access

The **Internet** is increasingly utilized in healthcare delivery and practice [52] and has been demonstrated to be a successful communication tool in the aftermath of a public health emergency. For example, the faculty, students, and staff of Tulane Medical School benefited greatly from a “recovery Web site” that was created to facilitate communications in the days and weeks following Hurricane Katrina [53].

Would an Internet-based risk communication strategy for public health emergency preparedness, response, and recovery be valuable to vulnerable populations? In fact, use of advanced communication technologies is a recommendation of the “Hurricane Katrina: Lessons Learned” report [11], and there is evidence to suggest that Internet-based communication

strategies may be particularly useful, as features of Internet-based messaging are especially effective at overcoming communication barriers commonly encountered by vulnerable populations. For example, tailored health communications have been shown to be more effective than non-tailored messages at influencing behavior [54], and communications delivered via the Internet can be very easily and specifically tailored [55], increasing the chances for success with vulnerable populations [9, 25, 34, 56]. There are several ways that Internet-based risk communications can be tailored to accommodate the needs of vulnerable populations, including the language in which the information is presented (for non-English speaking populations), the accompanying images displayed (for cultural tailoring for diverse populations), the reading level and detail provided (for low-literate populations or children), and the format in which the information is presented (visual and/or audio). Further, Internet access to Electronic Health Records (EHRs), where available, can facilitate communication critical to the medical needs of individuals with chronic illnesses. Finally, Internet-based messaging can also be frequently updated to reflect the often fast-changing circumstances surrounding a public health emergency.

In our review, very few studies addressed risk communication via the Internet for vulnerable populations [24, 26, 34, 36, 56-58]. The potential for Internet-based messaging to improve emergency communication with vulnerable populations is limited by Internet access [3, 26, 57], and some vulnerable populations may be especially limited in their use of the Internet. For example, The PEW Internet and American Life Project [59] found that only 26% of Americans age 65 and older are “online” using the Internet for email and other purposes, compared to 67% of Americans age 50 to 64. However, increased use of cell phones to access the Internet has widened the population of Internet users beyond those with computers and has made text messaging a viable option for widely disseminated risk communication. Additionally, there is evidence to suggest that some vulnerable populations may prefer to rely on social networks to receive information and to guide decision making during a public health emergency [32]. Thus, if one member of the social network was able to access the Internet, the benefits would reach a larger audience.

Use of the Internet to disseminate communication regarding emergency preparedness may be problematic, given that several vulnerable populations are less likely to have easy access to the Internet or to be savvy Internet users. However, during response and recovery, Internet access could be offered to affected individuals as part of reestablishing the communication infrastructure. For example, resources such as the Federal Emergency Management Agency’s (FEMA) Mobile Emergency Response Support detachments could provide Internet access to evacuees with websites developed and managed remotely. In this way, vulnerable populations could receive Internet assistance from individuals aiding in response and recovery, thereby benefiting from the strengths of the Internet as a communication tool. As technologically based approaches to communication may not address the needs of all groups (e.g., elderly, mentally ill, cognitively disabled), the Internet cannot replace “old media” means of communication (e.g., radio, television, print media). However, the percentage of the population engaged with the Internet is steadily increasing [60], and given that employing multiple modes of communication increases the chances of reaching the hard-to-reach [36], adding the Internet to the public health emergency risk communication arsenal could increase the chances of adequately addressing the needs of some vulnerable populations. However, even for those with Internet access, these electronic systems often become unavailable for all populations during disasters that affect electrical supply during the immediate aftermath of emergencies. Thus, the Internet may be most effective for preparedness and recovery stages of public health emergencies.

Implications for Tasks 4 and 5: Continued work should examine whether Internet-based resources for vulnerable populations are available and offer good potential for success (Task 4), and site visits should include an assessment of wireless communication capability and how these modes are integrated in state and local plans (Task 5).

Translation Does Not Ensure Comprehension

While translation is an obvious first step towards effective risk communication with non-English speakers, several studies we reviewed indicated that translation is not enough. To successfully communicate public health emergency risks to non-English speaking and diverse populations in general, communication must be **culturally competent** [9, 10, 24, 29, 38, 61]. Clarification of key terms must be addressed (e.g., definition of “emergency” [29]), linguistic barriers must be identified and remedied (e.g., the Spanish word for “chicken pox” is the same word for “smallpox” [38]), and cultural beliefs about the causes of disasters must be addressed [61]. Training plays a key role in preparing communicators to be culturally competent [24], and research is necessary to develop culturally competent educational materials [2]. Volunteers from vulnerable populations may be especially valuable in these endeavors [29] as part of a community-based participatory approach.

Implications for Tasks 4 and 5: Continued work should characterize the availability of outreach and educational materials that are offered in languages other than English and to what degree these materials also appear to be culturally competent (e.g., were they developed by members of the cultural group to whom they are targeted, do they contain culturally relevant images; Task 4). Efforts to address linguistic and cultural considerations should be examined in stakeholder interviews as part of the case studies (Task 5).

Vulnerability Assessments are a Critical Step in Program Development

Knowing the size and locations of vulnerable populations in a given jurisdiction facilitates effective outreach, including communication, during a public health emergency. **Vulnerability assessments** as a routine part of public health preparedness are critical to informing risk communication strategies [10, 56, 62]. Chapter 68 of U.S. Code Title 42 [2] describes the use of multihazard maps to identify where natural disasters are likely to occur. Similarly, population vulnerabilities can be mapped using Geographic Information Systems (GIS). GIS maps are increasingly used in public health research to examine distributions of disease incidence [63] and health-related knowledge [64] and could also be purposed to develop effective communication campaigns for vulnerable populations. For example, GIS maps could be used to determine where vulnerable populations may cluster (e.g., locations of hospitals, nursing homes, low-income housing) and could use this information to target risk communication campaigns. With funding from the Office of the Assistant Secretary for Preparedness and Response, RAND is currently completing an interactive web-based GIS tool to be used by health departments for this purpose. The tool will allow health departments to geographically identify where the most vulnerable members of their communities live (e.g., individuals with disabilities, non-English speaking individuals).

Implications for Task 5: Continued work should determine the degree to which vulnerability assessments are a routine part of preparedness activities and whether GIS mapping is routinely conducted as a part of vulnerability assessments for emergency preparedness. In addition, the task should examine whether stakeholders perceive that these maps could result in added value for risk communication planning.

The Special Needs of Children

When **children** are affected by a public health emergency, their developmental levels and their psychological reactions must be taken into account regarding communication [10, 65]. Often, emergency risk communication and messaging strategies will reach children through their caregivers. For parents, emergency risk communication should be frequent and instructive, as parents of young children are likely to experience additional anxiety related to protecting their children [28, 30, 46]. School-based communication strategies offer an opportunity to reach both children and their caregivers; school curricula may be an effective venue in which to promote risk communication for children that is tailored to their developmental abilities [66], and school nurses are an important ally in emergency risk communication for children [10].

Implications for Tasks 4 and 5: Continued work should examine what materials are available for children and parents/caregivers regarding public health emergency preparedness and whether there is an adequate range of developmentally tailored resources for older versus younger children (Task 4). Discussions with key informants should investigate whether school-based efforts or activities in other institutions in charge of children (e.g., child care centers) are a part of current emergency preparedness efforts in their jurisdiction (Task 5).

In Self-Contained Organizations, Leadership is Key to Communication Success

In addition to addressing vulnerable populations, three studies offered perspectives on successful communication strategies within self-contained organizations, such as hospitals [67], large office buildings [44], and schools [68]. In these cases, **clear leadership** was identified as key to communication success. Leadership regarding who is in charge of formulating and disseminating risk communication is critical to timely execution of message delivery and to avoiding unclear or ambiguous messaging.

Implications for Tasks 5: Continued work should investigate the chain of command and leadership structure around the steps involved with risk communication (e.g., message formulation, message delivery) and whether communication with vulnerable populations is specified in an organization's plan and if leadership on this communication is designated to someone.

Meteorologists as a Trusted Source

In what appears to be two unrelated references, **meteorologists** were specifically mentioned as excellent points of communication delivery in public health emergencies, as they are seen as trusted and objective sources of information [69, 70] and appear most often on television, which may be a preferred risk communication medium [40]. Though meteorologists were only mentioned twice, in a relatively small literature it is worth noting that two studies arrived at this same conclusion. Given the relevance of weather to several types of public health emergencies (e.g., natural disasters and any emergency with an airborne component), meteorologists would have frequent opportunities to be involved with public health emergency risk communication for vulnerable populations.

Implications for Tasks 4 and 5: Continued work should determine whether meteorologists are included within outreach materials (Task 4) and to what degree meteorologists or local weather departments are included within risk communication strategies (Task 5).

Quality and Content of the Literature on Public Health Emergency Risk Communication with Vulnerable Populations

In addition to a qualitative synthesis of the existing peer reviewed literature, we also examined data collected by the DAF to provide a general **summary of the quality and content** of the existing literature on public health emergency risk communication with vulnerable populations, including the main issues addressed by relevant statutes, regulations, and other related government or organizational reports. This summary includes descriptions of the types of vulnerable populations; the stages of emergency preparedness, response, and recovery; the types of public health emergencies; the functional areas; and the barriers to risk communication addressed in the literature to date.

Vulnerable Populations

A wide range of vulnerable populations were addressed in the review. Individuals from diverse cultures (including racial/ethnic minorities) were most commonly represented in the literature [7, 23, 24, 26-29, 32, 34, 37, 38, 41, 43, 47, 69-72], followed by low-income populations [7, 25, 26, 28, 32, 34, 38-40, 43, 47, 56] and those with chronic medical disorders [7, 22, 26, 28, 36, 39, 44, 47, 67, 68, 71]. Additionally, several studies addressed children [7, 30, 33, 41, 46, 56, 62, 65, 68, 71], individuals with little or no English proficiency [7, 29, 33, 34, 37, 38, 62, 70], those who are transportation disadvantaged [7, 26, 28, 32, 34, 39, 43, 71], the elderly [7, 36, 37, 39, 47, 56, 62], and disabled individuals [7, 23, 40, 44, 56]. Only a few citations (less than 5) were identified that addressed those who live in institutional settings [36, 39, 58, 71] or individuals with pharmacological dependency [7, 71]. There were no citations that addressed public health emergency risk communication for pregnant women.

Stages of Emergency Preparedness, Response, and Recovery

Studies addressed risk communication in the context of response to public health emergencies most often [21-23, 25, 26, 28, 32, 33, 35, 36, 38-41, 43, 44, 47, 58, 61, 62, 66, 67, 69, 70, 72] (**Figure 1**), followed by preparedness ([7, 24, 26, 29, 31, 32, 34-36, 38-41, 45, 47, 56, 57, 61, 62, 66-68]), and recovery [26, 27, 30, 35, 40, 41, 46, 47, 56, 61, 62, 65-67, 71]. In one study, stage was not specified [37] and in another, the focus was broadly on threat, warning, impact, reconstruction, and resilience [62].

We examined what stages of emergency were addressed by the type of vulnerable population. For individuals from diverse cultures, low income backgrounds, and with chronic medical conditions (the top three vulnerable populations represented in the literature), we found that emergency response (e.g., evacuation) was most frequently addressed (**Figure 1**). However, for children, emergency recovery (e.g., mental health issues) was most often the focus of study, whereas for those with limited English proficiency, emergency preparedness (e.g., education to raise awareness) was most commonly addressed.

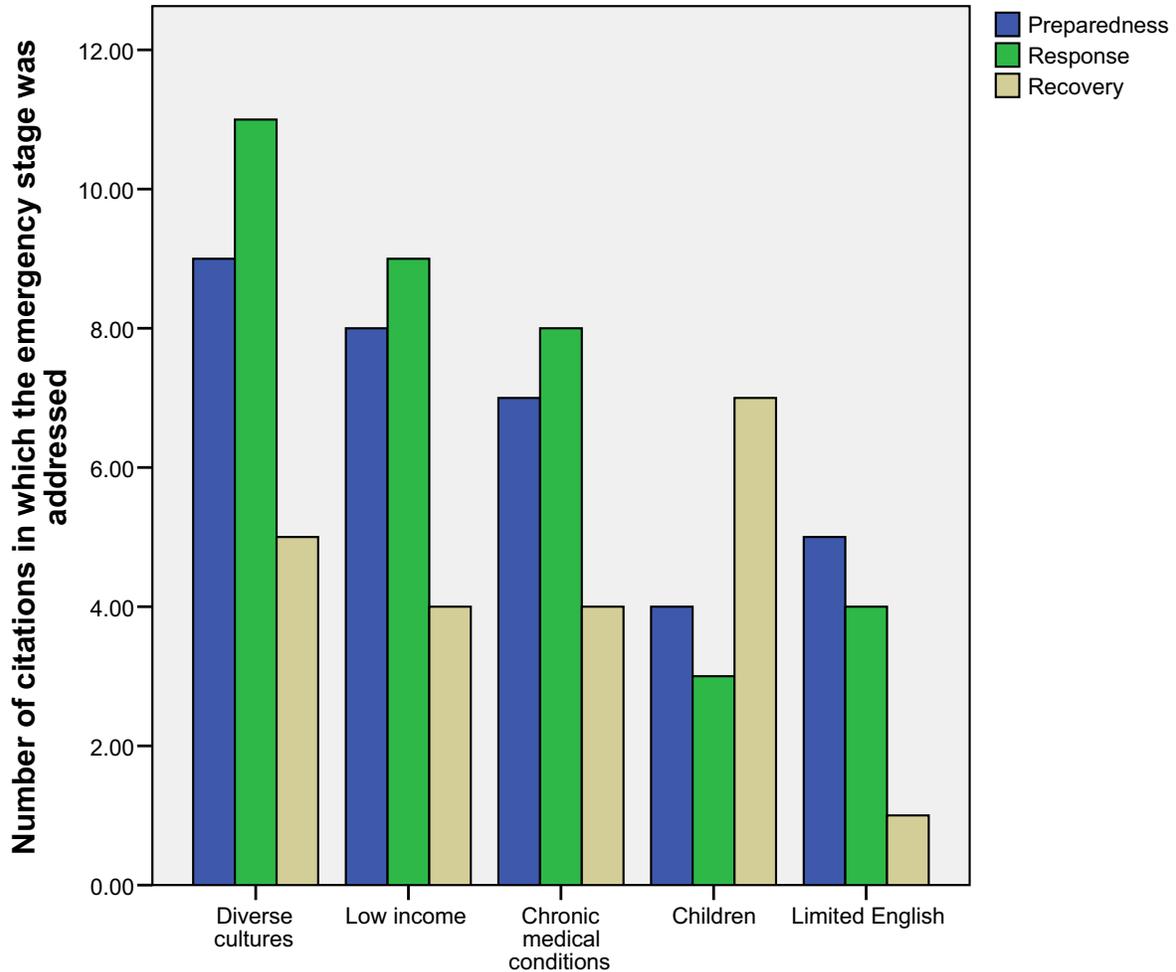


Figure 1. Stages of Emergency Addressed within Different Vulnerable Populations.

Regarding types of emergencies (**Figure 2**), natural disasters (e.g., hurricane, tsunami) were the topic most often in the literature on risk communication with vulnerable populations [22, 25-29, 31, 32, 35, 37-41, 43, 56, 58, 61, 65-68, 71] followed by terrorist threats or incidents [7, 23, 29, 31, 38, 44-46, 57, 62, 67-70, 72]. Infectious disease outbreaks were addressed in several citations [29-31, 33, 57, 67, 68] while infectious disease pandemics [21, 67, 68] and man made disasters [38, 67, 68] were each addressed less frequently. The remaining studies addressed another type of emergency, including agricultural [45], any trauma [46], flood or dam failures [39], heat waves [29, 36], power outage [67], school violence [68], or the type of emergency was not specified [24, 34, 47, 65].

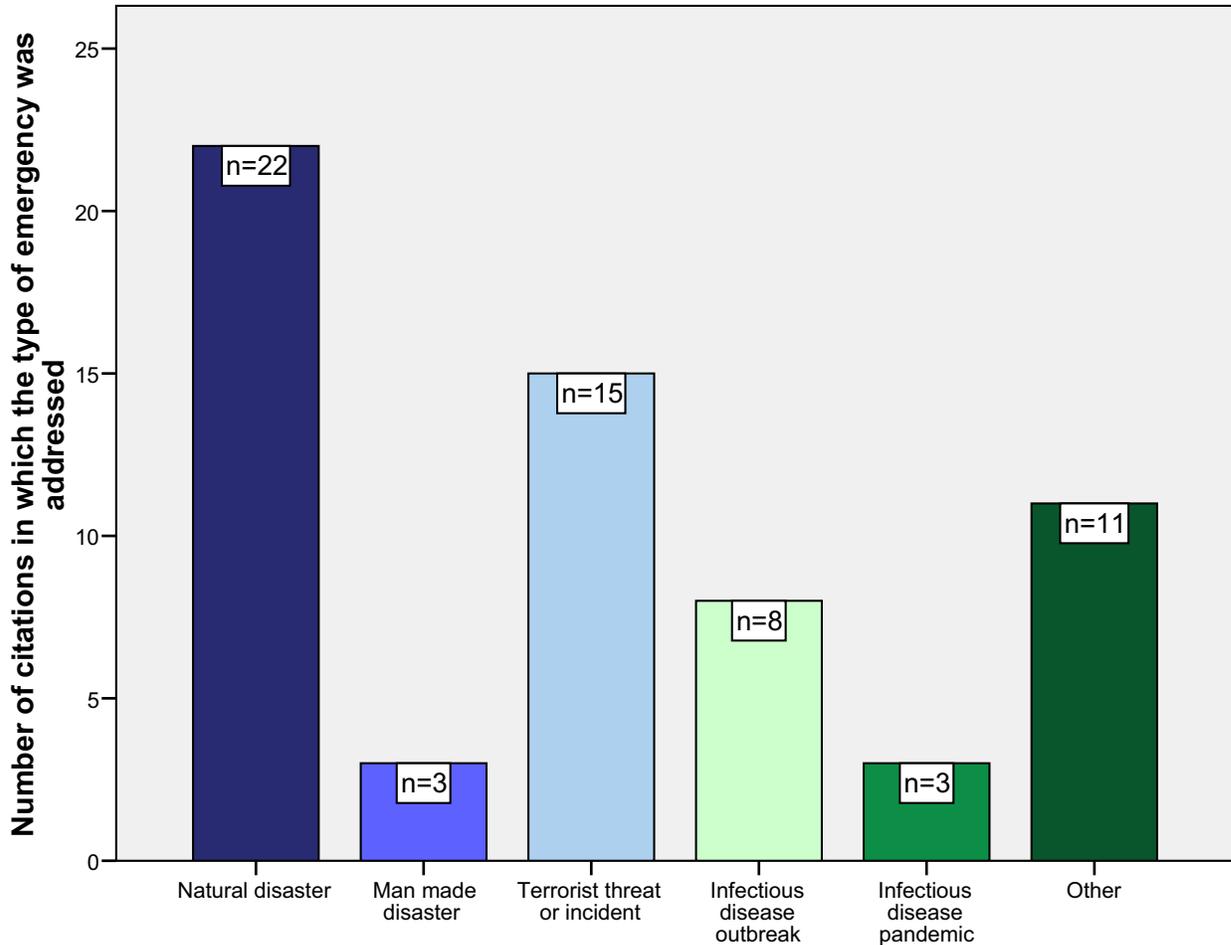


Figure 2. Types of Emergencies Addressed in the Review.

Functional Areas

As our working definition of risk communication highlights the importance of “actionable information,” we examined citations for whether specific functional areas were addressed in the context of risk communication (i.e., did the communication provide actionable information or instruction related to specific functional areas). Five functional areas relevant to the needs of vulnerable populations were considered: maintaining independence (e.g., communication regarding the securing of back-up medical supplies for the chronically ill), communication (e.g., communication regarding how to get needed information for individuals with hearing- or sight-related disabilities), transportation (e.g., where evacuation transportation can be located for the transportation disadvantaged), supervision (e.g., how those who require supervision, such as children or institutionalized individuals, can obtain it during an emergency), and medical care (e.g., how those who require medical care can obtain it during an emergency). Communication was the functional area most commonly addressed in the literature [7, 21, 22, 24-27, 29, 30, 32-38, 40, 41, 44-47, 57, 58, 61, 65-72], followed by medical care [21-23, 28, 30, 33, 35, 37, 39, 47, 58, 66-68, 71], transportation [31, 32, 34, 35, 37, 39, 47], maintaining independence [27, 37, 71], and supervision [71]. Several citations addressed an additional functional area, such as mental health [38, 46, 62, 65] or evacuation [40, 43, 44].

Table 1 shows the functional areas addressed by type of vulnerable populations represented, where an “x” indicates that at least one reference addressed both the vulnerable population and

the functional area. For the most part, functional areas were well distributed across types of vulnerable populations. However, there are some notable exceptions; for example, none of the literature we reviewed described emergency communication regarding maintaining independence, transportation, or supervision for individuals with disabilities. Similarly, emergency communication regarding supervision was missing from the literature on the elderly, and as no citations addressed pregnant women, functional areas relevant to this group in the context of public health emergencies (e.g., communication, medical care) were not addressed.

Table 1. Functional Areas Addressed within Different Vulnerable Populations.

Vulnerable Population	Functional Area Addressed				
	Maintaining independence	Communication	Transportation	Supervision	Medical Care
Diverse cultures	X	X	X	X	X
Low income		X	X		X
Chronic medical condition	X	X	X	X	X
Children	X	X		X	X
Elderly	X	X	X		X
Limited/no English proficiency	X	X	X		X
Transportation disadvantaged	X	X	X	X	X
Disabled		X			X
Institutionalized	X	X	X	X	X
Pregnant women					
Rural areas	X	X	X		X
Pharmacological dependency	X	X		X	X
Low literacy	X	X	X		X

Communication Barriers

Finally, we examined the literature for barriers identified to communication success including emotional interference (e.g., fear, anxiety), trust, resources to disseminate communication, inconsistent or ambiguous messaging, and preconceived assumptions based on prior experiences with the type of emergency addressed. All but one study [36] addressed the issue of barriers; of the categories included on the DAF (**Appendix A**), barriers related to trust were addressed most often [7, 23, 24, 28-32, 37-39, 43, 56, 69, 70, 72], followed by inadequate resources to disseminate communication [24, 26, 28, 31, 32, 34, 35, 44, 56, 61, 66, 68, 70, 71]. For example, Meredith et al. [72] found that African American focus group participants had significant trust concerns related to government officials communicating truthful information in the event of a terrorist attack. Inconsistent or ambiguous messaging ([7, 21-23, 26, 28, 29, 33, 44, 57, 69, 72]), emotional interference ([30, 32, 33, 37, 38, 46, 62, 65, 67, 69]), and incorrect assumptions [7, 23, 28, 29, 31, 32, 72] were addressed in several citations as well. For example, Eisenman and colleagues [32] found that one barrier to successful risk communication aimed at preparing vulnerable populations living in New Orleans for Hurricane Katrina was the incorrect assumption among some residents that the severity of Katrina would be similar to previous hurricanes that were far less devastating. In over half of citations there were barriers mentioned that did not fall within the categories we used on the DAF. These included (but were not limited to) barriers related to the specific characteristics of vulnerable populations, such as cultural beliefs, interpretations, or language barriers [24, 38, 61, 70], literacy [34, 35], and specific issues related to disabilities, such as provision of written information for the hearing impaired [23]. **Figure 3** (below) represents the distribution of barriers addressed.

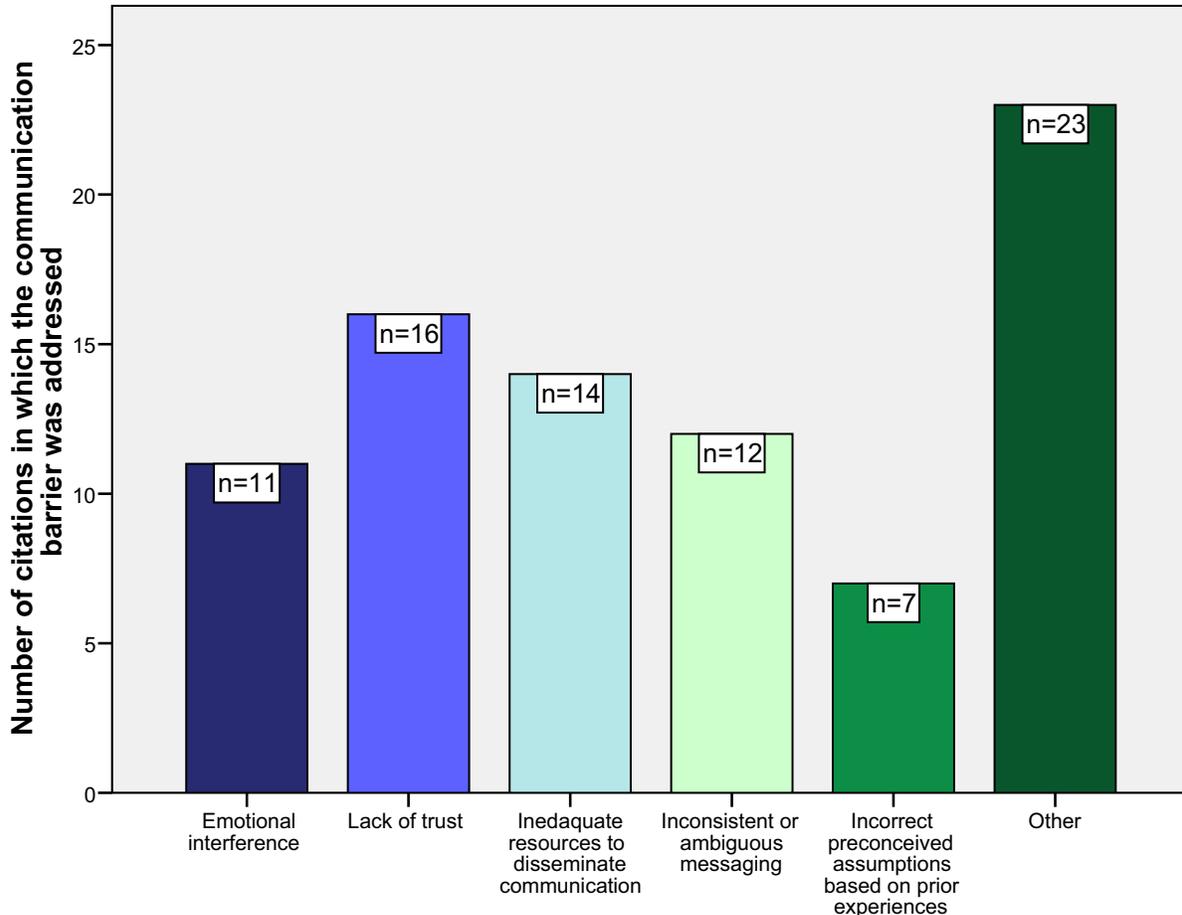


Figure 3. Barriers to Communication Success.

Statutes and Regulations

The DAF was used to extract data, where applicable, from the statutes and regulations included in the review. However, given the relatively small sample of statutes, regulations, and related reports deemed relevant for inclusion and the limited applicability of the DAF in characterizing these references (e.g., items such as Type of Study, Sample Size do not apply), rather than present aggregate data on DAF items we will briefly summarize the content relevant to emergency risk communication for vulnerable populations from each citation below. A table summarizing the vulnerable populations and stages of emergency addressed as well as key messages are displayed at the end of the section in **Table 2**.

The National Response Plan

The National Response Plan (NRP; [14]) from the Department of Homeland Security describes a comprehensive framework for response to all hazards. As such, the NRP addresses emergency preparedness, response, and recovery, but also prevention. The NRP was the only citation included in this review that addressed public health emergency prevention as a specific emergency stage.

Communication plays a significant role in the NRP. One of the plan’s “key concepts” is the provision of coordinated communication between federal, state, and local government, as well as between members of the public and private sectors, in response to a public health

emergency (generally referred to as Incidents of National Significance). Communication with vulnerable populations is not specifically addressed in the NRP.

Updated in 2006, the NRP details the development of a Joint Field Office (JFO) in response to an Incident of National Significance, the particular structure of which is determined by the type of emergency involved. In the JFO, primary responsibility for risk communication with vulnerable populations would fall to the External Affairs Officer (EAO). The EAO would work through the Federal Joint Information Center (JIC) and within the Logistics Section of the JFO. In its section on Incident Action Special Considerations, the NRP details three message considerations that would likely be impacted by an Incident of National Significance: message development, message delivery, and message receipt. Thus, the NRP acknowledges that there are significant challenges to successful risk communication in public health emergencies. These challenges are often exaggerated for members of vulnerable populations.

Finally, the NRP highlights the importance of citizens in all stages of emergencies, and describes the U.S. Citizen Corps, a community-based network that works to improve emergency preparedness, response, and recovery, by providing services that include “targeted outreach for special-needs groups.”

Title 42, The Public Health and Welfare, Chapter 68, Disaster Relief

Overall, Chapter 68 emphasizes that disaster relief must be nondiscriminatory [2]. Specifically, in Section 5151, the code states “provisions for insuring that the distribution of supplies, the processing of applications, and other relief and assistance activities shall be accomplished in an equitable and impartial manner, without discrimination on the grounds of race, color, religion, nationality, sex, age, or economic status.”

All vulnerable populations included in the PAHPA definition are not included in Chapter 68 of Title 42. Vulnerable populations specifically mentioned in the code are individuals from diverse cultures, low income backgrounds, seasonal farm workers, and “small impoverished communities,” defined as low income areas of less than 3000 persons. Emergency preparedness, response, and recovery are addressed in Chapter 68, and details are provided regarding associated communication between federal, state, and local government.

Chapter 68 primarily serves to legislate the duties of the federal government in responding to national emergencies and disasters. As such, the code does not provide specific recommendations regarding outreach to vulnerable populations beyond specifying that disaster relief be nondiscriminatory. However, in Section 5197h, the Minority Emergency Preparedness Demonstration Program is described. This program is intended to support research that 1) examines the preparedness and response capacities of diverse populations and 2) that promotes effective communication regarding public health emergencies to racial/ethnic minority groups. Relevant to the peer reviewed literature that addresses diverse populations and populations with limited English proficiency, the Minority Emergency Preparedness Demonstration program places an emphasis on the development of public health emergency education that is culturally competent. However, details on what defines culturally competent communication or education are not specified.

The Federal Response to Hurricane Katrina: Lessons Learned

The publicly available “Hurricane Katrina: Lessons Learned” report [11] follows a timeline beginning before Katrina’s landfall and ending with the continuing recovery efforts in the Gulf States. Emergency preparedness, response, and recovery are addressed for the vulnerable populations affected by the storm.

One hundred and twenty-five recommendations are made at the end of the report, organized within 17 “Critical Challenges.” One of the Challenges is Public Communications, which includes 5 recommendations specific to risk communication. The recommendations (summarized below) address several barriers to risk communication success identified in the peer reviewed literature, including trust in risk communication sources, resources to disseminate messaging, and clarity and consistency of risk communication. However, none of the barriers identified in the peer reviewed literature that specifically relate to vulnerable populations are referenced (e.g., cultural beliefs, interpretations, or language barriers [24, 38, 61, 70], literacy [34, 35], and specific issues related to disabilities, such as provision of written information for the hearing impaired [23]).

- *Recommendation #73:* The NRP should detail the ways in which clear and consistent communication will occur between officials from federal, state, and local governments.
- *Recommendation #74:* The Department of Homeland Security should train and provide rapidly deployable Public Affairs teams.
- *Recommendation #75:* Communications-related training should be provided to personnel in federal, state, and local governments.
- *Recommendation #76:* Credible spokespersons for risk communication should be identified and coordinated as part of White House crisis communications efforts.
- *Recommendation #78:* The Department of Homeland Security should develop an integrated emergency alert system that leverages advanced technologies.

Post-Katrina Emergency Management Reform Act of 2006

The Post-Katrina Emergency Management Reform Act of 2006 [15] outlines several actions to be taken by FEMA to address the needs of vulnerable populations before, during, and after public health emergencies.

Relevant to this review, the Reform Act recommends an Office of Emergency Communication within FEMA and designates an Administrator to create and oversee guidelines that address communication-related and other needs of individuals with disabilities, other vulnerable populations, and their caregivers. These guidelines will include provisions related to communication and accessibility both in shelters and more broadly during public health emergency response and recovery. Additionally, the Reform Act appoints a Disability Coordinator and establishes the National Emergency Child Locator Center (NECLC) within the National Center for Missing and Exploited Children. The NECLC is intended to facilitate communication aimed at reuniting families separated during a public health emergency via phone- and Internet-based media; for example, the NECLC is required to establish a toll-free hotline to receive reports of displaced persons and to manage a website that tracks information about displaced children.

The National Organization on Disability’s Report on Special Needs Assessment for Katrina Evacuees (SNAKE) Project

The National Organization on Disability’s SNAKE project report [6] describes the impact of Hurricane Katrina on vulnerable populations; specifically, individuals with “special needs” defined to include the elderly and those with physical, emotional, or cognitive disabilities. The SNAKE team evaluated shelter response in the aftermath of Hurricane Katrina using a survey that assessed shelter conditions, management, resources, and involvement of community-based organizations.

Among several recommendations made for how to better support vulnerable populations throughout emergency preparedness, response, and recovery, the SNAKE report offers specific guidance on how to present risk communication in accessible formats. Individuals who are deaf or hard of hearing were identified as the “most underserved” group with respect to communication needs. Accordingly, the SNAKE report suggests that the Federal Communications Commission remind purveyors of emergency information that emergency communications must be accessible to individuals with visual and hearing disabilities. The report goes on to emphasize that while accessible communication is critical during response to public health emergencies, communication must continue to be accessible during the recovery period as well; thus, any actions taken to increase the accessibility of emergency communications must extend beyond the area immediately affected by a public health emergency to include surrounding areas and states that will receive evacuees.

Trust for America’s Health: “Ready or Not? Protecting the Public’s Health from Diseases, Disasters, and Bioterrorism”

The Trust for America’s Health “Ready or Not?” 2007 report [12] aims to describe the nation’s progress toward achieving successful emergency preparedness (all hazards). Several preparedness indicators are examined state-by-state; however, none of the indicators included in “Ready or Not?” are specific to communication.

The report does address vulnerable populations in a section on “Additional Issues and Concerns.” Here, the report references another citation included in this review [24] and echoes the main points it contains, including the need to tailor risk communication to the needs of vulnerable populations and to deliver information through a trusted source, to increase communications-related training opportunities for emergency responders, and to involve members of vulnerable populations in community-based efforts to prepare for, respond to, and recover from public health emergencies.

The Joint Commission’s “Standing Together: An Emergency Planning Guide for America’s Communities”

The “Emergency Planning Guide” [10] from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) outlines 13 components of emergency planning for communities (rural and suburban) that are to be executed in a participatory fashion. “Ensure thorough communication planning” and “ensure thorough planning related to vulnerable populations” are specified as two of the 13 essential components.

The JCAHO Guide offers recommendations for emergency preparedness, response, and recovery for several vulnerable populations, including those who have disabilities, who live in institutional settings, who are elderly, who are from diverse cultures, who have limited English proficiency, who are children, who have chronic medical disorders, who have pharmacological dependency, and who are geographically isolated. Regarding communication planning, the Guide recommends 15 strategies, 3 of which are particularly relevant to this review: planners are encouraged to identify credible, trusted sources to disseminate risk communication to the public; to determine how messages can be disseminated in multiple forms so that all community members can receive the communication (e.g., offer information in multiple languages, in print and audio formats); and to craft culturally competent messages such that cultural and linguistic factors are taken into account.

Regarding vulnerable populations, the Guide suggests that emergency planners conduct needs assessments to identify vulnerable populations and to enlist members of vulnerable populations in planning and response activities, including drills and exercises. The developmental and

cognitive limitations of children regarding emergency risk communication are discussed; in particular, the Guide highlights children’s increased psychological vulnerability related to traumatic incidents associated with disasters and their limited cognitive resources with which to interpret relevant information. Educational settings are stressed as an important venue in public health preparedness: school nurses are identified as important partners for addressing the communication needs of children, and high school and college students are identified as potential participants in emergency planning and response.

Individuals with Disabilities in Emergency Preparedness (Executive Order 13347)

Executive Order 13347, Individuals with Disabilities in Emergency Preparedness [16] created the Interagency Coordinating Council on Emergency Preparedness and Individuals with Disabilities. The Council is chaired by the Secretary of Homeland Security and functions to ensure that the needs of disabled individuals are considered during the conception and implementation of emergency preparedness plans for all hazards.

Commission on the Accreditation of Rehabilitation Facilities’ “CARF Guide to Accessibility”

The CARF Guide to Accessibility [9] details the requirements that organizations must meet to successfully provide an environment that is accessible to individuals with disabilities. Though specific emergency stages are not addressed in this publication, issues regarding accessibility in the context of public health emergencies generally are addressed.

In Chapter 3 (and Checklist 4 of Appendix C), the Guide outlines numerous barriers to successful communication with disabled persons and specifies services that can be provided to overcome these barriers. Given the associated high-stress, it seems likely that the communication barriers identified by the CARF guide would only be exacerbated in the event of a public health emergency, thus underscoring the importance of following the guidelines to ensure communication accessibility for individuals with disabilities.

Visual, acoustic, and physical barriers to communication are included in the guide, such as inadequate lighting that interferes with lip reading or sign viewing, lack of signage and accessibility symbols, and high noise levels. Suggestions to overcome these barriers and to achieve successful risk communication with people with disabilities include installing sound buffers, flashing alarms, appropriate signage posted at heights accessible to individuals in wheelchairs, offering a large print option for printed materials, provision of assisted listening devices, and allowance of service animals.

The Administration on Aging’s “Just in Case: Emergency Readiness for Older Adults and Caregivers”

“Just in Case” [13] is a brief set of guidelines for the elderly and their caregivers addressing the functional areas of maintaining independence, communication, transportation, and medical care for emergency preparedness, response, and recovery. The guidelines are organized around 3 steps: *Know the Basics*, *Have Your Emergency Supplies Ready*, and *Make a Personal Plan*.

Communication is highlighted within the *Personal Plan* section; specifically, elderly individuals are encouraged to communicate with family, neighbors, and home health workers regarding a plan for staying safe during a public health emergency. Finally, “Just in Case” directs readers to several related websites, a readiness checklist, and a template to record emergency contact numbers and health conditions.

Table 2. Summary of Reviewed Statutes, Regulations, and Related Reports.

Statute/Regulation	Vulnerable Populations Addressed	Stages of Emergency Addressed	Key Message
The National Response Plan	Not specified	Prevention, preparedness, response, and recovery	Highlights the importance of citizens in all stages of emergencies and describes where communication procedures are housed in a Joint Field Office.
Title 42, Chapter 68	Diverse cultures, low-income, seasonal farm workers	Preparedness, response, and recovery	Details the disaster responsibilities of federal departments; disaster relief must be nondiscriminatory.
The Federal Response to Hurricane Katrina	Institutionalized individuals, elderly, diverse cultures, children, transportation disadvantaged, chronically ill, pharmacologically dependent, low-income	Preparedness, response, and recovery	Follows the timeline of events leading up to Hurricane Katrina's landfall through the recovery phase and offers 125 recommendations based on "lessons learned."
The Post-Katrina Emergency Management Reform Act of 2006	Individuals with disabilities, elderly, children, low-income, homeless, individuals with special needs and their caregivers	Mitigation, preparedness, response, and recovery	Recommends an Office of Emergency Communication within FEMA, a Disability Coordinator, and guidelines to ensure successful communication and accessibility for vulnerable populations.
National Organization on Disability's SNAKE Project	Individuals with disabilities, elderly	Preparedness, response, and recovery	Describes the impact of Hurricane Katrina shelter conditions on individuals with special needs; the deaf and hard-of-hearing are identified as the most underserved.
Trust for America's Health "Ready or Not?"	Individuals with disabilities, elderly, limited English proficiency, children, transportation disadvantaged, pharmacologically dependent, low-income, geographically isolated, homeless	Preparedness, response, and recovery	Reports progress on indicators of preparedness state-by-state. Cites [35] regarding communication strategies with vulnerable populations.
JCAHO's "Standing Together"	Individuals with disabilities, institutionalized individuals, elderly, diverse cultures, limited English proficiency, children, chronically ill, pharmacologically dependent, geographically isolated	Preparedness, response, and recovery	Outlines 13 components of emergency planning for rural and suburban communities. Recommends needs assessments to identify vulnerable populations and to enlist them planning and response activities.
Individuals with Disabilities in Emergency Preparedness (Executive Order 13347)	Individuals with disabilities	Preparedness	Established the Interagency Coordinating Council on Emergency Preparedness and Individuals with Disabilities.
CARF Guide to Accessibility	Individuals with disabilities	Not specified	Offers guidance to assure that risk communication can be accessible to and acted upon by disabled persons.
Administration on Aging's "Just in Case"	Elderly, caregivers for the elderly	Preparedness, response, recovery	Brief set of guidelines and resources addressing functional areas of maintaining independence, communication, transportation, and medical care during public health emergencies.

Gaps in the Literature on Public Health Emergency Risk Communication with Vulnerable Populations

Along with the themes regarding successful risk communication strategies with vulnerable populations, gaps in the literature were revealed through our review as well.

Vulnerable Populations are Underrepresented in the Public Health Emergency Risk Communication Literature

Only 40 citations – 20% of the peer reviewed literature on public health emergency risk communication – contained a substantive focus on vulnerable populations (i.e., vulnerable populations were referenced in the title or abstract). Some vulnerable populations were less well represented than others: only a few citations (less than 5) were identified that addressed those who live in institutional settings [36, 39, 58, 71], who are geographically isolated [21, 31, 45], those with pharmacological dependency [7, 71], or individuals with low literacy [37, 41]. Additional vulnerable populations addressed in only 1 citation each included developing countries [66], indigenous persons [61], those in “poor health” [57], refugees/immigrants [62], the rural poor in India [35], critically ill hospital patients [58], and socially isolated individuals [36]. None addressed pregnant women.

Thus, there is little evidence upon which to build effective risk communication strategies for many groups within vulnerable populations, including but not limited to individuals living in long-term care facilities, recent immigrants who have limited English proficiency, people with disabilities that affect mobility or cognitive capacity, or pregnant women.

Implications for Tasks 4 and 5: Continued work should determine how much of the available educational and/or outreach materials that are currently available are targeted towards the vulnerable populations largely left out of the peer reviewed literature (Task 4) and to what degree these groups are represented within risk communication strategies for vulnerable populations (Task 5).

The Literature is Primarily Descriptive and Qualitative in Nature

Qualitative studies were most often represented in the literature on public health emergency risk communication with vulnerable populations [21, 23, 29-33, 43-45, 61, 69, 70, 72], followed by literature reviews [24, 25, 35-38, 46, 56, 65] and observational studies (survey-based; [22, 27, 28, 39, 40, 57, 68]). The remaining studies reviewed were of another type (e.g., content analysis of web-based emergency preparedness materials [34]; multi-method studies incorporating qualitative and observational methods [7, 26]. Most studies relied on a qualitative analytical approach [7, 21, 23-25, 29-38, 41, 43-47, 56, 61, 62, 65, 67, 69-71], while a few employed descriptive or bivariate analyses [22, 28, 40, 57, 58, 68, 72] and 2 used multivariate analyses [27, 39]. Additionally, 1 citation used a country case study analytical approach [66] and another used both qualitative and multivariate analysis [26]. For over half of citations reviewed [22, 23, 25, 28-35, 37, 38, 40, 41, 43, 44, 46, 47, 56-58, 65, 67-70, 72] the primary research objective was descriptive. Program/policy development or evaluation was an objective of several references [7, 21, 24, 25, 31, 36, 40, 46, 47, 58, 61, 62, 65, 67, 71, 72] with the remainder of studies being needs assessments [24, 29-32, 45, 70], hypothesis driven [26, 27], or documentation of ways information is exchanged between countries [66].

Overall, within the small literature on public health risk communication that does address vulnerable populations, most references are descriptive in nature and use only qualitative methods in their study design. Indeed, there are several challenges to the empirical study of public health preparedness given that full scale public health emergencies are (fortunately) rare

events [73]. Better representation of different types of studies (e.g., observational studies, experimental studies) and different types of methods or analytical approaches (e.g., representative survey samples, quantitative analysis) would facilitate the growth of a strong evidence base that can offer specific guidance on communication interventions for vulnerable populations.

Gaps Related to Functional Areas Addressed

One of the critical functions of public health emergency risk communication is to provide actionable information about functional areas of importance to vulnerable populations. Though functional areas were well distributed across types of vulnerable populations, some gaps exist; for example, none of the literature we reviewed described emergency communication regarding maintaining independence, transportation, or supervision for individuals with disabilities. Similarly, emergency communication regarding supervision was missing from the literature on the elderly.

Implications for Tasks 4 and 5: Continued work should determine whether a range of functional areas are addressed in existing outreach and educational materials (Task 4) and to what degree functional areas are included within risk communication strategies for vulnerable populations (Task 5).

DISCUSSION

Though a large body of research exists on public health emergency risk communication, only a small portion of that literature addresses vulnerable populations, and most citations are primarily descriptive in nature, leaving very few that offer empirical support for specific public health messaging strategies for use with vulnerable populations. However, in the aftermath of Hurricanes Katrina and Rita in particular, studies of public health emergency risk communication focused on vulnerable populations have become more common. As the evidence base regarding risk communication strategies for vulnerable populations grows, policy makers and decision makers can draw upon the general literature on public health emergency risk communication to design strategies for success [1]. In addition, our review identified several promising approaches to successful public health emergency risk communication with vulnerable populations:

- Offer frequent risk communication in multiple modes that are locally and personally relevant;
- Employ community-based participatory approaches when designing and disseminating risk communication for vulnerable populations;
- Keeping in mind that access may be limited, consider Internet-based communication strategies, particularly during emergency response and recovery;
- Risk communication must be culturally competent in addition to being offered in languages appropriate for vulnerable populations;
- Vulnerability assessments are key to developing successful risk communication strategies with vulnerable populations;
- Children are a vulnerable population with special needs and schools are a promising setting for delivering risk communication to children and other vulnerable populations;
- Leadership is critical to successful risk communication with vulnerable populations, particularly in self-contained organizations (e.g., hospitals, companies, schools)

- Meteorologists may be a preferred risk communication messenger during public health emergencies to which they are relevant (e.g., natural disasters and any emergency with an airborne component).

Limitations

Though we aimed to be comprehensive in our review, our search strategy may have excluded potentially relevant references from the citations that were examined for inclusion. Our search aimed to capture the broad literature on public health emergency risk communication; those that addressed vulnerable populations were included in the review. Had our strategy first captured the broad literature on vulnerable populations and then included references that addressed public health emergency risk communication, we may have found different results. Further, by only including peer reviewed literature published since 2000 in our database search, we may have eliminated books or other reports that include information relevant to the review. Additionally, as the public health emergency risk communication literature published since 2000 focuses heavily on the events surrounding Hurricanes Katrina and Rita [22, 26-28, 32, 40, 41, 43, 58], our results may be biased towards risk communication regarding natural disasters and the vulnerable populations represented in the Gulf States. Finally, in reviewing a relatively small sample of statutes, regulations, and related reports deemed relevant for inclusion and the limited applicability of the DAF in characterizing these references, our incorporation of these citations into the larger review was somewhat limited.

Conclusion

Risk communication plays a key role in keeping vulnerable populations safe before, during, and after public health emergencies. This review offers insights into ways of improving public health emergency risk communication with vulnerable populations and suggestions as to how subsequent project tasks can further inform efforts to address vulnerable populations in emergency preparedness, response, and recovery.

Appendix A. Detailed Peer Reviewed Literature Search Methods

Peer Reviewed Literature

We conducted a review of the literature pertaining to the use of risk communication strategies for vulnerable populations in any stages of emergency preparedness, response, or recovery. Our review included peer-reviewed citations published in English since January 1, 2000. Using these limits, the search strategy in **Table A1** was used to identify citations for possible review in 4 databases (PubMed, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, Social Science Citation Index). Additionally, all references dated 2000 or later in the National Cancer Institute’s Risk Communication Bibliography were searched, and publications posted on the Center for Risk Communication website (<http://www.centerforriskcommunication.com/home.htm>) were also reviewed for inclusion. The review research team (EB and SS) examined titles and abstracts to filter out duplicate retrievals and to determine whether citations met additional inclusion criteria (Criteria A, **Table 1**).

Table A1. Literature Review Search Strategy and Inclusion Criteria.

Search strategy	[risk communication OR health communication OR public health messaging] AND [emergency preparedness OR emergency OR preparedness OR emergency response OR emergency recovery OR public health emergency OR disaster OR disaster preparedness OR disaster response OR disaster recovery]	1268 citations identified by search strategy ↓ 203 met Criterion A ↓ 40 met Criteria A and B
Criterion A	<ul style="list-style-type: none"> • Cannot address the consequences of a public health emergency without including risk communication • Cannot address only risk perception without addressing risk communication • Cannot describe a preparedness training program (though may describe the results of a training exercise) • Cannot address only inter-agency communication without addressing communication to the public 	
Criterion B	<ul style="list-style-type: none"> • Vulnerable populations are specifically and substantially referenced in the title and/or abstract 	

From over 1200 citations identified by our search strategy, 203 met Criterion A. These citations represented the broad literature on risk communication and public health emergencies. To identify which of these specifically addressed vulnerable populations (Criterion B), the review team conducted a second, more thorough abstract review of these 203 citations. Forty (**20%**) were determined to substantively address public health emergency risk communication for vulnerable populations and represented the final literature sample for full review.

Appendix B. Data Abstraction Form (DAF)

The DAF was used to systematically record information from the citations included in the review (peer reviewed literature and statutes/regulations). The DAF was developed by the research team to capture standard elements regarding quality and content (e.g., type of study, sample size, analytic approach). In addition, several items were created by the team to capture data for the specific purposes of this review, including what vulnerable populations were included in the reference, the source of risk communication and the communication delivery method, the type of public health emergency described, and the functional areas addressed (e.g., communication, medical care). Barriers to communication success were defined based on previous research conducted by members of the research team [72, 74] as well as a review of the literature on public health emergency risk communication [1]. Further, items to capture the primary research objective of each reference and the stages of emergency preparedness, response, and recovery addressed were included based on results of a recent literature review on disaster medicine and public health preparedness [75]. Additionally, as our working definition of risk communication highlights the importance of “actionable information,” we examined articles for whether specific functional areas were addressed in the context of risk communication (i.e., did the communication provide actionable information or instruction related to specific functional areas relevant to the needs of vulnerable populations). Finally, a field was included in the DAF to enable a qualitative analysis wherein the review team summarized the main points of each study in a free text entry of 3 to 4 sentences. Once a DAF was complete for all identified documents, the data were entered into SPSS, Version 16.0 for analysis. Free text entries were entered into the SPSS database, cut, and sorted into thematic categories.

1. Citation:			
2. Does the reference address vulnerable populations?		Yes	No
If yes: Which ones? (check all that apply)		who have disabilities	
		who live in institutional settings	
		who are elderly	
		who are from diverse cultures	
		who have limited English proficiency or who are non-English speaking	
		who are children	
		who are transportation disadvantaged	
		who are pregnant women	
		who have chronic medical disorders	
		who have pharmacological dependency	
	Other (specify; include low-income):		
Evaluation of Quality			
1. Type of study			
	Randomized controlled trial		
	Literature Review		
	Meta Analysis / Systematic Review		
	Qualitative data		
	Observational/ Survey		
	Longitudinal data		
	Other (specify):		
2. Sample description (Include gender, age, race/ethnicity)			
3. Sample size			
4. Data collection method			
	Focus group		
	In-person interview		
	Phone/Mail/Web survey		
	Other (specify):		
5. Measures			

6. Analytic approach	
	Qualitative synthesis (includes literature reviews)
	Descriptive or bivariate analysis only
	Multivariate analysis
	Other:
7. Estimated impact of results (check "not applicable" if citation is a literature review)	
	How novel is the study? (0-10 where 10 is most novel)
	How usable are the study's results? (0-10 where 10 is most usable)
	How rigorous are the study's methods? (0-10 where 10 is most rigorous)
	Average
Evaluation of Content	
1. Type of publication	
	Original research
	Statute or regulation
2. Stages of preparedness addressed (check all that apply)	
	Preparedness (e.g., vaccination, education, resource gathering)
	Response (e.g., evacuation)
	Recovery & Mitigation (e.g., shelter management, safety maintenance, MH)
	Other (specify):
3. Source of risk communication (check all that apply)	
	Local government
	State government
	Federal government
	Health care provider/health care system
	Other (specify):
4. Communication delivery method (check all that apply)	
	Written
	Internet
	Radio/Television
	Interpersonal
	Other (specify):
5. Intended communication audience	
6. Primary research objective (check all that apply)	
	Descriptive
	Program/policy development or evaluation
	Hypothesis driven
	Needs assessment
	Other (specify):
7. Type of Emergency (check all that apply)	
	Natural disaster
	Man-made disaster
	Terrorist threat/incident
	Infectious disease outbreak
	Infectious disease pandemic
	Other public health emergency
	Other emergency (specify):
8. Outcomes assessed (check all that apply; say "not applicable" if citation is a literature review)	
	Change in awareness
	Change in understanding/comprehension
	Change in behavior
	Other (specify):
9. Barriers identified to communication success	
	Emotional interference
	Trust in source of communication
	Resources to disseminate communication
	Inconsistent or ambiguous messaging
	Pre-conceived assumptions based on prior experience with type of emergency
	Other (specify):

10. Functional areas addressed (check all that apply)	
	Maintaining independence
	Communication
	Transportation
	Supervision
	Medical care
	Other (specify):
11. Impact of communication (check "not applicable" if citation is a literature review)	
	Significant
	Neutral
	Low
	Unknown
	Not applicable (e.g., a specific communication intervention was not evaluated)
12. Overall implications	

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