**Communicating Public Health Alerts and Guidance with Technical Audiences:
Qualitative Research Evidence Synthesis**

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1.0 INTRODUCTION

The National Academies of Sciences, Engineering, and Medicine (National Academies) Committee on Evidence-Based Practices for Public Health Emergency Preparedness and Response (PHEPR) commissioned a systematic review and synthesis of existing evidence to support the creation of guidelines for prioritizing public health preparedness and responses capabilities as developed by the Centers for Disease Control and Prevention (CDC).

The synthesis of evidence presented in this report addresses the effectiveness of different channels for communicating public health alerts and guidance with technical audiences during a public health emergency.

Specifically, the purpose of the evidence synthesis was to address the following questions:

- What is the effectiveness of different channels for communicating public health alerts and guidance with technical audiences during a public health emergency?
- What are the benefits and harms of engaging technical audiences in the development of communication plans, protocols, and channels?
- What are the barriers and facilitators to effective communication with technical audiences?
- What benefits and harms (desirable and/or undesirable impacts) of different communication channels?

The evidence of interest for answering the questions was the findings from primary research studies that used qualitative research methods such as interviews and free-text survey responses. Given the qualitative research approach and the methodological range of primary studies available in the corpus for this evidence synthesis, the questions were treated as informing different aspects of the phenomenon.

2.0 METHOD

2.1 Literature Search

A broad literature search was undertaken from which relevant qualitative research studies were selected. The literature search was conducted in the Medline (Ovid), Embase (Ovid), and Scopus databases and used the following inclusion and exclusion criteria:

- Date: 2001 - present;
- Language: English; and
- Document Type: Exclude commentaries, editorials, letters, and notes.

More details about the search process, including the search strings, are available separately in the National Academies report.

To be selected for the present evidence synthesis, a qualitative study had to use a qualitative method of data collection, such as interviews, as well as a qualitative method of data analysis, such as thematic analysis.

Based on the above, there were total 8 qualitative studies selected for the evidence synthesis. In addition, two studies contained qualitative analysis of free-text responses to a survey. The findings from these sources were separately considered to affirm or question those findings from the more complete qualitative studies. The studies (first author and year) are listed in Table 3.1.

2.2 Relevance Assessment of Individual Studies

Individual articles were judged for different levels of relevancy to the phenomena of interest (see Lewin et al., 2018 and Noyes et al, 2018, for details of the relevancy criteria). Studies were judged to have direct relevance (i.e., directly mapped onto phenomenon of interest); indirect relevance (i.e., some aspects of phenomenon of interest covered whereas other aspects are analogs/substitutes for phenomenon of interest); partial relevance (i.e., only some aspects of the phenomenon of interest covered); or unclear relevance (i.e., unclear whether underlying data were relevant) with the phenomenon of interest.

2.3 Quality Appraisal of Individual Studies

The selected studies were individually appraised using the Critical Appraisal Skills Programme (CASP; 2018) checklist, which is applicable to assessing qualitative research. Areas of appraisal by CASP include appropriateness of qualitative methodology, data collection, relationship between research and participants, ethics, rigor of data analysis, clarity of findings, and value of research. Each area is assessed using "yes," "no," or "can't tell."

We modified the checklist to include an overall rating in addition to the ratings of individual elements. Based on the CASP checklist evaluations, each study received a final overall quality rating of one of the following four categories: no or very minor concerns (no significant flaws); minor concerns (minor flaws not impacting credibility/validity of findings); moderate concerns (some flaws likely to impact credibility/validity of findings); or serious concerns (significant flaws impacting credibility/validity of findings). This overall rating was not a summation of the individual element ratings but a separate judgment.

2.4 Data Analysis and Synthesis

We used Atlas.ti (Version 8.1, Atlas.ti Scientific Software Development GmbH, Berlin, Germany), a qualitative data analysis software, for data extraction and synthesis. The primary study articles were uploaded into Atlas.ti and the extraction, coding, and synthesis processes were directly applied to these documents.

Study characteristics and key findings along with supporting information were extracted from each study. We used the general process of reading and re-reading the full article, including the abstract, rationale, method, results and analysis, and discussion sections to identify the characteristics and findings of interest.

2.4.1 Study Characteristics

Total 9 study characteristics were extracted. These included: Country and location of event; emergency event; emergency event phase; guidance source; channel; technical audience; data source; data providers; and jurisdictions involved.

2.4.2 Study Findings

The key findings and supporting information from each study were extracted in the form of key phrases, sentences, and direct quotations. For studies that used multiple methods, only the qualitative portion was extracted. The purpose of extraction of findings was to identify and note evidence that mapped onto the phenomenon of interest.

Specifically, we employed the pragmatic framework synthesis method (see Barnett-Page, & Thomas, 2009; Pope, Ziebland, & Mays, 2000), which uses an iterative deductive and inductive process, to analyze and synthesize the findings. A five-step process was used: Familiarization to create a priori descriptive codes and codebook development; first-level in vivo coding using descriptive codes; second-level coding into descriptive themes (families of descriptive codes); analytic theming (interpretive grouping of descriptive themes); and charting/ mapping and interpretation. Tracy (2018), provides additional instructions on the key principles of coding qualitative data for the purposes of analysis, which was adapted for the current context.

The first step of familiarization involved an initial close reading of the project documents and the selected articles to create descriptive codes. The familiarization with the project documents unpacked the key questions, sub-key questions, context questions, evidence-to-decision issues, aims and objectives of the project, and the logic models, to identify key phrases/ words that meaningfully addressed the phenomenon of interest. The familiarization with the articles similarly identified key phrases/ words that described various aspects of the phenomenon of interest. Both sets of key phrases/ words were converted to descriptive codes, which captured the essence of the extractions and replaced the in vivo original words with ones that translated across studies, creating a common yet representative nomenclature. We developed a codebook, which compiled the codes with corresponding definitions, thereby forming a set of a priori descriptive codes.

The second step of first-level in vivo coding involved multiple close readings of the articles in their entirety, with attention to findings wherever they appeared (particularly in the abstracts, results, discussions, and conclusions). We highlighted the in vivo findings (consisting of verbatim key phrases, sentences, and paragraphs) related to the key question, sub-key questions, context questions, or evidence-to-decision issues and assigned a descriptive code. When there were no a priori codes that matched the essence of in vivo extractions, this was considered an emergent code. The emergent code was translated to a new descriptive code, and the code with a corresponding definition was incorporated in the codebook. During this process, the researchers were attentive to all meaningful extractions, whether they appeared to confirm or counter previously coded extractions. For mixed-method studies that had both qualitative and quantitative portions, only the qualitative findings were coded.

The third step of second-level coding involved a synthesis process of creating descriptive themes, where a theme was a family of descriptive codes in which codes that formed a cohesive set were grouped together. The themes represented a nuanced description, rather than just a generalized description, of the phenomenon of interest.

The fourth step involved a synthesis process of creating analytic themes. This analytical theming relied on a robust interpretation of the descriptive themes and how they intersected relationally with one another, whether, for

example, separately, cumulatively, or dialectically. The descriptive themes were grouped together in a nuanced manner to create the analytic themes.

The fifth step of mapping/ charting involved explaining how the analytic themes specifically addressed the phenomenon of interest. Additionally, evidence-to-decision issues were addressed in this step by looking at how the analytic themes were grounded in descriptive themes, codes, and in vivo extractions.

2.5 Assessment of Confidence in Synthesized Findings

The fourth-step analytic themes, and in some cases the third-step descriptive themes, constituted the final set of synthesized findings. These findings were assessed for confidence using GRADE-Confidence in the Evidence from Reviews of Qualitative research (GRADE-CERQual; Lewin et al., 2015; Lewin et al., 2018).

The synthesized findings were assessed using four domains: Methodological limitations, relevance, coherence, and the adequacy of data supporting the synthesized finding. Each synthesized finding was then given an overall assessment as follows:
- High confidence - it is highly likely that the finding is a representation of the phenomena;
- Moderate confidence - it is likely that the finding is a representation of the phenomena;
- Low confidence - it is possible that the finding is a representation of the phenomena; and
- Very low confidence - it is not clear if the finding is a representation of the phenomena.

2.6 Quality Assurance of Review

Quality assurance of the review was achieved through discussion until consensus was reached. The discussion involved team members as well as the National Academies staff and methodology consultant.

2.6.1 Quality Assurance of Extraction of Data

An initial codebook for extracting study characteristics and findings was developed. After receiving feedback on a draft from team members, National Academies' staff, and methodology consultant, the document was suitably revised. Training sessions for the use of the codebook were conducted with the research team.

Next, a pilot test of the codebook portion for extracting study characteristics and findings was conducted. Two team members, the lead author of the report and a graduate student research assistant, separately coded approximately 25% of the articles. An analysis of the coding showed high agreement (approx. 80%) between the two readers.

The pilot test generated suggestions for refinement from the team members. The final codebook was created after incorporating this feedback.

2.6.2 Quality Assurance of Quality Appraisal of Individual Studies

All team members discussed the different elements of the CASP ratings tool and their application to the identification and assessments of the elements within the articles. After this, two team members, the lead author of the report and a graduate student research assistant, separately used the CASP tool to appraise all the articles. The two team members discussed any disagreements. The lead author made the final determination based on the discussion.

2.6.3 Quality Assurance of Synthesis of Findings

The synthesis of findings was done by the lead author of the report. The synthesis process and the synthesized findings were discussed in weekly meetings with the second author, who closely read the synthesized findings and offered critique. A draft of the findings was also discussed with and critiqued by the National Academies staff and methodology consultant. The final synthesized findings were developed based on the discussion and critique.

The assessment of confidence in the synthesized findings was done by the lead author of the report. The second author reviewed the assessments, queried the lead author for additional information, and offered suggestions. The final assessment was decided after this discussion.

3.0 FINDINGS

3.1 Relevance Assessment and Quality Rating of Individual Studies

The relevance assessment, as summarized in Table 3.1, showed the following for the 10 studies: 5 were of direct, 4 were of partial, 1 was of indirect, and none were of unclear relevance. Thus, 50% of the studies were directly relevant to the phenomenon of interest.

The quality rating using the CASP tool, as summarized in Table 3.1, showed the following for the 10 studies: 5 had no or very minor, 1 had minor, and 4 had moderate concerns. Thus, 60 % of the studies were of high and moderate and 40% were of low quality.

Table 3.1. Study Citation, Relevance Assessment, and CASP Quality Rating (N = 10)

Study [First Author Only, Publication Year]	Relevance [Direct, Indirect, Partial, Unclear]	CASP Rating of Quality [No or Very Minor, Minor, Moderate, Serious Concerns]
Filice (2013)	Partial [Does not examine the full range of communication activities]	No or Very Minor
Garrett (2011)	Direct	Moderate
Janssen (2006)	Partial [Does not examine the full range of communication activities]	Moderate
Khan (2017)	Direct	No or Very Minor
Leung (2008)	Partial [Does not examine the full range of communication activities]	Moderate
Lis (2018)	Partial [Does not examine the full range of communication activities	Moderate
Markiewicz (2012)	Partial [Does not examine the full range of communication activities]	No or Very Minor
Ockers (2011)*	Direct	Minor
Revere (2015)	Direct	No or Very Minor
Staes (2011)*	Direct	No or Very Minor

Note. * Ockers (2011) and Staes (2011) contained qualitative analysis of free-text responses as part of a quantitative survey. The findings from these two studies were separately considered to affirm or question findings from the more complete qualitative studies.

3.2 Study Characteristics

Of the 10 studies, a majority were conducted in the United States (8) and 2 in Canada. Three studies were for all hazards emergencies and pandemics, with some conducted during/after influenza (5), SARS (1) and Ebola (1) outbreaks. Six related to all phases of an event, 3 focused particularly on preparedness, and 1 on response. A majority of studies referred to public health guidance (8), without specifying the source. In two studies, where messages were examined/tested, one developed guidance materials and the other utilized guidance delivered

through Health Alert Network (HAN) and Clinician Outreach and Communication Activity (COCA) channels. Only two studies focused specifically on communication channels, namely electronic medical records (Garrett, 2011) and short messages services (SMS; Revere, 2015). Four studies did include some results about multiple channels. Five had minimal results related to channels, yet broadly discussed preferences and challenges about effective communication. The technical audiences were primarily health care providers (8). Additionally, there were two studies that included community-based partners (Leung, 2008; Revere, 2015). Table 3.2 provides information for all the study characteristics.

Table 3.2. Study Characteristic and Characteristic Categories

Study Characteristic	Characteristic Categories

Country and Location of Event	Canada: 2
	  --Ontario: 1
	  --Toronto: 1
	United States: 8
	  --National: 3
	  --California, Oregon, Louisiana, Washington State: 1
	  --Montana, Washington State: 1
	  --North Carolina: 1
	  --Utah: 1
	  --Washington State: 1

Emergency Event	All Hazards: 3 Ebola: 1 Influenza: 5 SARS: 1
Emergency Event Phase	All Phases: 6 Preparedness: 3 Response: 1
Guidance Source	Public Health Guidance: 8 Obtained/Adapted from HAN and COCA: 1 Developed for Study: 1
Channel	Conference Calls: 1 Electronic Medical Record: 1 SMS/Text: 1 Multiple: 2 No Specific Channel: 5*
Technical Audience	Emergency Departments: 1 Pediatric Emergency Departments: 1 Healthcare Providers: 2 Healthcare Providers and CBPs: 1 CBPs-Homeless Providers: 1 Healthcare, Healthcare Coalition: 1 Hospitals and Clinicians: 1 Vaccine Healthcare Providers: 1 None: 1 (CDC staff)
Data Source	Interviews: 4 Interviews and Survey: 2 Survey: 2 (free-text responses) Meetings: 2
Data Providers	CBP (Homeless Service Providers), Public Health, EMS

	Staff, Clinicians: 1
	Health Alerts: 1
	Healthcare Providers: 2
	Healthcare Providers and CBPs: 1
	Pediatric Emergency Department leaders: 1
	Emergency Department Clinicians: 1
	Healthcare, Healthcare Coalition Partners: 1
	State and Local Public Health, Public Health Epidemiologists, Supervisors of Epidemiologists, Clinicians: 1
	National Stakeholders: 1
Jurisdictions Involved	Local: 7
	Regional: 1
	State: 3
	National: 2

Note. *Liaisons and coalitions are treated as amplifiers rather than channels in this review. Thus, those studies fall into the category of no specific channel. Alternatively, they could be considered as role-based channels.

The frequencies for the study characteristic categories may not add up to 10 (the total number of studies) as some studies examined multiple categories for a characteristic.

3.3 Synthesized Findings

The phenomenon of interest for the present evidence synthesis was communicating public health alerts and guidance with technical audiences. The findings from individual studies were synthesized to describe this phenomenon, both as a whole and its different aspects as embodied in the questions of interest noted in the introduction to this report.

Five synthesized findings emerged from the 10 studies forming the corpus for the evidence base. The findings are discussed below and are summarized in Table 3.3.7 The table also presents the assessment of confidence in the evidence for the findings as judged using the GRADE-CERQual tool (see Section 2.5 for description).

3.3.1 Technical Audiences and Communication in General

No synthesized finding emerged related to technical audiences and communication in general.

In the event of a public health emergency or pandemic, target audiences noted the complexity of guidance and emergency dynamics. Nonetheless, target audiences stress the importance of knowledge accuracy and quality, and find challenging the evolving degrees of uncertainty (Khan, 2017). In general, target audiences stress the importance and preference of just-in-time guidance dissemination (Janssen, 2006; Leung, 2008), which is concisely summarized by the statement, "When it's important tell me what to do and I'll do it" (Janssen, 2006, p 382). Additionally, target audiences stress how they want no more and no less than the right amount of information (Ockers, 2011). In brief, accuracy, quality, timeliness, and usefulness of guidance is of utmost importance (Staes, 2011).

Revere (2015) noted that "public health is highly trusted, thus thoughtful, effective messaging will ensure continuation of this goodwill." Such a sentiment indicates how communication, as in *process*, and communications, as in *messages*, work interactively in concert.

3.3.2 Technical Audiences and Communication Channel Types

Finding 1: Multiple channels facilitate effective communication by attending differentially to contextual dynamics while avoiding message overload. Contextual dynamics include such priorities as access, accuracy, coordination, dissemination, reciprocity, and timeliness.

Per se, none of the studies in this review conducted comparative analyses on the effectiveness of different channels for communicating public health guidance and alerts during a public health emergency. Two studies focused on electronic health records and SMS (Garrett, 2011; Revere, 2015). Most studies reported some results related to certain channels; participants reported what worked well, what did not work well, and suggestions for consideration. Table 3.3.1 below summarizes these for observations and considerations for the channels discussed in the studies of this review.

Table 3.3.2. Different Channel Types and Their Use

Type of Channel	Use of Channel
Face-to-Face	Direct contact through in-person meetings are synchronous which accommodates degrees of nuance and flexibility related the uptake and understanding of public health guidance. (Khan, 2017) In-person meetings between public health personnel and emergency department clinicians are useful, especially when there is perceived anxiety or discomfort about particular guidance. (Khan, 2017)
Phone Calls	Direct contact through phone calls and teleconferences are synchronous which allows for degrees of nuance and flexibility related the uptake and understanding of public health guidance. It is also helpful for <u>very</u> urgent communication (Khan, 2017). In one example, public health epidemiologists as role-based channels participated in weekly phone calls with the state public health department (Markiewicz, 2012). In another example, the process of using 2-tiered conference calls expedited specific decision-making for coordinated patient care decisions (Lis, 2018). The 2-tiered calls (triage call followed by coordination call) allow for collaborative, cross-agency decision-making.
Email	Regardless of situational context (emergency vs. non-urgent) and message recipient (target audience), e-mail is a favored modality for receiving public health messages (Revere, 2015). Despite limitations of email, it was the preferred method of communication for public health guidance to front-line staff by ED clinician administrators, who judged it the fastest way to present information to clinician (Khan, 2017) Email dissemination relies on an established listserv, prepared in advance. This is used as a push-type, one-way channel for communicating guidance to target audiences. This may be seen as a limitation, as some key people not be on the list and/or the list requires constant maintenance to keep-to-date (Khan, 2017; Leung, 2008)
Fax	This channel is often used as in tandem with email (Ockers, 2011; Revere, 2015). Faxes still may arrive when phone calls cannot connect

Internet/Websites	One study indicated that providers were as likely to seek information from Google as CDC (Janssen, 2006), Revere and colleagues (2015) noted that some health providers and community-based organizations are currently using social media as a channel to some degree; however, this was less so for public health agencies. This result was quite inconsequential to focus and the main findings of the study. Evident in the corpus of the studies for this review is the delay of research related to emerging technologies.
SMS/Text	SMS/text provides rapid, in-the-field short messages, probably helpful in emergencies but not for mass communications. When information is lengthy, email appears better suited and preferred. (Revere, 2015) Both public health agencies and their stakeholders note multiple values/uses as well as concerns regarding two-way public health messaging and SMS (Revere, 2015) Use of SMS may facilitate communication and be potentially beneficial. For example, it can readily provide "eyes on the ground" reports, short polls, post-disaster check-in of status and availability, and is an alternative when phone lines are out of service. Conversely, there are concerns, including receiving SMS on personal phones, restrictive screen space, it is not persistent and easy to ignore, limited cell coverage, security, and inability to forward (Revere, 2015).
Electronic Health Records	Electronic health records would enable guidance to arrive directly to point of individual care and monitoring They have the potential to be a channel but as of yet have many issues—related to technology, resources, and compatibility with emergency guidance—to be considered and managed before effective implementation could occur (Garrett, 2011).
Multiple Channels	Both public health and ED participants described using judgment around the optimal channel depending on the context, such as the level of uncertainty or urgency (Khan, 2017; Staes, 2011)

The use of two channels, email and fax, have been the preferred channels and still are considered quite optimal. However, advances in information technologies often push the public health system to examine and adopt new channels, so as to continue to fulfill its core function of providing information to the public health community (Janssen, 2006; Revere, 2015). Results from free-text responses in the survey conducted by Ockers (2011) similarly indicated that email and faxblast are the preferred channels.

The specific channels by which participants communicate influence communication. Participants described using multi-pronged approaches, where they first used one method, and then followed up with another. As reported by Khan (2017), "Both public health and ED participants described using judgment around the method depending on the context, such as the level of uncertainty or urgency" (p. 6). One provider participant said, "[I communicate] almost exclusively by email if it is something urgent. One-on-one if it is very urgent, like the people working today need to know, then I would call them directly, because not everyone checks their email on their way to work, but normally for stuff that is sort of 24, 48 hours, I send it by email" (Khan, 2017, p. 6)
Another provider participant showed preference for multiple channels by stating "…emails get sent off and I am sure someone from public health feels 'my responsibility is done', but in reality it is not a closed loop communication, and things could be missed. So I would hope that in important situations there is the closed loop communication of a phone call or…If something was truly a very big emerging threat to know that things are being acted on." (Khan, 2017, p.6).

Janssen reported findings that indicate multiple communication strategies can be utilized and the choice of a specific strategy needs to balance message content (emergency versus routine communications), delivery (one- vs. two-way), and channel (SMS, email, etc.) with stakeholder preferences and technical capabilities, all the while mitigating the risk of message overload and over-looking of important information (Janssen, 2006). All recognize the importance of not overburdening all partners with too much messaging over too many channels (Revere, 2015).

3.3.3 Technical Audiences and Communication Channel Directionality

No synthesized finding emerged related to technical audiences and channel directionality.

Although alert messages usually are intended as one-way sharing of information, all messages have the potential for two-way communication if they include a phone number or email address to which recipients can respond with questions or concerns (Revere, 2015). The decision to use bi-directional strategies is complex and public health agencies need to manage messaging concerns/barriers and benefits for all parties (Revere, 2015)

Public health participants discussed using direct contact and bi-directional communication practices to follow up and facilitate closing the communication loop (Khan, 2017; Leung, 2008; Markiewicz, 2012). CBPs noted they want the option to reply, whether they do or not (Revere, 2015).

As concluded by Revere (2015), "Bi-directional messaging has perceived benefits and challenges: Both public health agencies and their stakeholders share similar values/uses for two-way messaging—case counts; message receipt confirmation; surveillance; surge capacity—and concerns regarding bi-directional messaging—burden; management; technology; privacy, security or HIPAA (Health Insurance Portability and Accountability Act) considerations; concerns regarding information utility, use and potential for misunderstanding replies. (Revere, 2015)

Information reciprocity between public health agencies and their stakeholders is needed: Although free flow of information is desirable to both public health agencies and their stakeholders, requests for information from technical audiences must be perceived as necessary/critical and public health agencies need to engage in information reciprocity—i.e., sharing results generated by information submitted by technical audiences to demonstrate its utility and value and ensure these results can be utilized by technical audiences and likewise will be used by public health agencies to improve the community's health (Revere, 2015)

The technology needed for bi-directional messaging is a concern for some; concerns include the funding for new technologies, whether or not the technology is supported by the workplace, and the need to learn how to utilize a new system (Revere, 2015).

The study by Revere (2015) was the only study to substantively examine and discuss directionality, specifically bi-directionality. Therefore any synthesized finding on directionality would be unwarranted at this time.

3.3.4 Engaging Technical Audiences in the Development of Communication Plans, Protocols, and Channels

There were two synthesized findings related to engaging technical audiences in the development of communication plans, protocols, and channels. The first finding spoke to dissemination and the second finding addressed usefulness.

Finding 2: Engaging technical audiences in the development of communication plans, protocols, and channels appears to help in the dissemination of guidance.

Despite increasing concerns about public health emergencies and threats of pandemics, some studies in this review noted ongoing, variable levels of preparedness, with similar variable understandings of pandemics and their dynamics (Filice, 2013; Khan, 2017; Janssen, 2006; Markiewicz, 2012) and guidance does not reach all target audiences (Filice, 2013; Janssen, 2006). Embedded within hospitals, public health epidemiologists increased information flow and timely dissemination (Markiewicz, 2012). Some CBPs reported they were not on established listservs and, yet, wanted rapid, direct dissemination from the source rather than indirect dissemination from those who are on the list-serve (Leung, (2008).

The act and process of engaging technical audiences prior to public health emergencies helps relationship-building (also coalition-building and identification of liaisons and point-of-contacts), which reflects improved emergency response by facilitating understandings of institutional needs, sharing of expertise, dissemination and implementation of guidance, and enhancing situational awareness (Filice, 2013; Leung, 2008; Markiewicz, 2012).

Finding 3: Engaging technical audiences in the development of communication plans, protocols, and channels may improve the usefulness of guidance, especially through prior attention to how the guidance is translated into actionable knowledge.

Two studies highlighted the challenge providers experience when implementing guidance information into action in their practice and institutional settings (Filice, 2013; Khan, 2017). They do, however, value strong (and especially pre-existing) relationships with local public health and other healthcare entities and reported them as beneficial to response scenarios by facilitating communication of institutional needs, enhancing situational awareness, and by allowing for sharing of pediatric expertise. They similarly reported partnerships and coalitions as valuable strategies for effective communication (Filice, 2013; Khan, 2017)

Additionally, by engaging technical audiences in the development of channels, plans, and processes, target audiences foresee improvements in interdisciplinary coordination during response (Filice, 2013; Khan 2017; Lis, 2018). Likewise, there is some indication that engaging technical audiences my help facilitate the incorporation of lessons learned from past experiences (Filice, 2013; Lis, 2018).

3.3.5 Facilitators and Barriers to Effective Communication with Technical Audiences During Emergencies

There were two synthesized findings related to facilitators and barriers to effective communication with technical audiences during emergencies. The first finding addressed facilitators and the second finding noted the barriers.

Finding 4: Liaisons and institutional points-of-contact may facilitate message dissemination, congruence between guidance and practice, and coordination efforts during emergencies.

Liaisons and institutional points-of-contact can function as pivotal means for effective communication. Although they do amplify message dissemination, they have additional influences on the communication process. They may, in fact act as role-based channels (Markiewicz, 2012). They appear to knowledgeably reach target audiences within institutions (Filice, 2013; Khan, 2017; Leung, 2008; Markiewicz, 2012) and by identifying key contacts within public health agencies, they begin to understand, in advance, public health bureaucracy during response (Filice, 2013). Liaisons and points-of-contact can rapidly increase speed of dissemination (Markiewicz, 2012) Additionally, they have facilitated reciprocity by promptly meeting the bi-directional needs for information requests between institutions and public health agencies and adapting as needed and well to changing dynamics (Markiewicz, 2012). Hospitals and other healthcare agencies appear to readily designate these individuals as team leaders for preparedness efforts, protocol development and revision, and integrating institutional learning (Filice, 2013; Khan, 2017; Markiewicz, 2012).

In addition to liaisons and points-of-contact, coalitions, through developed relationships and networks, have facilitated improvements in interdisciplinary coordination during responses (Khan, 2017). A regional coalition

helped with challenges related to the coordination of communication across institutions and jurisdictions, and differences in work environments across sectors (Khan, 2017). Another coalition helped with developing consistent use of other channels and collaborative decision making (Lis, 2018). In this respect, coalitions may also function as role-based channels. At the same time, two studies reported that coalitions can be very time intensive and needed continuous updating. Such challenges may be most acutely felt by smaller agencies (Leung, 2008; Lis, 2018).

Finding 5: Source and channel inconsistencies, excessive message volume, guidance and practice incongruences, and poor coordination within and between agencies work against effective communication during emergencies.

Although not specific to channel, target audiences note the difficulties they experience when there are multiple guidance sources—international, national, state, and local public health agencies as well as institutional—and, often, inconsistencies between guidance information (Filice, 2013; Khan, 2017; Leung, 2008; Staes, 2011). A clinician commented that "medical office emails duplicated health department ones, reading both to find discrepancies was too time consuming", and ""if [healthcare institution] recommendations are different than the CDC's then this difference should be explicitly noted and explained" (Staes, 2011, p. 6). Unfortunately, health care providers in addition to community members cited their most common information source as Google; followed by the CDC (Janssen, 2006). Compounding this barrier to accurate and quality guidance, is the rapidly changing information during a response and, in turn, the need for rapid dissemination of updated guidance (Filice, 2013; Khan, 2017; Leung, 2008). In summary, challenges for effective communication between EDs and public health agencies were described as resulting from inconsistent or uncoordinated messaging. (Khan, 2017).

Timeliness of guidance receipt relates partially to channel. Khan (2017) reported that some participants found inconsistencies in channel use to be challenging; they came to expect certain sources to use certain channels and when that was violated, timely access may have been hindered. Leung (2008) reported that some of the smaller agencies and community-based partners were not included in prepared email listservs or other guidance-push directories and, therefore, received information through other pathways/relationships,

Additionally, inconsistencies in channel use or differences in channel preference across institutions and jurisdictions are frustrating challenges for healthcare providers (Khan, 2017; States, 2011). An emergency department participant summarized this frustration by sharing the following experience, "Where one health unit was using an email listserv to distribute information to clinicians, a neighboring counterpart was resisting using the same method…[W]hy [one health unit] would have a much better communication network with physicians and why when we said we want these outbreaks emailed to us. 'Oh no, we have to fax them.' Well why do you have to fax them? 'Because that is what we have always done. That is how we will be sure they get there'" (Khan, 2017, p. 4-5).

Although some duplication is okay and sometimes helpful, the volume of messages can quickly become a burden and discourage rather than encourage use of arriving guidance (Khan, 2017; Markiewicz, 2012; Staes, 2011)

A frustration that can lead to poor implementation of guidance is the perceived lack of congruence between guidance and practice (Filice, 2013; Khan, 2017). Moreover, a respondent summed up frustration with perceived inflexibility of national guidance by saying, "All the personal protective equipment—that was a big frustration of mine. The reality is we just quit wearing masks, quit doing that stuff. When they create guidelines that are unrealistic and difficult to follow … you feel more unsupported. Because you do what you need to do, and yet you know you're violating what some people in the cubicle believe is the right thing to do …. Boy, if we had to gown up and mask up or especially if we did … N95 masks … [for] every patient who walked in with fever, things would have literally ground to a halt" (Filice, 2013, p. 58).

Important challenges also related to the lack of coordinated communication across institutions and jurisdictions, and differences in work environments across sectors (Khan, 2017)

3.3.6 Technical Audiences and Benefits and Harms of Different Communication Channels

No synthesized finding emerged related to benefits and harms of different communication channels.

The ten studies examined in this review rarely discussed benefits and harms per se. The ten studies mostly discussed how different channels corresponded to facilitators and barriers after incorporating contextual considerations. However, one benefit and two harms follow.

One benefit manifests when public health officials demonstrate thoughtful and inclusive deliberations about providing guidance. They not only facilitate effective communication, they also build relationships with healthcare providers characterized by trust, respect, responsiveness, transparency, flexibility, and consultation (Khan, 2017; Lis, 2018).

One alarming harm manifests when there is an absence of received guidance or a lack of congruency between guidance and practice in public health emergencies. In such instances, healthcare providers may double-down with routine practices and institutionally-determined adaptations (Filice, 2013)

Filice (2013) suggested another harm. When past experience and lessons learned do not result in revisions of protocols and practices, there is disillusionment with future, coordinated efforts for preparedness.

3.3.7 Summary of Synthesized Finding and Confidence in the Finding

The 5 synthesized findings as discussed above are summarized in the table below. The table also presents the GRADE-CERQual assessment of confidence in the evidence supporting each finding.

Table 3.3.7 Summary of Synthesized Finding and Confidence in the Finding

Objective: Describe the phenomenon of communicating public health alerts and guidance with technical audiences, both overall and its various specific aspects			
Perspective: Staff of public health and other emergency operations response agencies			
Summary of Finding	**Studies Contributing to the Finding (First Author Only)**	**Overall CERQual Assessment of Confidence in the Evidence for the Finding**	**Explanation of Assessment**
Technical Audiences and Communication Channel Types			
1. Multiple channels facilitate effective communication, by attending differentially to contextual dynamics while avoiding message overload. Contextual dynamics include such priorities as access, accuracy, coordination, dissemination, reciprocity, and timeliness.	Garrett (2011); Janssen (2006); Khan (2017); Leung (2008); Ockers (2011); Revere (2015); Staes (2011)	Moderate	The 7 studies have no, very minor, or minor concerns for coherence, adequacy, and relevance, but have moderate concerns for method.
Engaging Technical Audiences and the Development of Communication Plans, Protocols, and Channels			
2. Engaging technical audiences in the development of communication plans,	Filice (2013);	Moderate	The 6 studies have minor concerns for methods,

protocols, and channels appears to help in the dissemination of guidance	Janssen (2006); Khan (2012); Leung (2008); Lis (2018); Markiewicz (2012)		adequacy, and relevance, but have moderate concerns for coherence.
3. Engaging technical audiences in the development of communication plans, protocols, and channels improves the usefulness of guidance, especially through prior attention to how the guidance is translated into actionable knowledge.	Filice (2012); Khan (2017); Lis (2018)	Moderate	The 3 studies have no, very minor, or minor concerns for methods, coherence, and relevance, but have serious concerns for adequacy.
Facilitators and Barriers to Effective Communication with Technical Audiences During Emergencies			
4. Liaisons and institutional points-of-contact appear to facilitate message dissemination, congruence between guidance and practice, and coordination efforts during emergencies.	Filice (2013); Janssen (2006); Khan (2017); Leung (2008); Lis (2018); Markiewicz (2012); Staes (2011)	Moderate	The 7 studies have no, very minor, or minor concerns for methods, coherence, and relevance, but have moderate concerns for adequacy.
5. Source and channel inconsistencies, excessive message volume, guidance and practice incongruences, and poor coordination within and between agencies work against effective communication during emergencies.	Filice (2012); Janssen (2006); Khan (2017); Leung (2008); Markiewicz (2012); Staes (2011)	Moderate	The 6 studies have no, very minor, or minor concerns for methods, coherence, and relevance, but have moderate concerns for adequacy. Two studies have low confidence, 4 high. No or very minor concern about coherence. Moderate concerns about data adequacy. No or very minor concerns about relevance.

4.0 DISCUSSION

4.1 Evidence to Decision Framework

4.1.1 Balance of Benefits and Harms

Historically, emails and fax have been the consistently and widely used channels to push mass emergency guidance. Although under-reported and under-studied in the studies of this review, many other channels have emerged such as the Internet websites, HAN, COCA, text-based messaging/SMS, electronic health records, and provider access lines, among others.

As noted previously, multiple communication strategies can be utilized. The choice of a specific strategy needs to balance message content (emergency versus routine communications), channel (email, fax, SMS, etc.), and delivery (one- vs. two-way) with target audience preferences and technical capabilities, all while mitigating the risk of message overload and over-looking of important guidance (Janssen, 2006; Revere, 2015)

4.1.2 Acceptability and Preferences

Emails and fax have been preferred channels (Ockers, 2011; Khan, 2017; Revere, 2015). Adoption of another strategy raises concerns about 1) addition of a channel that will compound burdens of message volume, and 2) the availability of resources, such as personal/work devices, and technical support (Revere, 2015).

By engaging technical audiences in such issues addressed by the phenomenon of interest, this more inclusive, collaborative, and dynamic process for generation of public health guidance, before and during a public health event, may improve provider acceptance of and implementation fidelity to guidance. (Filice, 2013).

4.1.3 Equity

There is indication that small jurisdictions and rural areas are less adaptable to changes in technology and channels than other areas (Revere, 2015).

4.1.4 Resource and Economic Considerations

All technologies and channels incur ongoing costs. Nevertheless, the indirect costs of new technologies related to training and technical support need to be added to direct cost of new technologies (Revere, 2015)

4.1.5 Feasibility and PHEPR System Considerations

Some channels are presently more feasible than others. Use of electronic health records remains somewhat distant and really attends to point of individual care. Text-based messages/SMS already are in use. It appears important to weigh the strengths and limitations of any channel/technology in context. The more consistency and judicious use of any one strategy/channel, the more likely there will be effective communication.

4.2 Limitations

A notable limitation of the evidence synthesis is the limited number of studies (10) in the evidence base. There were only 5 studies directly related to the phenomenon of interest. This "thin" corpus provides a weak basis for descriptive or synthesized findings of high confidence.

Another limitation is the time gap between changing technologies with increased communication implementation/opportunities in the field and research studies of evaluation. Although SMS and Internet

technologies as channels have existed for at least a couple of decades and are being utilized to some degree, there is relatively little research about their use or effectiveness in public health and emergency preparedness/response. There is urgent need of more research.

4.3 Conclusion

The five findings from the review and synthesis of evidence from qualitative research represent a limited description and understanding of the phenomenon of the varying effectiveness of communication channels during public health emergencies. Although, the evidence and the findings provides some helpful insight, they provide little depth, which limits their usefulness as a guide for developing policy recommendations. However, they do begin to map our extant knowledge and highlight the need to purposeful, future research.

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6.0 APPENDIX

Table 6.1. Illustrative Excerpt of Findings Synthesis Process Showing Development of Descriptive and Analytical Themes

Descriptive Codes: a priori and Emergent	Verbatim Text from Article Linked to Descriptive Code	Descriptive Themes: Families of Descriptive Codes	Analytic Theme: Interpretive Grouping of Descriptive Themes
Relationships/partnerships [a priori]	pediatric EDs that maintained strong relationships with local public health and other health care entities found those relationships to be beneficial to pandemic response (Filice, 2013)	There were not multiple descriptive themes to be interpretively combined into an analytic theme.	*Finding 3: Engaging technical audiences in development efforts may improve the usefulness of guidance, especially through prior attention to the translation of guidance into actionable knowledge.*
Relationships/partnerships [a priori] Compatibility of Guidance with Practice Realities [a priori]	Respondents reported that strong, especially preexisting, relationships with local public health departments—relationships established in response to previous events or facilitated by the Hospital Preparedness Program—made communication during the pandemic easier. Specifically, this facilitated identification of key contacts and navigation of the public health bureaucracy: pediatric EP leaders reported difficulty reconciling public health guidance with the reality of ED practice (Filice, 2013)		
Planning and Policies/ Protocols [a priori] Identification of Technical Audiences [a priori]	Planning and responding in an interdisciplinary, inter-institutional manner was also beneficial for situational awareness, particularly with regard to understanding and planning for the effects of the H1N1 pandemic (Filice, 2013)		
Relationships/partnerships [a priori] Identification of Technical Audiences [a priori]	Respondents saw regional interactions as an opportunity to share pediatric expertise and contribute to the development of common treatment patterns for children (Filice, 2013)		

Compatibility of Guidance with Practice Realities [a priori]	Respondents relied on local, regional, and federal public health guidance related to responding to the H1N1 pandemic. They reported difficulty reconciling recommendations with perceived realities of feasibility, necessity, or both within their own institutions (Filice, 2013)		
Collaboration [a priori] Inclusive and Participatory Relationships [Emergent]	A more inclusive, collaborative, and dynamic process for generation of public health guidance, before and during a public health event, may improve adherence and provider acceptance (Filice, 2013)		
Relationships/Partnerships [a priori]	We found hospitals that proactively established relationships with public health and other community entities reported benefiting from them during the H1N1 pandemic response (Filice, 2013)		
Relationships/Partnerships [a priori] Coalitions [Emergent]	Preparedness policies that promote establishment and maintenance of community-level health care coalitions may lead to a more cohesive, effective response to future infectious events, as well as to other public health emergencies (Filice, 2013)		
Relationships/Partnerships [a priori]	Relationships are central to effective communication between public health agencies and emergency department clinicians at the local level (Khan, 2017)		

Relationships/Partnerships [a priori] Collaboration [a priori] Compatibility of Guidance with Practice Realities [a priori]	Partnerships and collaboration were described as invaluable for effective communication. Participants gave examples of where and how this was occurring within institutions (e.g., hospitals), across institutions (e.g., across EDs), and across sectors (e.g., between PHUs and EDs). Processes of collaboration within institutions were charac-terized as facilitating understanding of public health guidance, and as supporting decision-making (Khan, 2017).		
Relationships/Partnerships [a priori] Compatibility of Guidance with Practice Realities [a priori]	Strong relationships enable public health agencies to extend the provision of information ("baseline communication") to translate knowledge and guidance into practice in a particular ED setting (Khan, 2017)..		
Relationships/Partnerships [a priori]	A related idea described by participants is the valuable role of emergency preparedness and planning activities in fostering relationships that can promote effective communication during EPHIs (Khan, 2017)		
Compatibility of Guidance with Practice Realities [a priori]	Consider and respond to the target audience. The ED audience was recognized as distinct, a microcosm and a challenge for public health agencies to understand. Brokering an understanding of clinician and public health agency roles in an EPHI situation was deemed valuable by participants, considering the importance of the ED audience (Khan, 2017).		
	In order for public health guidance to be taken up in practice, communication		

Compatibility of Guidance with Practice Realities [a priori]	processes must be conceptualized as more than the simple provision of information between settings. In this way, our study describes strategies that may also relate to a rapid knowledge to action cycle (Khan, 2017).		
Planning and Policies/ Protocols [a priori]	A major strength of the network's acute infectious disease project is gaining the involvement, trust, and interest from regional partners to create standard protocols and expectations for better coordinated incident response (Lis, 2018).		