Best practices in public risk communication during enteric illness outbreak investigations: a scoping review

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Introduction: Public risk communication is intended to inform and protect the health of individuals during enteric illness outbreaks. However, there is limited practical research that assesses the effectiveness of communication during outbreaks. The aim of this study was to identify best practices in public risk communication during enteric illness outbreak investigations.

Methods: A scoping review of five bibliographic databases and gray literature was conducted to identify studies that described public communication during foodborne, waterborne, or enteric zoonotic outbreaks. Eligibility criteria were applied to citations and then full text by two independent reviewers. Data from included studies was extracted and synthesized into categories. Evidence adequacy and agreement were assessed and used to assign an overall level of confidence for each best practice.

Results: In total, 25 studies were included with most studies occurring in North America and Western Europe. Seven principles, nine practices, and eight platforms were identified. Of these, six principles, four practices, and two platforms received a high confidence rating in their overall effectiveness.

Discussion: Effective risk communication during enteric illness outbreak investigations requires public health authorities to identify, characterize, tailor information to, and meaningfully engage with their target audiences, build relationships and collaborate with media outlets, and maintain and increase credibility to deliver trustworthy risk communication messages.

KEYWORDS

best practices, risk communication, health communication, enteric illness, foodborne illness, foodborne disease, acute gastrointestinal illness, outbreaks

1 Introduction

Enteric illness is caused by exposure to contaminated food or water, contact with animals, or via person-to-person contact that commonly result in self-limiting gastrointestinal symptoms, such as abdominal pain, nausea, and diarrhea (Public Health Agency of Canada, 2017). However, enteric illness can also cause more severe outcomes, particularly in high-risk groups such as children and older adults, that require medical attention, and in rare instances, can be fatal (Public Health Agency of Canada, 2017). Chronic sequelae, including reactive arthritis, irritable bowel syndrome, ankylosing spondylitis, and others, can also develop

following enteric infection (Galanis et al., 2023; Gohari et al., 2022). Enteric illnesses pose a significant annual burden on the health of Canadians. The most recent national burden of illness estimate suggests that 4 million Canadians become sick due to an enteric illness each year, resulting in over 11,000 hospitalizations and 230 deaths (Thomas et al., 2013; Thomas et al., 2014). In Ontario alone, estimated healthcare utilization for enteric illness includes 137,000 primary care visits, 40,000 emergency department visits, and 6,200 hospitalizations based on available evidence (Drudge et al., 2019; Greco et al., 2020). Contamination can occur at different points along the agri-food continuum, including production, processing, transportation, retail, preparation, and consumption. An enteric illness outbreak occurs when multiple people are exposed to and become ill from the same enteric pathogen. This contrasts with isolated, sporadic events arising from lack of personal preventive behaviors (e.g., poor hand hygiene or cross-contamination while preparing a meal consumed by an individual or household).

Management of enteric illness outbreaks requires rapid, coordinated efforts and significant resources. Early, rapid interventions limiting those exposed to a common, contaminated source during an enteric illness outbreak can be highly effective and are integral to controlling disease spread. During an outbreak investigation, clear, frequent information exchange is required between government, industry, and public stakeholders. Effective risk communication informs the public of key outbreak characteristics, such as suspected food sources, and enables the public to engage in recommended, protective behaviors (World Health Organization, 2017; Infanti et al., 2013; Tumpey et al., 2019). Aspects of risk communication that influence public behavior include the source, timing, message content, and communication channels used (Cairns et al., 2013; Andersen and Spitzberg, 2010; Janoske et al., 2012; Vilella-Vila and Costa-Font, 2008). Although risk communication is an integral part of responding to enteric illness outbreaks, there is limited evidence on how to effectively communicate risk to the public during enteric illness outbreaks, specifically, where multiple stakeholders across sectors and at all jurisdictional levels are involved and the potential impact of a slow response is significant. This evidence is needed to inform best practices and identify critical knowledge gaps related to effective communication in these rapidly evolving situations (Frisby et al., 2014).

To address a lack of collated evidence on this topic, we conducted a scoping review to identify and synthesize the extent and nature of the literature on risk communication best practices during enteric illness outbreak investigations (Arksey and O'Malley, 2005). The objectives of this review are to: (1) Identify and synthesize relevant literature for public risk communication best practices during enteric illness outbreaks, and (2) Generate a set of recommendations for best practices for risk communication during enteric illness outbreaks.

2 Methods

2.1 Overview

We conducted a scoping review in accordance with the Joanna Briggs Institute Manual for Evidence Synthesis (Peters et al., 2020) and PRISMA for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018) to identify and characterize effective risk communication practices (intervention) during enteric illness outbreaks affecting

general populations (population) to ultimately reduce the incidence of outbreak-associated enteric illnesses (outcome). There is no relevant comparator group for this particular synthesis.

2.2 Scoping review protocol

A preliminary search of PROSPERO, PubMed, and Google Scholar was conducted and no published or in-progress systematic or scoping reviews on the topic were identified. The scoping review protocol was developed according to the Joanna Briggs Institute Manual for Evidence Synthesis (Peters et al., 2020) and refined by an interdisciplinary research team with expertise in enteric illness outbreak management, health communication, and review methodology (Supplementary File S1).

2.3 Eligibility criteria

Literature was included if it was primary academic or gray literature describing public risk communication practices during human enteric illness outbreak investigations related to foodborne, waterborne, or enteric zoonotic illnesses and written in English or French. No study design, date, or geographic restrictions were employed. Articles with no full text availability were excluded.

2.4 Information sources

Five bibliographic databases with topics related to risk communication, enteric illnesses, and human infectious disease outbreaks were searched: Ovid MEDLINE, CAB Direct, Web of Science, PsycInfo, and Communication and Mass Media Complete. The search strategy was first developed for Ovid MEDLINE through consultation with a Research Librarian and research team and was then adapted for each database as appropriate (Supplementary Table S1). The initial search of bibliographic databases was carried out on March 13, 2023. A simplified gray literature search strategy was then iteratively developed. Gray literature comprises materials produced outside traditional publishing channels, such as documents written by governments and industry groups (Paez, 2017). Two information sources were queried: Google Scholar and ProQuest Theses and Dissertations (Supplementary Table S2). Following established guidelines (Canadian Agency for Drugs and Technology in Health, 2018), the first 50 results of each search were reviewed to identify relevant citations.

2.5 Selection of sources of evidence

Citations were uploaded into Covidence, an online review management software, and duplicates were removed using the deduplication tool (Covidence, n.d.). Twenty-five citations were initially screened using their titles and abstracts to test agreement between the two reviewers (HM, JM). Once 95% agreement was obtained, the remaining titles and abstracts were independently screened against the eligibility criteria. Next, the full text of selected citations was assessed by the two reviewers using the same eligibility criteria. Any disagreements were resolved through discussion.

2.6 Data extraction

A data extraction tool was initially developed by one reviewer (HM) and was then assessed and modified by the research team prior to full data extraction. Data items included study characteristics (title, authors, year of publication, location, aim), study population, sample size, study design, methods, type of outbreak, type of pathogen, communication framework or model, communication platforms used, communication practices identified, evaluation methods and results, study limitations, and future directions or recommendations. Data was extracted independently by two researchers (HM, JM) in Covidence, and any discrepancies were then identified and resolved through discussion. Data was exported into Excel (Microsoft Corporation, 2018) for synthesis.

2.7 Data synthesis

Data was synthesized according to three categories: communication principles, communication practices, and communication platforms. These categories emerged from the included studies, aligned with the objectives of the review, and validated by enteric illness epidemiologists on the research team. Communication principles are overarching strategies used to potentially broaden message reach. Communication practices describe the types of information that should be included in risk messages to the public. Communication platforms are mechanisms by which risk communication messages can be delivered. The weight of evidence for each category was evaluated according to evidence adequacy and evidence agreement, which were derived from relevant evidence assessment frameworks applicable to qualitative evidence and the review scope. Specifically, the Intergovernmental Panel for Climate Change's uncertainties guidelines (Mastrandrea et al., 2010) and the Confidence in Evidence from Reviews of Qualitative Research Assessment (Noyes et al., 2018) were used. Evidence adequacy relates to the type and generalizability of studies, where study type refers to the way evidence is collected and evaluated (University of Wisconsin Population Health Institute, 2022) and generalizability refers to how well the evidence represents the finding of interest (Noyes et al., 2018). In addition, the weight of evidence was assessed via the number of relevant studies (Mastrandrea et al., 2010; Glenton et al., 2018). Scores of high, moderate, or low were systematically assigned to type, generalizability, and weight of evidence (Supplementary Table S3). For weight of evidence, numerical cut-offs were chosen based on the data. A final evidence adequacy score was determined by directly summing the scores for type, generalizability, and weight of evidence.

Evidence agreement refers to the level of consensus for effectiveness of each principle, practice, or platform for risk communication during enteric illness outbreaks (Mastrandrea et al., 2010). For each principle, practice, or platform, the proportion of studies with concordant evidence was determined and a score of high (75–100%), moderate (25–74%), or low (0–24%) was assigned.

Overall confidence in the effectiveness of each principle, practice, or platform was assigned a score of high, moderate, or low using a scoring matrix of evidence adequacy and evidence agreement (Supplementary Table S4). In general, the higher the evidence adequacy and agreement, the higher confidence there is in the principle, practice, or platform's ability to effectively communicate risk during enteric illness outbreaks. No confidence was assigned when evidence adequacy and/or agreement could not be assessed (Mastrandrea et al., 2010).

3 Results

3.1 Selection of sources of evidence

A total of 8,365 citations were initially identified (8,342 citations from bibliographic databases and 23 citations from gray literature). After deduplication, 8,164 citations were screened by title and abstract and 95 citations were screened via full text for eligibility. After screening, 25 studies were included (Figure 1).

3.2 Sources of evidence

Study locations were primarily in North America and Western Europe. Most studies were conducted in a single country (n = 22). Almost half of the studies occurred in the United States (n = 14), followed by Germany (n = 5), Canada (n = 2), and the Netherlands (n = 2). Other study locations included Ethiopia, South Africa, Denmark, Sweden, Norway, and Belgium. The most common study design was qualitative (n = 12), followed by mixed methods (n = 6), quantitative (n = 5), and opinion papers (n = 2). Over half of the studies used a communication framework or model to guide their risk communication and evaluation (n = 16). Most studies involved foodborne illness outbreaks (n = 23), although the causative pathogen varied. Outbreaks caused by *Escherichia coli* (n = 8) and *Salmonella* (n = 7) were most common followed by *Listeria* (n = 4), multi-pathogen outbreaks (n = 2), and outbreaks with an unknown etiologic agent (n = 2).
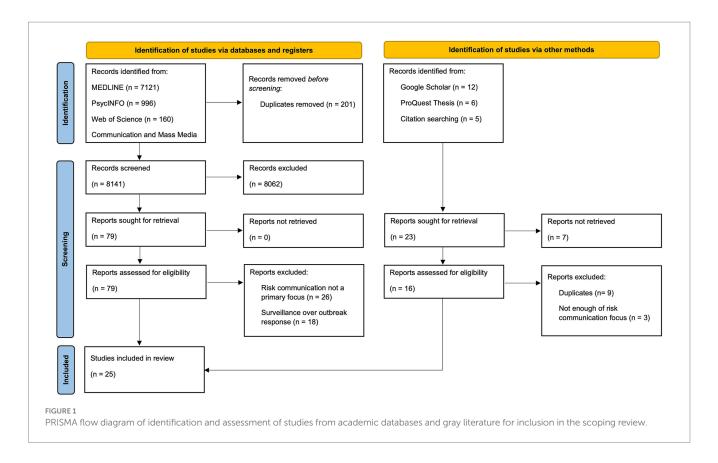
3.3 Narrative synthesis

Seven principles, nine practices, and eight platforms were identified (Tables 1–3). The overall evidence evaluation identified six principles, four practices, and two platforms with a high confidence rating in their overall effectiveness (Table 4). The six high-confidence principles were: (1) maintaining rapid and ongoing risk communication, (2) using consistent messaging, (3) building trust with the public, (4) addressing the social/cultural context of the outbreak, (5) collaborating within and across organizational levels, and (6) establishing and maintaining two-way communication with the public. The four high-confidence practices were: (1) provide preventive measures and other behavioral recommendations to minimize disease risk, (2) communicate the pathogen source, including implicated food item(s) and case location(s), (3) express empathy, and (4) state what is unknown about the outbreak. The two high-confidence platforms were newspaper (print or online) and television. Social media and websites received a moderate rating of confidence.

3.4 Principles (n = 7)

3.4.1 Maintain rapid and ongoing communication during the outbreak

Risk communication messages should be regularly and consistently disseminated for the duration of the outbreak, including when the outbreak has been declared over. If daily updates can

FIGURE 1
PRISMA flow diagram of identification and assessment of studies from academic databases and gray literature for inclusion in the scoping review.

be provided, these should be communicated early in the morning. Public health authorities should be guided by a flexible risk communication plan, designed and tested prior to crisis onset. The plan should include building strong relationships with media outlets to facilitate rapid information dissemination to the public via media platforms. National alert systems should be explored for rapid notification of national and international stakeholders, when applicable (Adera et al., 2022; Arnade et al., 2010; Dodd and Cooper, 2012; Irlbeck et al., 2013; Jung et al., 2021; Lamprecht et al., 2022; Parmer et al., 2016).

3.4.2 Use consistent messaging

Messaging should be consistent within and across stakeholders that communicate with the public, particularly public health authorities and media. Messages delivered by public health authorities and media should importantly be similar. Public health authorities should actively collaborate with media outlets, possibly using integrated communication strategies, to ensure consistent messaging. A designated media relations team may be useful in streamlining message creation and delivery (Bitsch et al., 2014; Focker et al., 2021; Frisby et al., 2014; Irlbeck et al., 2013; Leblebicioglu, 2012; Sobel, 2002; van Velsen et al., 2012).

3.4.3 Build trust with the public

Public health authorities should be the first (i.e., most timely) communicator of risk during outbreaks. The public is more likely to view authorities as a trusted source of information when they are first in delivering risk communication messages. Risk communicators must be honest in their messaging and remain accessible to the public. Lying (e.gs. half-truths, omissions),

downplaying public health risks, and silence should be avoided. Credibility systems should be established by public health authorities to promote an objective certification system for risk communication messages delivered to the public (Adera et al., 2022; De Vocht et al., 2013; Opat et al., 2018; Rowe and Alexander, 2009; van Velsen et al., 2012).

3.4.4 Address the social/cultural context of the outbreak

Risk communicators must identify specific sub-populations that may be disproportionately affected by the outbreak. Risk communication should be tailored to multiple target socio-demographic audiences according to their communication preferences, which should be determined in a proactive manner. This will likely require the development of multiple message formats and use of multiple platforms to deliver tailored, contextual risk communication messages (Lamprecht et al., 2022; Surgeoner et al., 2009; Vidoloff and Petrun, 2010).

3.4.5 Collaborate within and across organizational levels

Collaboration within national government agencies and across organizational levels with jurisdictional partners at sub-national and local/regional levels is important for creating and delivering risk communication messages. Creation and delivery of risk messages should be coordinated and guided by a framework detailing how national agencies can and will work with jurisdictional partners, while respecting the autonomous nature of many of these organizations. These frameworks can also provide guidance to partners on creating effective risk communication messages if partners choose to create their own communication products. Strong inter-coordination can

TABLE 1 Principles for effective risk communication during enteric illness outbreaks (*n* = 7).

Evidence summary	Evidence adequacy			
	Type	Generalizability	Total	Rating
Principle 1: Maintain rapid and ongoing communication during the outbreak (*n* = 9)				
Daily updates were provided, mainly through radio and television. Effective communication attributed to rapid and ongoing messaging (Adera et al., 2022).	2	2	4	Moderate
Slow and inadequate messaging and poor media relationships prevented timely message dissemination (Lamprecht et al., 2022).	2	2	4	Moderate
The public's emotional reactions to the CDC's reports was relatively more positive and significant than the FDA's or FSIS's. CDC reports were preferred over recalls because they provided immediate communication (Jung et al., 2021).	3	3	6	High
Slow communication between emergency managers and journalists decreased effectiveness (Parmer et al., 2016).	2	3	5	High
Strong media contacts and flexible, prior communication plans supported rapid message dissemination (Irlbeck et al., 2013).	2	1	3	Moderate
A multidisciplinary advisory team allowed for rapid internal communication and one source of public risk messages (Dodd and Cooper, 2012).	2	1	3	Moderate
Rapid and ongoing risk communications led to relatively quick drops in spinach and leafy greens sales due to them being identified sources of the outbreak (Arnade et al., 2010).	3	2	5	High
Public health and government agencies were readily accessible to the media allowing for timely messaging (Vidoloff and Petrun, 2010).	2	3	5	High
Use of cross-country communication channels and alert systems supported rapid, international information dissemination (Bruun et al., 2009).	2	3	5	High
Principle 2: Use consistent messaging (*n* = 7)				
The risk message content varied across public health communications which led to many messages requiring corrections. The public was confused on what information was accurate and what they should follow (Focker et al., 2021).	2	3	5	High
There was mismatched information sharing when government and newspaper communication was compared. The public was confused which information was accurate (Bitsch et al., 2014).	3	3	6	High
83–97% of the TV content did not include the same high-risk messaging as the FDA and CDC. The public received inconsistent risk communication (Frisby et al., 2014).	3	3	6	High
Interviewees stated that message consistency was followed by all stakeholders (Irlbeck et al., 2013).	2	1	3	Moderate
The messages being communicated by the media did not align with the outbreak/pathogen information public health had. This inconsistent and misleading risk communication left the public confused and panicked (Leblebicioglu, 2012).	1	1	2	Low
Participants indicated that they received conflicting and constantly changing outbreak information. This inconsistency led to communication being ineffective (van Velsen et al., 2012).	2	1	3	Moderate
The CDC practice of having a designated media relations team was deemed effective for consistent risk communication (Sobel, 2002).	2	3	5	High
Principle 3: Build trust with the public (*n* = 5)				
Communication needs to come from a trusted source (Adera et al., 2022).	2	2	4	Moderate
Transparent risk communication improved public trust (Opat et al., 2018).	2	1	3	Moderate
High trust in communication from government increased public acceptance and led to expected behavioral changes (De Vocht et al., 2013).	2	2	4	Moderate
Showcasing that communication is credible helps to develop public trust (van Velsen et al., 2012).	2	1	3	Moderate
Communication by government or public health agencies is not sufficient to increase public acknowledgement or belief of outbreak information (Rowe and Alexander, 2009).	1	3	4	Moderate
Principle 4: Address the socio-cultural context of the outbreak (*n* = 3)				
A minority of news reports (32%) tailor information to "vulnerable groups" in this outbreak (Lamprecht et al., 2022).	2	2	4	Moderate

(Continued)

TABLE 1 (Continued)

Evidence summary	Evidence adequacy			
	Type	Generalizability	Total	Rating
CDC press releases included additional messaging providing specific advice for vulnerable populations (e.g., low socioeconomic status) during the outbreak (Vidoloff and Petrun, 2010).	2	3	5	High
Low compliance with hand hygiene was partially attributed to lack of tailored communication to the university population (Surgeoner et al., 2009).	3	1	4	Moderate
Principle 5: Collaborate within and across organizational levels (*n* = 3)				
Internal collaboration was deemed ineffective. Internal communication strategies need to be improved to ensure the public is notified on time for future outbreaks (Focker et al., 2021).	2	3	5	High
Researchers believed public communication from agencies on all levels of government could have been minimized through effective internal collaboration practices (Taylor et al., 2010).	2	3	5	High
Regular internal communication between federal and state partners, allowed all relevant actors to have the most up to date information and to disseminate accurate, ongoing public risk communication (Sobel, 2002).	2	3	5	High
Principle 6: Establish and maintain two-way communication with the public (*n* = 3)				
Researchers concluded if Facebook comments were monitored in real-time, they could lead to adjustments in risk messaging and inform illness prevention strategies (Ablan et al., 2022).	2	3	5	High
The public's Facebook comments allowed the researchers to conclude that the public appreciated the two-way communication employed by Blue Bell (Opat et al., 2018).	2	1	3	Moderate
Social media would have improved risk communication because it would have allowed for response to public inquiries (Irlbeck et al., 2013).	2	1	3	Moderate
Principle 7: Evaluate communication practices during or at the conclusion of an outbreak (*n* = 2)				
Lack of planned evaluations reduced effective risk communication (Adera et al., 2022).	2	2	4	Moderate
Risk communication was consistently examined and updated during the outbreak (Dodd and Cooper, 2012).	2	1	3	Moderate

be achieved through regular, timely calls with all relevant partners to draft and deliver risk communication messages for the duration of the outbreak. Likewise, strong internal coordination can be supported through regular communication and use of internal online platforms to act as a singular source of outbreak information (Focker et al., 2021; Sobel, 2002; Taylor et al., 2010).

3.4.6 Establish and maintain two-way communication with the public

Public health authorities should monitor public reactions and responses to risk communication products, including questions posed by the public, which may indicate opportunities for public health authorities to address misunderstandings or confusion. Public feedback can also highlight opportunities for improving future risk communication products and should be collected and evaluated to support iterative improvement. Real-time monitoring of reactions and responses can be achieved on most online and social media platforms. In addition, public health authorities should interact with the public by directly responding to questions and comments for the duration of the outbreak (Ablan et al., 2022; Irlbeck et al., 2013; Opat et al., 2018).

3.4.7 Evaluate communication practices during and/or at the conclusion of an outbreak

An evaluation plan should be proactively developed by public health authorities to monitor the effectiveness of risk communication

products and support iterative improvement, both during an outbreak and for future outbreaks. During an outbreak, the effectiveness of risk communication products should be monitored in real-time and adjustments to communication strategies or products made accordingly. Once an outbreak has concluded, a more thorough evaluation can be conducted to support future improvement of communication practices. The communication strategies and plan should be reviewed for effectiveness in as close to real-time as possible (Adera et al., 2022; Dodd and Cooper, 2012).

3.5 Practices (*n* = 9)

3.5.1 Provide preventive measures and other behavioral recommendations to minimize risk

The public must be informed of actions they can take to prevent illness during the outbreak, including avoiding the source of the outbreak (if known), and using general safe food handling and hygiene practices. In addition, there may be other behavioral recommendations specific to a particular hazard or sub-population that should be identified with knowledge from industry or other stakeholders and included as part of tailored risk communication products (Ablan et al., 2022; Arnade et al., 2010; Frisby et al., 2014; Lamprecht et al., 2022; Mahon et al., 1999; Parmer et al., 2016; Patrick et al., 2007; Surgeoner et al., 2009; Vidoloff and Petrun, 2010).

TABLE 2 Practices for effective risk communication during enteric illness outbreaks (*n* = 7).

Evidence summary	Evidence adequacy			
	Type	Generalizability	Total	Rating
Practice 1: Provide preventive measures and other behavioral recommendations to minimize risk (*n* = 9)				
Facebook posts were effective in encouraging preventative behaviors as most user's post-messaging actions aligned with the CDC's recommendations (Ablan et al., 2022).	2	2	4	Moderate
Risk communication was deemed ineffective because most media reports disproportionally focused on avoidance actions rather than all necessary preventative behaviors (Lamprecht et al., 2022).	2	2	4	Moderate
Prevention practices were commonly seen in risk communication which aligned with the study's "best practices (Parmer et al., 2016)."	2	3	5	High
The "high instructional video," that detailed relevant preventative behavior, was an effective source of risk communication (Frisby et al., 2014).	3	3	6	High
Consumers rapidly responded to the FDA spinach recall information and stopped buying spinach showcasing the effectiveness of promoting preventative behavior (Arnade et al., 2010).	3	2	5	High
Prevention practices and behavioral recommendations included in the press releases aligned with the NCFPD's "best practice" guidelines (Vidoloff and Petrun, 2010).	2	3	5	High
The observational results did not align with the behavioral change students claimed to engage in. The lack of proper prevention communication possibly fueled the outbreak (Surgeoner et al., 2009).	3	1	4	Moderate
Risk communicators need to be more explicit when detailing the risks that come with eating the implicated product. Preventative behaviors were poorly explained leading to ineffective communication (Patrick et al., 2007).	2	1	3	Moderate
The researchers believed that preventative behaviors were not effectively communicated in the media, which was a downfall in the outbreak investigation (Mahon et al., 1999).	2	1	3	Moderate
Practice 2: Communicate the pathogen source, including implicated food item(s) and case location(s) (*n* = 4)				
News reports analyzed included content related to what is known about the outbreak spread and pathogen. Researchers deemed this an effective communication practice (Lamprecht et al., 2022).	2	2	4	Moderate
The "standard" video included information about the pathogens source (eggs) and how far it spread. This was deemed insufficient for effective risk communication (Frisby et al., 2014).	3	3	6	High
Describing what is known about the pathogen and its spread was commonly seen in risk communication which aligned with the study's "best practices" (Parmer et al., 2016).	2	3	5	Moderate
Government risk communication and newspaper reporting indicated the potential food sources of the pathogen which affected purchasing behavior (Bitsch et al., 2014).	3	3	6	High
Practice 3: Express empathy (*n* = 2)				
There was limited risk communication incorporating empathy. This made communication ineffective as empathy was a "best practice" (Lamprecht et al., 2022).	2	2	4	Moderate
The lack of empathic statements was deemed ineffective because it could be difficult to persuade the public to take action during an outbreak (Parmer et al., 2016).	2	3	5	High
Practice 4: State what is unknown (*n* = 2)				
There was limited risk communication incorporating what was not known about the outbreak. This made communication ineffective as this was a "best practice." (Lamprecht et al., 2022).	2	2	4	Moderate
Stating what is not known, a "best practice" should have been used more frequently in communication to make it effective (Parmer et al., 2016).	2	3	5	High
Practice 5: Provide a timeline of the outbreak and actions being taken by government and public health organizations (*n* = 3)				
Risk communication was ineffective as it lacked sufficient emphasis on "commitment" (to the outbreak investigation), a "best practice" of communication (Lamprecht et al., 2022).	2	2	4	Moderate
Participants were dissatisfied by lack of investigation updates and communication regarding public health actions (van Velsen et al., 2012).	2	1	3	Moderate
The popular media frame, "war on microbes" gave the public unrealistic expectations of public health authorities, making communication ineffective (Gauthier, 2011).	2	2	4	Moderate

(Continued)

TABLE 2 (Continued)

Evidence summary	Evidence adequacy			
	Type	Generalizability	Total	Rating
Practice 6: Provide information on the foodborne disease and pathogen (*n* = 2)				
Risk communication was ineffective as it lacked sufficient emphasis on disease symptoms, a "best practice" of communication (Lamprecht et al., 2022).	2	2	4	Moderate
Stated that the pathogen information communicated by the media was alarming and caused public panic, which was an ineffective aspect of risk communication (Leblebicioglu, 2012).	1	2	3	Moderate
Practice 7: Describe the economic impact (*n* = 1)				
The "collateral damage" media communication frame emphasizes the economic issues the outbreaks can cause to the food industry. This practice was ineffective as it placed unwarranted blame on public health authorities (Gauthier, 2011).	2	2	4	Moderate

3.5.2 Communicate the pathogen source, including implicated food, water, or animal source(s) and case location(s)

The type of outbreak (foodborne, waterborne, or zoonotic) and source(s) should be stated. If the source is unknown, the public should be informed that the source is unknown and that there are several sources being investigated. These sources should be named, if possible. In addition, case locations should be reported and regularly updated as the outbreak evolves (Bitsch et al., 2014; Frisby et al., 2014; Lamprecht et al., 2022; Parmer et al., 2016).

3.5.3 Express empathy

Public health authorities should include empathetic statements in their risk communication to help support the public in staying calm and limiting unnecessary fear regarding the outbreak. Empathetic statements support the emotional processing of information, which tends to occur prior to logical processing of information (Lamprecht et al., 2022; Parmer et al., 2016).

3.5.4 State what is unknown about the outbreak

Details of the outbreak that are still being investigated and are currently unknown should be shared to promote honest and transparent communication. The public should be made aware of how these unknowns may impact their risk of illness (Lamprecht et al., 2022; Parmer et al., 2016).

3.5.5 Provide a timeline of the outbreak and actions being taken by government and public health organizations

Official outbreak investigation details, including a timeline and when the investigation is closed, should be clearly communicated. Actions taken by relevant agencies should also be described, emphasizing the continuous commitment of public health authorities to the investigation (Gauthier, 2011; Lamprecht et al., 2022; van Velsen et al., 2012).

3.5.6 Provide information on the enteric illness and pathogen

Epidemiological information including length of the latent period, length of the incubation period, clinical signs and symptoms, and other descriptive epidemiological information should be presented.

Additional high-level details about the pathogen itself can also be provided (Lamprecht et al., 2022; Leblebicioglu, 2012).

3.5.7 Describe the economic impact

If the outbreak is associated with a specific product, industry stakeholders should be consulted by public health authorities regarding planned risk communication products. If substantial economic loss may occur, it is important that risk communication products do not place unnecessary blame on public health authorities (Gauthier, 2011).

3.5.8 Communicate incidence risk and rates

While this practice was identified, no evidence was provided on how to effectively communicate measures of disease burden during an outbreak.

3.5.9 Describe medical interventions that can be safely used to reduce exposure or adverse health outcomes

This practice relates to informing the public of medications and treatments used to reduce or eliminate the pathogen, as well as ongoing treatment development efforts. No evidence was provided for how to effectively communicate this information.

3.6 Platforms (*n* = 8)

3.6.1 Newspaper (Print or online)

Risk communication can be delivered through physical newspapers or news websites. News sources that are popular amongst the target audience(s) should be prioritized by public health authorities for information sharing. Public health authorities should seek to build and maintain good working relationships with news outlets to promote timely, objective, and prioritized information sharing during outbreaks (Gauthier, 2011; Lamprecht et al., 2022; Patrick et al., 2007; van Velsen et al., 2012, 2014).

3.6.2 Television

Risk communication should be delivered on popular television channels that are frequented by the target audience(s). Television news broadcasts are an important source of outbreak information

TABLE 3 Platforms for effective risk communication during enteric illness outbreaks (*n* = 7).

Evidence summary	Evidence Adequacy			
	Type	Generalizability	Total	Rating
Platform 1: Newspaper (print or online) (*n* = 5)				
Due to several prominent news factors, the researchers concluded that newspapers modified and selected for aspects of the outbreak that would promote newsworthiness and not necessarily align with best practices of risk communication (Lamprecht et al., 2022).	2	2	4	Moderate
Newspapers and news websites were deemed effective for delivering risk communication as they were a popular source of passive and active communication consumption (van Velsen et al., 2014).	2	2	4	Moderate
The popularity of newspapers and news websites made it an effective platform for risk communication (van Velsen et al., 2012).	2	1	3	Moderate
The newspaper notices were more beneficial than simply posting on food recall websites for outbreak notification (Patrick et al., 2007).	2	1	3	Moderate
Two simultaneous outbreaks involving the same pathogen were communicated differently in newspapers. This platform was deemed ineffective as it caused public confusion (Gauthier, 2011).	2	2	4	Moderate
Platform 2: Television (*n* = 4)				
The researchers believed TV to be a useful platform for risk communication because of its popularity and ability to improve outbreak knowledge (Adera et al., 2022).	2	2	4	Moderate
TV broadcasts were deemed an ineffective source of risk communication as most failed to include essential message components during the outbreak (Frisby et al., 2014).	3	3	6	High
TV was deemed effective for delivering risk communication as it was a popular source of passive and active communication consumption (van Velsen et al., 2014).	2	2	4	Moderate
TV was deemed an effective platform for risk communication because of its popularity and reach potential (van Velsen et al., 2012).	2	1	3	Moderate
Platform 3: Social media (*n* = 5)				
Facebook was identified as an effective platform for the spread of risk communication as it allowed for "information sharing" amongst the public, aligning with the CDC's recommendations (Ablan et al., 2022).	2	3	5	High
Facebook was deemed an effective way of engaging with the public during the outbreak as comments could be placed on risk communication posts (Opat et al., 2018).	2	1	3	Moderate
Social media was a popular platform, but it did not deliver sufficient outbreak communication. Researchers believe this platform should not be prioritized for risk communication (van Velsen et al., 2014).	2	2	4	Moderate
Social media allows personal opinion to add to risk communication. This is ineffective because misinformation could spread (Leblebicioglu, 2012).	1	2	3	Moderate
Social media was deemed an ineffective platform for risk communication as it was not popular or believed to be a reliable source of information (van Velsen et al., 2012).	2	1	3	Moderate
Platform 4: Websites (*n* = 2)				
Wikipedia was deemed an effective platform as it was common source for active consumption of information and participants believed it to be reliable (van Velsen et al., 2014).	2	2	4	Moderate
Participants turned to Wikipedia for outbreak information. It was believed to be a reliable source and effective for risk communication (van Velsen et al., 2012).	1	2	3	Moderate
Platform 5: Posters/Flyers (*n* = 2)				
A communication checklist based on the CDC communication index showed print materials for risk communication received a score under 89, indicating a need for improvement (Adera et al., 2022).	2	2	4	Moderate
The DoD advisory team also created food safety information sheets that allowed timely understanding of risk by the public and acknowledgement of which foods to avoid (Dodd and Cooper, 2012).	2	1	3	Moderate
Platform 6: Radio (*n* = 1)				
Radio was deemed effective for delivering risk communication as it was a popular source of passive communication consumption (van Velsen et al., 2014).	2	2	4	Moderate
Platform 7: Outbreak response teams (*n* = 1)				
Individuals that received risk communication from Health Education Workers had high outbreak knowledge, making it an effective platform of risk communication (Adera et al., 2022).	2	2	4	Moderate

TABLE 4 Overall evidence evaluation for identified principles, practices, and platforms for effective risk communication during enteric illness outbreaks.

Communication component	Evidence adequacy	Evidence agreement	Overall confidence
Principles			
1. Maintain rapid and ongoing communication during the outbreak.	High	High	High
2. Use consistent messaging.	High	High	High
3. Build trust with the public.	Moderate	High	High
4. Address the socio-cultural context of the outbreak.	Moderate	High	High
5. Collaborate within and across organizational levels.	Moderate	High	High
6. Establish and maintain two-way communication with the public.	Moderate	High	High
7. Evaluate communication practices during and/or at the conclusion of an outbreak.	Moderate	Moderate	Moderate
Practices			
1. Provide preventive measures and other behavioral recommendations to minimize risk.	High	High	High
2. Communicate the pathogen source, including implicated food, water, or animal source(s) and case location(s).	Moderate	High	High
3. Express empathy.	Moderate	High	High
4. State what is unknown about the outbreak.	Moderate	High	High
5. Provide a timeline of the outbreak and actions being taken by government and public health organizations.	Low	Moderate	Low
6. Provide information on the enteric illness and pathogen.	Low	Low	Low
7. Describe the economic impact.	Low	Low	Low
8. Communicate incidence risk and rates.	NA	NA	NA
9. Describe medical interventions that can be safely used to reduce exposure or adverse health outcomes.	NA	NA	NA
Platforms			
1. Newspaper (print or online)	Moderate	High	High
2. Television	Moderate	High	High
3. Social Media	Moderate	Moderate	Moderate
4. Websites	Low	High	Moderate
5. Posters/Flyers	Low	Low	Low
6. Radio	Low	Low	Low
7. Outbreak Response Teams	Low	Low	Low
8. E-mails	NA	NA	NA

with a broad reach and should be prioritized during outbreaks (Adera et al., 2022; Frisby et al., 2014; van Velsen et al., 2012, 2014).

3.6.3 Social media

Facebook and X (formerly Twitter) are universally popular social media platforms for risk communication. Risk communication should be disseminated from official public health accounts to establish and ensure credibility. Public health authorities can use social media to monitor the public's reactions and inquiries related to outbreak risk communication. The effectiveness of risk communication may be affected if public opinion becomes intertwined with risk communication information provided by public health authorities (Ablan et al., 2022; Leblebicioglu, 2012; Opat et al., 2018; van Velsen et al., 2012, 2014).

3.6.4 Websites

Public health authorities should monitor webpages posted by other sources (e.g., other government websites, private industry websites, Wikipedia) to ensure accurate information is being presented to the public. Where possible, incorrect information

should be flagged or edited when identified (van Velsen et al., 2012, 2014).

3.6.5 Posters/Flyers

Physical copies of posters or flyers with outbreak information can be posted or distributed within relevant communities during an outbreak. Appropriate use of graphics and design elements may improve awareness and comprehension. Where possible, plain language should be used (Adera et al., 2022; Dodd and Cooper, 2012).

3.6.6 Radio

Radio broadcasts can be important sources of information during an outbreak. If known, radio channels popular with target audience(s) should be prioritized to share information with the public (van Velsen et al., 2014).

3.6.7 Outbreak response teams

Public health authorities may create response teams at the onset of an outbreak to raise awareness in affected communities, particularly via person-to-person communication. These teams should include

government, health, media, and social science personnel (Adera et al., 2022).

3.6.8 E-mails

If contact information is available, e-mails can be used to directly communicate with target audiences; however, no evidence was provided regarding how to effectively utilize this platform.

4 Discussion

4.1 Summary of main findings

In this scoping review, we synthesized findings from 25 studies that evaluated the effectiveness of risk communication principles, practices, or platforms during enteric illness outbreak investigations. We identified 7 principles, 9 practices, and 8 platforms for which evidence exists for their effectiveness, and further identified 6, 4, and 2 high-confidence principles, practices, and platforms, respectively. To support their incorporation into risk communication efforts, we provide the following four recommendations in no particular order: (1) build relationships and collaborate with media outlets, (2) identify target audiences and tailor information accordingly, (3) engage with target audiences, and (4) increase and maintain credibility of public health organizations delivering risk communication messages.

4.1.1 Build relationships and collaborate with media outlets

Effective implementation of identified risk communication principles and practices and use of platforms requires collaboration with various entities along communication pathways from the investigating public health organization to target audiences. This includes collaboration within and across the investigating organization, other public health organizations, private industry stakeholders, and media outlets. Media outlets play an important role in disseminating health information, particularly during outbreaks, as they can increase public awareness and shape public opinion (Pinto et al., 2023). In Canada, various demographic groups are engaged with media outlets, with over 80% of adults reading print or digital newspapers each week (Watson, 2024).

During enteric illness outbreaks, it is important to ensure timely communication of the most pertinent outbreak information. Collaboration with media outlets can facilitate enteric illness outbreak communication efforts by increasing message consistency, information dissemination, awareness about ongoing outbreaks, and uptake of protective behavioral recommendations (Maciel-Lima et al., 2015; Hong et al., 2019; Pieri, 2019; Nwakpu et al., 2020; Adera et al., 2022). Conversely, a lack of collaboration in risk communication can impede message uptake and undermine the credibility of information (Food and Agriculture Organization of the United Nations and World Health Organization, 2016; Savoia et al., 2023).

Collaboration with media outlets can be facilitated by guiding protocols and communication plans that promote positive relationships between media outlets and public health organizations. Specifically, promoting collaboration with media outlets requires a strategic approach across three stages: pre-outbreak preparation, active

communication during the outbreaks, and post-outbreak follow-up. Prior to the outbreak, positive relationships should be established between media outlets and public health organizations responsible for risk communication (Irlbeck et al., 2013; Centers for Disease Control and Prevention, 2014). Further, designing a streamlined pathway for communication between these two stakeholders can increase understanding of their respective roles and goals during outbreak risk communication and increase the efficacy of collaboration (Lamprecht et al., 2022). During the outbreak, consistent engagement with the media can facilitate rapid dissemination of outbreak information to the public, including advisories that the outbreak has ended. During the outbreak, designated media relations teams should be established to ensure accurate, timely, and consistent dissemination of outbreak information (Sobel, 2002; Dodd and Cooper, 2012). Once the outbreak has concluded, public health authorities should evaluate their performance and collaborative efforts with media outlets to identify opportunities for improving future risk communication (Food and Agriculture Organization of the United Nations and World Health Organization, 2016). Further, feedback from media outlets should be sought to understand how public health organizations can better support collaboration when future enteric illness outbreaks occur (Food and Agriculture Organization of the United Nations and World Health Organization, 2016).

4.1.2 Identify target audiences and tailor information accordingly

The primary goal of risk communication is to provide the public with information needed to make informed health decisions (World Health Organization, 2017). To support this, it is important to identify target audiences and tailor messages to address their concerns and needs, ensuring that the information is culturally relevant and accessible. Studies indicate that certain populations are at greater risk of acquiring enteric illnesses, including pregnant women, young children, older adults, and the immunocompromised (Barkley et al., 2016; Cardemil et al., 2017). Tailoring communication to vulnerable groups during enteric illness outbreaks can increase accessibility, uptake, and acceptance of behavioral recommendations (Kreuter et al., 1999; Benham et al., 2021).

To effectively tailor risk communication, it is important to understand the populations at risk. This involves identifying and characterizing specific sub-populations at risk, assessing their current knowledge and perceptions of risk, and recognizing any barriers to communicating with them (Public Health Ontario, 2016). For instance, when developing risk communication products, particularly during foodborne illness outbreaks, it is important to maintain cultural sensitivity, as food preparation and consumption practices are often deeply rooted in tradition (Food and Agriculture Organization of the United Nations and World Health Organization, 2016). Additionally, platform preferences must be considered to ensure that the most effective communication channels are used to reach those at risk. Audiences use a variety of platforms and channels to acquire information, including social media, websites, and newspapers, with some consulting multiple sources to inform their health decision-making process (Lin et al., 2014; Jardine et al., 2015; Ali et al., 2020). Tailored communication can enhance the adoption of behavioral recommendations (Glanz et al., 2015), highlighting the importance of a customized approach when communicating about enteric illness outbreak investigations.

4.1.3 Engage with target audiences

Engaging with target audiences can contribute to the success of risk communication during enteric illness outbreaks. In general, top-down communication has been used during public health events given the urgency of the situation (Public Health Ontario, 2023). However, adopting a bi-directional communication approach when the situation is less urgent can offer benefits. Promoting two-way communication with the public allows investigating health organizations to understand the needs of those at risk, reduce the impact of ongoing outbreaks, increase public engagement with risk communication products, increase trust in investigating organizations, and promote the uptake of recommended behaviors (Guan et al., 2021; Public Health Ontario, 2023). Social media is an effective platform for disseminating information to a broad audience and promoting bi-directional conversation (Malecki et al., 2021). With over 33 million social media users in Canada, and 1 in 7 using social media networks daily (Dixon, 2024), public health organizations have access to a platform with a broad reach potential. While our scoping review found conflicting evidence regarding the effectiveness of social media for risk communication – some sources questioned its reliability (van Velsen et al., 2012) and cited the potential for spread of misinformation (Leblebicioglu, 2012) – others recognized its value in helping users acquire information about the outbreak and share their own experiences and opinions (Opat et al., 2018; Ablan et al., 2022).

To promote engagement with the public, it is important to consider practices that can enhance the public's engagement with risk communication products. Generally, risk communication products disseminated by government and public health organizations experience less interaction (Kamiński et al., 2021). However, public health organizations are among the most trusted sources of information during outbreaks (Waddell, 2020), and therefore practices promoting engagement with target audiences should be implemented. For instance, when communicating via social media, aligning risk communication products with best practices such as using a conversational tone and including call to actions may help to increase engagement (MacKay et al., 2022).

4.1.4 Increase and maintain credibility of public health organizations delivering risk communication messages

An individual's perception of the investigating organization can influence public trust (Food and Agriculture Organization of the United Nations and World Health Organization, 2016). This study identified transparency and timeliness as contributing factors to building trust and credibility. Maintaining transparency, such as addressing uncertainties in an ongoing outbreak and explaining how the investigating agency plans to address them, is important for building credibility, enhancing public understanding, and encouraging uptake of recommended behaviors (Food and Agriculture Organization of the United Nations and World Health Organization, 2016; Plohl and Musil, 2021). Similarly, maintaining timeliness of risk communication, such as addressing when the outbreak has ended, is also important for building and maintaining trust and credibility, and positively influencing risk perception and action (Food and Agriculture Organization of the United Nations and World Health Organization, 2016; Gong et al., 2021; Yi et al.,

2024). For instance, enhanced intra-organization coordination and initiating of risk communication by information sources can prevent the spread of misinformation and rumors (Adera et al., 2022).

Other identified practices that can build and maintain trust and credibility include expressing empathy. Empathetic communication should address and validate the emotions of the public (Public Health Ontario, 2016). Using empathy when communicating about enteric illness outbreak investigations can increase trust, promote engagement with risk communication products, and support the uptake of recommended behaviors (Liao et al., 2020; Parmer et al., 2016; MacKay et al., 2022; Savoia et al., 2023).

4.2 Implementation of best practices

To support implementation, active, multifaceted training and education approaches, such as workshops, online training modules, centralized resources, and other educational outreach is recommended to enhance knowledge retention and application by practitioners (MacKay et al., 2024). In addition, incorporating these practices into ongoing public health training programs, such as those for emergency preparedness or food safety, would ensure that practitioners are well-versed in their application. These strategies not only increase the reach of evidence but also motivate practitioners to adopt and integrate these practices effectively into their work environments (McCormack et al., 2013). Tailored approaches that reinforce learning and keep practitioners updated on evolving best practices are likely to be beneficial (McAlpine et al., 2024).

4.3 Relationship to general health and risk communication

These findings align closely with established principles of crisis and risk communication while highlighting unique considerations for enteric illness outbreaks. General risk communication emphasizes timeliness and transparency to build public trust and combat misinformation, which is particularly critical for enteric illnesses due to their acute nature and potential for rapid spread through foodborne pathways (Food and Agriculture Organization of the United Nations and World Health Organization, 2016). Tailored messaging, a cornerstone of effective communication, becomes even more vital for vulnerable populations, such as pregnant individuals or the immunocompromised, who face heightened risks during enteric outbreaks (Barkley et al., 2016; Kreuter et al., 1999). The role of media and multi-channel outreach, commonly leveraged in health crises, requires additional coordination with food safety authorities and industry stakeholders to address consumer concerns effectively (Maciel-Lima et al., 2015; Malecki et al., 2021). Furthermore, enteric illnesses demand an immediate behavioral focus, such as avoiding contaminated foods or practicing safe food preparation, in contrast to longer-term health interventions like vaccination campaigns (Glanz et al., 2015; Food and Agriculture Organization of the United Nations and World Health Organization, 2016). Together, these considerations underscore the importance of tailoring risk communication strategies to the unique characteristics of enteric illness outbreaks.

4.4 Limitations

This scoping review has several limitations. First, while a geographic limiter was not applied in our search strategy, most studies included in the review were from North America and Europe. This may bias our findings to risk communication efforts appropriate to these contexts whilst limiting generalizability to other areas. Second, our review excluded studies that only described risk communication during an enteric illness outbreak and did not provide an evaluation of its effectiveness. This may have excluded or downplayed important principles, practices, or platforms. We attempted to mitigate this by still listing identified practices and platforms with no evidence of effectiveness for completeness. Third, this review may not have captured new and emerging risk communication efforts (e.g., use of TikTok) where peer-reviewed evidence is still forthcoming. We aimed to include other sources of evidence that may have described novel risk communication approaches using a gray literature search.

5 Conclusion

This scoping review synthesized evidence for effective risk communication principles, practices, and platforms that can be implemented during enteric illness outbreaks. These approaches are intended to be general; however, their implementation should be guided by organizational and community needs. Proactive and intentional planning and adoption of evidence-based risk communication approaches is needed to optimize sustainable use and implementation. Ongoing evaluation of these and other emerging approaches is needed to support effective message dissemination and uptake of health protective behaviors during outbreaks. Effective risk communication remains an essential component of responses to enteric illness outbreaks in support of limiting adverse health outcomes and unnecessary healthcare utilization.

Data availability statement

The original contributions presented in the study are included as citations in the article. Further inquiries can be directed to the corresponding author.

Author contributions

HM: Methodology, Investigation, Writing – original draft. JEM: Methodology, Supervision, Writing – review & editing. JM: Investigation,

Writing – review & editing. HS: Writing – review & editing. MM: Writing – review & editing, Methodology. LC: Methodology, Writing – review & editing. MP: Funding acquisition, Methodology, Writing – review & editing. LG: Methodology, Writing – review & editing, Conceptualization, Project administration, Supervision.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2024.1509940/full#supplementary-material

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