Communicating with the public in emergencies:

A systematic review of communication approaches in emergency response

Sayaka Hinata [a], Hannah Rohde [b], and Anne Templeton [a]

[a] Department of Psychology, University of Edinburgh, Edinburgh, UK

[b] Department of Language Sciences, University of Edinburgh, Edinburgh, UK

Abstract

Natural hazards and man-made emergencies pose a consistent challenge to emergency responders and government agencies, raising questions about how to communicate with the public most effectively during the emergencies to maintain safety. We conducted a pre-registered systematic review of current literature with the aim of categorising the depictions of emergency responders' views of the public (e.g., as a group simply to help or as a group to also elicit help from) and modes of communication (e.g., online or face-to-face). From a screened set of 2084 papers, we identified 26 that met our inclusion criteria. Across these papers, the approaches of the emergency responders and government agencies were categorised into three main categories: Command and Control, Uncertainty and Management, and Trust and Collaboration. We found different modes of communication usage across different types of emergencies (e.g., fires and floods) in the literature, with social media being the most prominent. Further, three different patterns of social media use can be categorised: one-way, passive two-way and active two-way. We identified challenges in implementing two-way communication: specifically, distrust in the public during emergencies and organisational constraints on using information from the public. The views toward the public that emergency responders and government agencies hold can be related to what modes of emergency communication they choose to use with the public. Importantly, two-way communication between emergency responders/government agencies and the public should be encouraged, allowing for dialogue where the public share information with emergency responders who in turn make use of public engagement to enhance public safety.

Introduction

Public behaviour during emergencies

Accurate understanding of public behaviour during emergencies is vital to ensure safe emergency response (Drury et al., 2019). Accumulated research has shown that the public tend to show cooperative behaviour during emergencies. For example, survivors of the Great East Japan Earthquake in 2011 reported how people tried to help others and were reluctant to leave because they believed that only they could provide assistance, despite the need to escape immediately (Iwanamishoten, 2013). Another example is the sinking of the M/V Estonia in 1994 with over 800 deaths where the records of survivors and eyewitness testimonies detail numerous efforts among passengers to help each other. When the ship lifted severely and passengers fell, they managed to form a human chain to hold on to each other and pull people to a safer location (Cornwell et al., 2001). The evidence suggests that the public can provide substantial help in emergencies. The public are usually the first witnesses on the scene in emergencies or disasters before professional emergency responders arrive (Cocking, 2013). Despite this, the public have typically been regarded as a nuisance or potential liability by emergency responders and government agencies, and their contribution can be undervalued (Whittaker et al., 2014).

Assumptions of emergency responders and government agencies

It is important to understand how emergency responders and government agencies assume the public respond in emergencies because these assumptions may influence the ways that they communicate with the public during emergencies. Further, these assumptions may shape policy and practice throughout emergency management, in emergency preparedness, response, and recovery. The instructions given to the public will be based on such policy, and the assumptions that guide the way instructions are framed and delivered can heavily influence whether the public are able to take an active role in the emergency response. These assumptions, therefore, have consequences for the public's ability to contribute meaningfully to emergency response (Drury et al., 2019).

Recommendations by emergency responders and government agencies may be based on assumptions of inherent collective psychological vulnerability of members of the public, which can prevent opportunities for the public to help create a safe response (Durodié et al., 2002). For instance, if emergency responders believe the public will easily panic, they may choose to restrict information (Lügering et al., 2023). However, evidence suggests that sharing information can enhance public engagement (Norris et al., 2008), although ongoing debate surrounds whether increased information leads to greater public engagement, as demonstrated by Bukar et al. (2022). Conversely, when the public perceive that information is being withheld, they are likely to feel anxiety and distress (Carter et al., 2012). There is also consistent evidence that communication approaches which treat the public as active participants in the response effort are most effective, in comparison to using coercive,

controlling approaches that may reflect misconceptions of "irrational" crowd behaviour (Drury et al., 2019).

Some previous research has shown that treating the public as active participants in emergencies is beneficial for emergency response, since the public will search, create and share information (see Austin et al. 2017). However, this work seems to have only minimally been applied to emergency management practice. Boholm (2019) found that interviewees from government agencies largely adhered to a traditional, technocratic, top-down model of risk communication. The interviewees described little or no attempt to investigate the concerns of members of the public. Additionally, dialogue with the public was practically absent and communication with the public was mainly one-way. As Carter and Amlôt (2016) argue, it is important that emergency responders and government agencies correctly understand possible public behaviour during emergencies to enable them to construct their emergency response accordingly. However, despite the importance of understanding possible public behaviour, so far there has been little research about how emergency responders and government agencies characterise the public response during emergencies. Therefore, where possible, it is crucial to examine the ways that emergency responders and government agencies presume the public will respond during emergencies. The assumptions and behaviours of emergency responders and government agencies impact initial public reactions and thereby the potential safety of the response. Currently, there is a gap between the research that shows how the public can be useful and the extent to which those findings are reflected or implemented in practice during emergencies.

Modes of communication

Members of the public will seek information from multiple channels in emergencies. For example, Reuter and Spielhofer (2017) surveyed the public about their preferred modes of communication for seeking information about emergencies. They found that the majority reported using TV (86%) and online news sources (80%), followed by local radio (54%) and social media (42%). Additionally, a smaller percentage mentioned using online websites (31%) and mobile apps or text messages (22%).

There are two main reasons why it is important to understand which modes of communication are being used during emergencies by emergency responders. First, the mode of communication selected can provide insights into emergency responders' openness to dialogue with the public and their ability to use the knowledge of and to coordinate with the public. Second, it can provide insights into the assumptions which emergency responders have about the public. For example, one-way modes of communication (e.g., warning messages on TV) typically involve giving a command without the opportunity for the public to respond. On the other hand, two-way modes of communication (e.g., conversations over social media) allow the public to participate in the emergency response and might be an indicator that emergency responders characterise the public as individuals who can offer help and ideas.

There are caveats, however, when drawing conclusions from observations about which modes of communication are used. First, some emergency situations may only allow for one type of communication to be used because of the situation (e.g., loudspeakers when limited emergency staff makes communicating with individual members of the public prohibitively slow). Second, some emergencies require emergency responder organizations to use multiple modes of communication (e.g., both social media and face-to-face communication). Nonetheless, exploring which modes of communication are commonly used by emergency services and government agencies when communicating with the public provides a window into current practice and the opportunities available for two-way engagement with the public.

Previous studies

Social media usage in emergency management is not a new concept, as evidenced by recent studies by Alexander (2014) and Simon et al. (2015), which discuss, which discuss the development of social media use for emergency management and its potential contributions in the future. However, questions remain regarding how emergency responders perceive the public. Some research has explored the role of the public in emergencies, such as Pechta et al. (2010) which aimed to understand and characterize the role of the public as participants in the emergency communication process, and Rake and Njå (2009) which discussed the perceptions and performances of experienced incident commanders. However, these studies have not specifically targeted the responders' perspectives towards the public.

The following two papers set the stage for our systematic review investigating emergency responders' perceptions of the public. First, Drury et al.'s (2013) systematic review of perceived crowd behaviour in emergency planning documents claims that most documents focus on crowds being vulnerable, which minimizes their potential role in coping with emergencies. Second, Reuter et al.'s crisis communication model, developed in 2012 and expanded upon in 2018, emphasizes the integration of social media and traditional communication methods in managing crises. The model highlights the dynamic interaction between authorities, the public, and technology during crisis situations. This systematic review builds on these reviews by covering three areas that previous studies have not fully addressed: 1) Exploring emergency responders' and government agencies personnel's perspectives on the public during emergencies, as this may be related to their choice of communication modes, 2) Understanding the modes of communication used, both online and in person, and 3) Capturing the trends in modes of communication over decades and across international contexts.

Current study

Understanding the assumptions emergency responders and local and/or national government agencies hold about the public may help researchers to understand the ways such emergency responders and government agencies choose to communicate with the public. Since the communication approach taken by emergency responders and government agencies can impact how safely the public responds, it is important to assess what these assumptions are. How and why the public respond in emergencies are longstanding questions in social psychology, particularly within crowd psychology (Drury et al., 2019). After the attack on the Twin Towers on September 11, 2001, emergency guidance in the UK has started to reflect that members of the public can behave helpfully during emergencies, although this is not always consistently acknowledged (see Drury et al., 2019). However, recent analyses (Carter & Amlôt, 2016; Ntontis et al., 2019) note that some of the guidance still carries assumptions about members of the public as psychologically vulnerable and uncooperative. Some of the current recommendations in the guidance can conflict with the evidence showing the public can effectively provide support to one another and emergency services during emergencies (Kerslake, 2022).

To comprehend current interactions between emergency responders/government agencies and the public during emergencies, it is crucial to examine how these agencies characterize the public and the communication approaches they employ. To understand these interactions, this systematic review aims to answer two research questions: 1) How does the previous literature describe the ways the emergency responders and government representatives characterise the public response in emergencies? 2) What modes of communication are used by the emergency responders and government representatives to communicate with the public in emergencies?

The methodology of our review is shown in Section 2, and the quantitative as well as qualitative results are provided in Section 3. Following this, the findings are discussed in relation to trust or distrust in the public during emergencies and organisational constraints on using information from the public (Section 4). We then turn to avenues for future study and address our study limitations and potential in Section 5. Finally, in Section 6, we discuss the importance of two-way communication between emergency responders/government agencies and the public to enhance the public safety.

Methods

This systematic review was pre-registered on the Open Science Framework (https://osf.io/2vb53/). The methodology and results of the review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines (Page et al., 2021) to ensure clear reporting. Our review had two stages of categorisation and analyses. The first stage involved identifying characterisations that emergency responders and government agencies make of the public during emergencies, e.g., a belief that the information provided should be strictly controlled because of either their experience with, or their lack of knowledge of, or interest in the public's actual inclination to be

involved. The second stage involved categorising the modes of communication used by emergency services and government agencies to disseminate information in emergencies: e.g., face-to-face or online.

Search study and terms

A systematic literature search was conducted by the first author using the following databases: PsycINFO (Ovid), Web of Science and Policy Commons, for the years 2000–2022. Policy Commons is a platform that includes different types of literature not only academic papers, but also peer-reviewed journal papers, post-incident reports and white papers, etc. This use of Policy Commons allows us to access a broader range of documents to examine the interaction between emergency responders and government agencies and the public in order to improve the accuracy of our reported results.

We used slightly different search strings across the different databases for identifying literature due to the requirements of the databases. The searches covered three areas: 1) perception of emergency management by emergency responders and government agencies, 2) roles and organisations in emergency response (e.g., fire, ambulance and rescue services), and 3) interactions between emergency responders and members of the public during emergencies. The search string for each database can be seen in Table 1.

Table 1

Search strings for each database

Database (1): Policy Commons

'emergency management*'

AND

'emergency service*'

AND

'communication'

Database (2): PsycINFO (Ovid)

"risk communication*" OR "crisis communication*" OR "communication*" OR "social communication*" OR "social behavior*" OR "reciprocit*" OR "crisis intervention*" OR "collective behavior*"

AND

"ambulance*" OR "ambulance service*" OR "fire fighter*" OR "paramedic*" OR "police*" OR "rescue worker*" OR "police personnel*" OR "first responder*" OR "emergency service*" OR "crisis intervention service*" OR "emergency personnel*" OR "government*" OR "government agenc*"

AND

"disaster*" OR "natural disaster*" OR "crisis management*" OR "safety management*" OR "emergency preparedness*" OR "emergency management*" OR "risk management*"

Database (3): Web of Science

"emergency management" OR "emergency preparedness"

AND

"emergency service*" OR "responder*"

AND

"communication*"

Inclusion and Exclusion Criteria

Literature was included if it met the following criteria: 1) it included interactions during emergencies between members of the public and emergency responders/government agencies involved in disaster planning and response, 2) it was written in English, 3) it was published between 2000 and 2022, and 4) it had the full text available. We chose 2000 to represent the time when social media was gaining prominence and therefore government bodies and emergency services had the opportunity to use it as a means of communicating with the public. We also chose 2000 because literature published since

then would capture any important findings or developments in the literature prior to 2000. The types of literature included peer-reviewed journal papers, post-incident reports, case studies, testimonies, toolkits/how-to papers and white papers.

Literature was excluded if it focused on: 1) post-incident interactions after emergencies completed (e.g., resilience, during recovery and trauma), 2) special skills which need longer training such as medical treatment or information security, 3) emergency infrastructure such as building banks to prevent flooding or fire alarms to encourage people to evacuate, 4) medical workers and emergency departments in hospitals, 5) students and teachers in school settings, 6) specific characteristics or personality traits of emergency services and the individual members of the public, 7) inter-agency communication within the emergency services. We also excluded 8) dissertations because we have already included a sufficient number of grey literature which means not peer-reviewed sources from the results obtained through Policy Commons.

Data extraction

Results of the database searches were imported into the review management software Covidence. Covidence was used to manage the selected papers for both the title and abstract screening and full text reviews.

The titles and abstracts of 2084 papers were initially screened for eligibility based on inclusion and exclusion criteria. Following an initial screening, 93 full-text articles were accessed and reviewed by the first author to verify eligibility. A spreadsheet was maintained with extracted data from the eligible literature. Relevant data for each reviewed article included each type of interaction discussed in the literature and a record of the authors, publisher, year and title of publication, country, types of organisations and people involved in the communication (e.g., emergency services, government agencies and the public), modes of communication (e.g., in person and social media), characterisation of the public (e.g., a group to control or a group to engage with).

All literature was screened against eligibility criteria to minimise bias. The full text of papers passing initial review was retrieved for final decisions on inclusion. Papers were then categorised according to emergency responders and/or government agencies' views of the public and/or the mode of communication used by emergency responders and/or government agencies. The reliability of the coding was assessed by providing randomly selected papers across the categories to two blind reviewers who independently allocated and matched the papers and categories.

Risk of bias and quality assessment

We used the Mixed Method Appraisal Tool (MMAT) (Hong et al., 2018) to assess the quality and bias within the literature. The MMAT is a checklist that includes 5 questions per methodology to provide a quality appraisal tool for quantitative, qualitative and mixed methods studies in systematic

reviews by requiring ratings for the adequacy of the research questions and methodology used. Since we also aimed to review literature that did not include peer-reviewed empirical research (e.g., white papers and post-incident reports), we included additional quality checks such as the reputation of authors (e.g., known authors or think tank/government organisation/charity) and/or obvious conflicts of interest that may impact reporting.
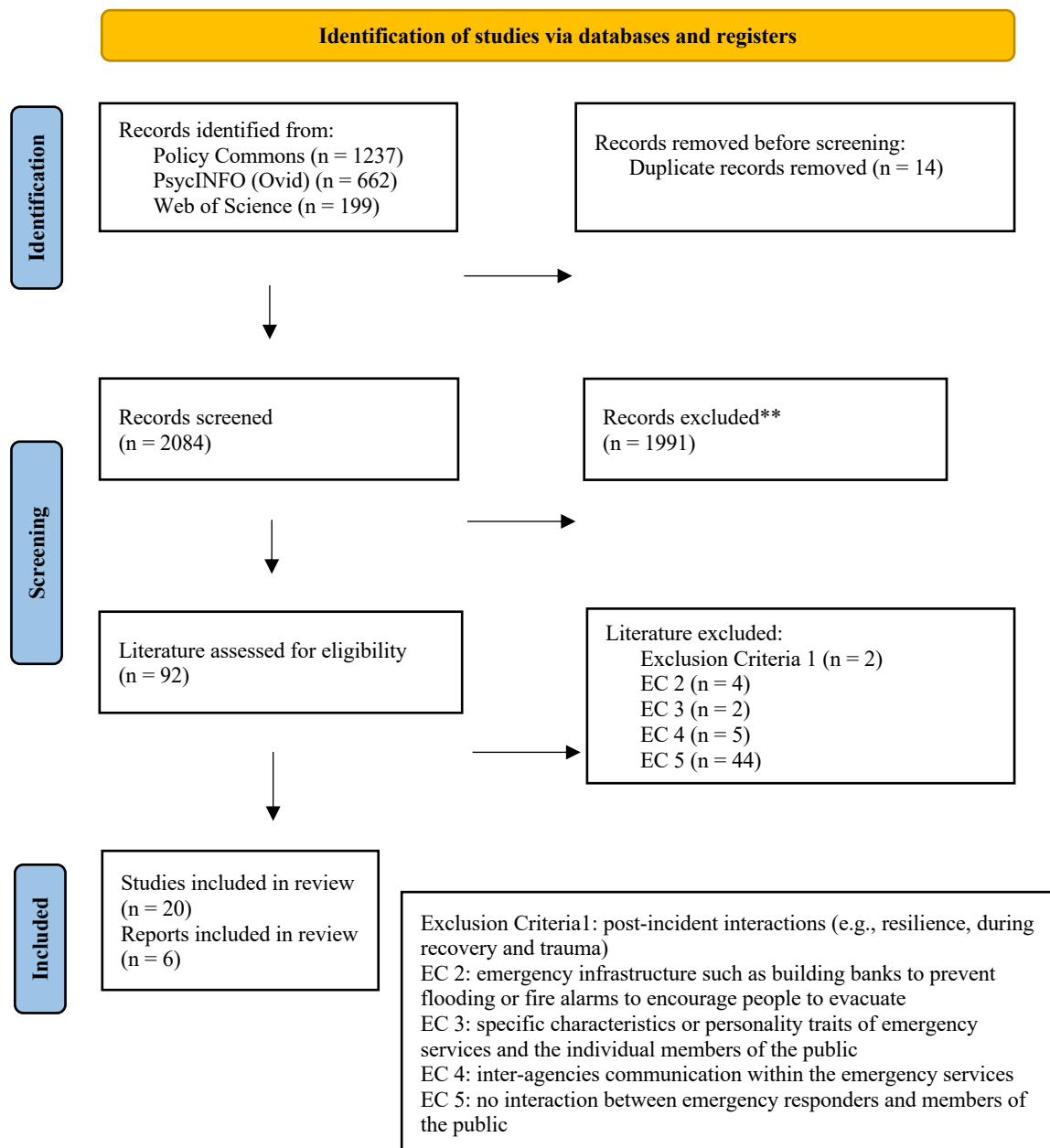
Strategy for data synthesis

We included all articles that met our criteria for inclusion. Papers were categorised according to characterisation of the public and modes of communication.

Results

Across the three databases, 2098 papers were identified (Policy Commons (n = 1237), PsycINFO (Ovid) (n = 662), Web of Science (n = 199)), of which 2084 papers were included for title and abstract screening after duplicate records were removed. See Figure 1 for the list of excluded articles, and the supplementary materials for the reasons literature was excluded.

Twenty empirical articles and six policy reports (total literature n = 26) were included for the full text review according to inclusion and exclusion criteria. The papers were read and categorised according to 1) how the emergency responders and/or government agencies interacted with the public and/or viewed the public in emergencies, and 2) which mode of communication used. For the first research question, the categories were created based on common themes in how the public were treated/viewed. Table 2 shows the title and description of the categories. The second rater read eight papers to ensure that descriptions of the categories were clear and to assess the accuracy of the first rater's categorisation of the literature (kappa value = 0.50). After their review, we updated the description of the categories. Then the third rater independently categorised six papers (23.0% of the final included literature) to ensure the new category descriptions were clear and to assess the accuracy of the first rater's categorisation of the literature. Two articles were randomly selected per category and independently reviewed, showing very strong agreement between the raters (kappa value = 0.83).

Figure 1

PRISMA diagram of literature review process

Identification of studies via databases and registers

Identification

Records identified from:
    Policy Commons (n = 1237)
    PsycINFO (Ovid) (n = 662)
    Web of Science (n = 199)

Records removed before screening:
    Duplicate records removed (n = 14)

Screening

Records screened
(n = 2084)

Records excluded**
(n = 1991)

Literature assessed for eligibility
(n = 92)

Literature excluded:
    Exclusion Criteria 1 (n = 2)
    EC 2 (n = 4)
    EC 3 (n = 2)
    EC 4 (n = 5)
    EC 5 (n = 44)

Included

Studies included in review
(n = 20)
Reports included in review
(n = 6)

Exclusion Criteria1: post-incident interactions (e.g., resilience, during recovery and trauma)
EC 2: emergency infrastructure such as building banks to prevent flooding or fire alarms to encourage people to evacuate
EC 3: specific characteristics or personality traits of emergency services and the individual members of the public
EC 4: inter-agencies communication within the emergency services
EC 5: no interaction between emergency responders and members of the public

Approach of emergency services and government agencies to the public in emergencies

The approaches of the emergency services and government agencies were categorised into 3 main categories (see Table 2 for category descriptions and paper distribution across these categories).

COMMUNICATION APPROACHES IN EMERGENCY RESPONSE

Table 2

Title and description of the categories for emergency responders' characterisation of the public

Title	Description	No. papers
Command and Control	Emergency responders/government agencies believe the public tend to behave irrationally and lose control in emergencies	15
Uncertainty and Management	Emergency responders/government agencies believe the public can behave rationally only if emergency responders/government agencies instruct the public about how to respond	9
Trust and Collaboration	Emergency responders/government agencies believe the public behave rationally and actively contribute solutions	2

Command and Control

Papers within the Command and Control category were most frequent and described beliefs held by emergency responders/government agencies that members of the public tend to behave irrationally and lose control in emergencies. For example, Boholm (2019) interviewed public officials at six government agencies in Sweden and found that dialogue with members of the public on issues of risk was very limited, and government agencies felt they did not need to communicate with members of the public. Similarly, Tippet et al. (2015) demonstrated that emergency responders and government agencies often assume that the public will comply with instructions when they emanate from authoritative voices in government. This implies that they believe the public requires the direction of emergency responders to act rationally and comply with their commands. Emergency responders and government agencies are often afraid to risk losing control of the public (Hall & Wolf, 2021), so they tend to withhold some information (Palttala et al., 2011). Notably, however, efforts to control the public do not necessarily mean that the public receives no information; some amount of information may still be provided (see Granatt, 2004).

Uncertainty and Management

Papers within the Uncertainty and Management category were also frequent. They described beliefs held by emergency responders/government agencies that the public can behave rationally but only if emergency responders/government agencies instruct the public about how to respond. For example, Schmidt (2019) suggested that emergency responders and government agencies recognized the benefits of extra help, local knowledge, and increased response performance when involving members of the public, but the organisations found it hard to trust untrained individuals who might risk their

own safety or that of others. Specifically, they were concerned about issues of liability and responsibility if members of the public got injured when they actively engaged in the response process. Furthermore, Jamieson (2020) analysed the New Zealand government's response, illustrating their careful tailoring of information delivery to ensure public understanding of government messages, thereby maintaining public safety. For example, in raising public awareness of the importance of social distancing, the New Zealand government believes it is crucial to adjust the tone and manner to encourage compliance with government directives when conveying information to the public.

Trust and Collaboration

Papers within the Trust and Collaboration category were most rare. They described beliefs held by emergency responders/government agencies that the public behave rationally and actively contribute solutions. For example, Bukar (2020)'s analysis of crisis communication on social media showed that members of the public are not treated as merely passive information receivers. Instead, they actively seek out crisis information and exchange views with others. Members of the public are seen as being able to make sensible decisions before taking protective action, so messages from emergency responders should be clear and specific to achieve appropriate action (Sutton et al., 2014). In another case, that the U.S. Coast Guard (USCG) used Twitter to directly engage with affected members of the public and gain information from them during Hurricane Harvey. This strategy represents two-way communication between a government agency and impacted members of the public (Boman et al., 2020).

With regards to the modes of communication, our review of papers revealed the use of a range of options including TV and social media (see Table 3 for a summary). The majority of papers indicated that emergency responders and government agencies used YouTube and social media platforms such as Facebook and Twitter to communicate with specific groups of the public. Updates over television were also used to inform large numbers of the public about how protect themselves from possible risks during emergencies.

Table 3

Modes of communication and a total number of papers

Modes of communication	No. papers
TV	1
Social Media (general)	1
YouTube	1
Facebook	4
Twitter	7

Nearly half of papers mentioned the use of social media such as Facebook and Twitter, so we also investigated how the emergency responders use these social media. We identified three different categories of using social media when emergency responders and government agencies communicate with the public during emergency: one-way, passive two-way and active two-way.

In one-way social media communication, emergency responders use social media for sending messages to the public, e.g., to convey situational updates or advice on how to handle emergency situations (see Eckert et al., 2018; Hughes & Tapia, 2015). This usage is not very different from the use of more traditional mass media, so the potential benefits of social media are not fully utilized.

In passive two-way communication, emergency responders may track the engagement of the public, e.g., reviewing the public response tweets in order to determine situational awareness to gauge how the emergency is proceeding (see Parsons et al., 2018). In such cases, emergency responders use information from the public, but they do not engage in dialogue with the public. According to Parson et al (2018), information gathering on Twitter has been limited even though emergency responders are aware of the potential for data gathering on Twitter; reasons include lack of resources, which may hamper the responders' ability to use Twitter well for this purpose.

Active two-way communication represents the most advanced way of communicating via interactive conversation. Under this approach, emergency responders reply to public tweets and act on information in posts from the public. For example, emergency responders send direct replies to members of the public who tweeted their emergency situations, asking whether they had been rescued or not and directing them to call specific phone numbers for help (Boman et al, 2021). Further, even though this messaging is often a copy of messages to other people simply telling them what action to take (e.g., which phone number to access), this strategy indicates direct communication between governmental agencies and affected members of the public and is in keeping with former findings that government agencies tend to be formal in responses on Twitter during emergencies (Zhao et al., 2019).

The distribution of communicative approaches is summarised in Figures 2 and 3. From 2000 to 2021, the number of papers that addressed questions about how emergency responders and government agencies interact with the public and/or view the public in emergencies increased overall. These papers primarily described situations in America, Australia, and Europe. The most common communicative approach across most of the locations and throughout most of the time period was Command and Control; however, papers about situations on the Australian continent shows beliefs about the public that align with the Uncertainty and Management approach.

COMMUNICATION APPROACHES IN EMERGENCY RESPONSE

Figure 2

Communication approaches across time
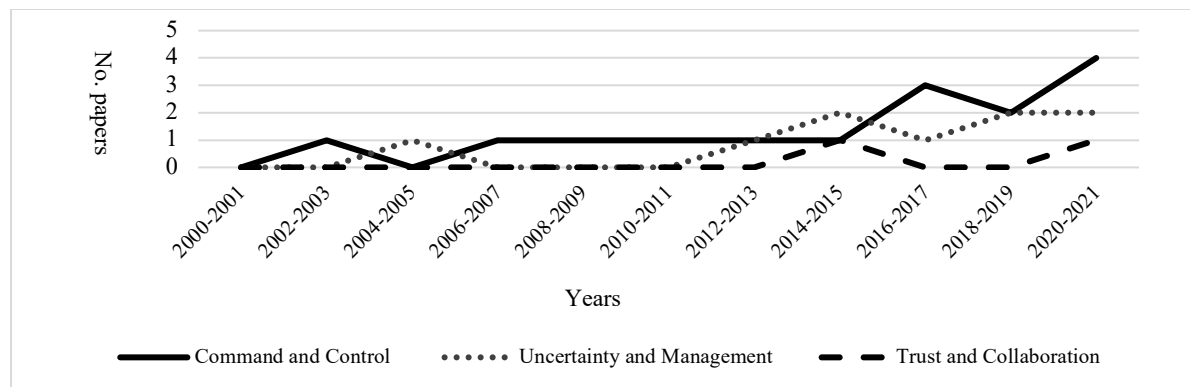
Figure 3

Communication approaches across place
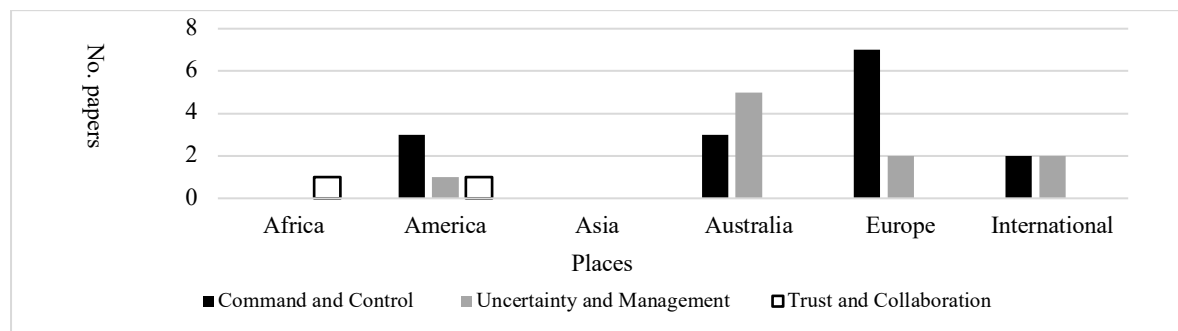
Mixed Methods Appraisal Tool

To assess the quality of the papers in our systematic review, we used the criteria laid out in the Mixed Methods Appraisal Tool (Hong et al., 2018). We rated that 100% of quality criteria were met when a study allowed us to choose yes to all 5 questions for the relevant study design and we rated 20% quality criteria met when the study allowed us to choose yes to 1 question. We allocated 100%-80% as high, 80%-40% as medium and 40%-20% as low quality. The quality rating for each article is presented in Table 4.

Table 4

The papers included in this systematic review

The authors	Publication Year	Title	Characterisation of the public	Quality
Boholm	2019	Risk communication as government agency organizational practice.	1) Command and Control	Medium
Boholm	2019	Lessons of success and failure: Practicing risk communication at government agencies.	1) Command and Control	Medium
Boman	2021	Exploring the U.S. Coast Guard's stance agility on Twitter during Hurricane Harvey.	3) Trust and collaboration	High
Bonfield	2009	Comments on "Assessing and managing environmental risk: Connecting local government management with emergency management."	1) Command and Control	High
Eckert	2020	Health-Related Disaster Communication and Social Media	1) Command and Control	Medium
Frewer	2003	The views of scientific experts on how the public conceptualize uncertainty.	1) Command and Control	High
Granatt	2004	On trust: Using public information and warning partnerships to support the community response to an emergency.	2) Uncertainty and Management	Medium
Helsloot	2013	Twitter: An Underutilized Potential during Sudden Crises?	1) Command and Control	Medium
Hughes	2015	Social Media in Crisis: When Professional Responders Meet Digital Volunteers.	2) Uncertainty and Management	Medium
Jamieson	2020	"Go hard, go early": Preliminary lessons from New Zealand's response to COVID-19.	2) Uncertainty and Management	High
Johnston	2020	Emergency management communication: The paradox of the positive in public communication for preparedness.	2) Uncertainty and Management	High

Kim	2020	Facebook as an official communication channel.	1) Command and Control	High
Liu	2020	Leadership under fire: How governments manage crisis communication.	1) Command and Control	Medium
MAiD	2015	Managing animals in disasters	2) Uncertainty and Management	High
Middleton	2019	EMG506-Literature Review Assessment Item 4 Literature Review.	2) Uncertainty and Management	Medium
Palttala	2012	Communication Gaps in Disaster Management: Perceptions by Experts from Governmental and Non-Governmental Organizations.	2) Uncertainty and Management	Medium
Parsons	2018	Social media in emergency management: exploring Twitter use by emergency responders in the UK.	2) Uncertainty and Management	High
Paton	2017	Community understanding of tsunami risk and warnings in Australia.	2) Uncertainty and Management	High
Simon	2014	Twitter in the Cross Fire-The Use of Social Media in the Westgate Mall Terror Attack in Kenya.	3) Trust and collaboration	High
Tampere	2016	Facebook discussion of a crisis: Authority communication and its relationship to citizens.	1) Command and Control	High
Thornton	2016	Harnessing the Capacities of Spontaneous Volunteers: Application and Adaptation of the Queensland Model.	1) Command and Control	Medium
Treurniet	2015	Shaping the societal impact of emergencies: striking a balance between control and cooperation.	1) Command and Control	High
Trnka	2020	Rethinking states of emergency.	1) Command and Control	Medium
Vari	2002	Public involvement in flood risk management in Hungary.	1) Command and Control	High

| Wester | 2011 | Fight, flight or freeze: Assumed reactions of the public during a crisis. | 1) Command and Control | High |
| Wukich | 2016 | Government social media messages across disaster phases. | 1) Command and Control | High |

Discussion

The analysis of social media in emergency management is not new, as evidenced by Alexander (2014) and Simon et al. (2015), who detail its development and future possibilities, and there is work that examines the role of social media in incident commanders' actions and decisions (Rake & Njå, 2009) as well as the role of the public emergency communication (Pechta et al., 2010). However, prior work has not systematically addressed how emergency responders who use social media to communicate with the public perceive their audience. Our current review extends previous literature by investigating emergency responders' and government agencies' perceptions of the public during emergencies. We seek to understand the modes of communication they employ—both online and in person—and their level of trust towards the public. Moreover, we capture trends in communication modes over decades and across international contexts.

By reviewing the academic literature, white papers and post-incident reports, we categorised the level of trust and engagement emergency responders and government agencies feel toward the public during emergencies, and what opportunities for engagement are permitted by the different modes of communication used (particularly social media). In this section, we discuss two main reasons why emergency responders and government agencies may be unlikely to have two-way interactive communication with the public during emergencies: distrust in the public during emergencies, and organisational constraints on using the information from the public, which we discuss below.

Trust or distrust in the public during emergencies

We identified three different types of approaches to the public when analysing the assumptions of emergency responders and government agencies. These approaches reflect the varying degrees to which emergency responders and government agencies trust members of the public to react appropriately and to be a helpful resource in emergencies, from the least trusting (Command and Control) to most trusting (Trust and Collaboration). These attitudes towards the public - such as to what extent they trust the public - could be related to how open they are to dialogue with the public, which in turn may influence what modes of communication they use with the public (e.g. one-way or two-way).

According to Frewer et al. (2003), many emergency management experts thought that giving the public information about uncertainty would enhance distrust in their institutions and would produce

irrational behaviours and confusion regarding the extent and impact of a particular risk. However, a few papers showed that some emergency responders and government agencies are likely to collaborate with the public through direct two-way communication because they trust the public to be helpful and act responsibly. For example, the U.S. Coast Guard (USCG) used Twitter to communicate during Hurricane Harvey directly with potentially affected members of the public (Boman et al., 2021). Further, after the Haiti earthquake in 2010, emergency responders started to notice that the information and assistance which digital volunteers, i.e., members of the public participating in social media, could be helpful. Digital volunteers gathered and organized online information swiftly and provided the information to the emergency responders (Meier, 2011). These examples have important implications since if current emergency management is combined with a mode of communication that allows two-way interactions, they could increase their direct coordination with the public to facilitate safe response.

However, some papers described hesitation about being able to trust the capacity of the public in emergencies. Even when emergency responders and government agencies did consider open communication and resource sharing with the public, there was concern about whether or not the information and response from the public is itself trustworthy. According to Frewer et al (2003), there was a widespread belief that the public cannot generalize uncertainties related to emergency management processes. For example, there was concern about members of the public releasing misinformation on social media during emergencies, especially during the earlier stages of the response when the situation is not clear.

Another reason why emergency responders and government agencies may be unlikely to have two-way interactive communication with the public during emergencies is due to organisational constraints. For example, Owen (2014) discusses how the use of information from the public is still controversial especially among senior emergency responders. Emergency responders would prefer to have a single channel of incoming rescue information because it is challenging in general to manage information, particularly from multiple sources, during emergencies (Boman et al, 2021). The open data produced by the public must engender a strong enough level of confidence for the emergency responders and government agencies to accept it and act on it. Also, to be useful, the benefits of data from the public must exceed whatever additional physical and time costs that might be incurred to filter and interpret such data.

Moreover, emergency responders and government agencies typically work within a centralized command structure, standard operating procedures, and internal monitoring systems to ensure appropriate responses to emergency incidents. These mechanisms have been successful at bringing rescue to millions of people, sometimes falling short of idealized metrics of speed, efficiency and knowledge (Walton et al. 2011). Imposing this controlled structure is seen by emergency responders

and government agencies to ensure accuracy, security, legitimacy between the organization and information source. Due to the perceived lack of authentication, large-scale responders have been reluctant to incorporate information from the public into their process of emergency response (Hughs & Tapia, 2015).

Modes of communication and the use of social media for coordination

The modes of communication used to inform the public in emergencies can dictate the extent to which interactive communication is possible between the emergency responders and government agencies and the public. According to Reuter et al.'s (2012; 2018) crisis communication model, two categories pertain to communication between emergency responders/government agencies and the public. The "Authorities to Citizens" (crisis communication) category corresponds with our category of active two-way communication, as it enables authorities to engage with the public in real-time to correct misinformation. Similarly, the "Citizens to Authorities" (integration of citizen-generated content) category corresponds with our category of passive two-way communication, as both involve authorities monitoring information shared by the public on social media. Additionally, we introduce a new category of one-way communication, wherein the government and emergency services (authorities) disseminate information to the public (citizens) without actively soliciting input from the public. Our updated discussion reflects how we both replicate and expand upon the social media crisis communication matrix.

During emergency response, emergency responders and government agencies aim to inform not only those directly involved but also those who are not affected (Granatt, 2004). TV has long been used to inform the public about how protect themselves from possible risks. However, these one-way modes of communication entail limited ability for the public to respond or ask questions of those providing the announcement.

Granatt (2004) argued that a serious drawback of mass media for communication in emergencies is that warning messages do not always reach the target audience or they arrive too late. However, the paper also stated that it was widely agreed there is no substitute for using mass media to deliver detailed information directly to specific groups. Notably, since Granatt's paper, the public's increased use of smartphones has provided access to a substitute media for receiving detailed information: social media. Indeed, social media was the most prominent mode of communication in the review.

Social media may allow for increased coordination and collaboration because of its tools and functionality for promoting online conversations. Such tools could allow for the coordination of risk reduction operations via two-way interactive communication approaches between emergency responders and government agencies and the public unlike traditional one-way communication approaches (Chatfield et al., 2013). Social media platforms are altering the methods and strategies that organizations use to communicate during crises, introducing new dynamics and challenges to

traditional approaches of crisis communication. The significant impact of social media on crisis management necessitates quick and flexible responses from those responsible for managing these crises. (see Cheng, 2018; Stewart & Wilson, 2016)

We identified these different modes of social media usage across different types of emergencies (e.g., fires, floods and hurricanes). Nonetheless, all agencies showed an emphasis on disseminating messages for protective action information and situational information via one-way communication, and fewer engaged in more interactive approaches to promote public participation (e.g., passive or active two-way).

Further developing two-way communication between emergency responders and the public could potentially have great benefits for safe emergency response. Community engagement can facilitate the building of trust and confidence among community members in the organisations that provide the information and messages, and consequently encourage coordinated action (Prior & Paton, 2008). Moreover, if members of the public provide helpful input during emergencies, emergency responders can collect information from the public about their needs and about potential solutions (Sutton et al. 2014). Therefore, we recommend that emergency responders and government agencies consider social media as a platform given its potential for dialogue and coordination with the public in emergencies.

Future research avenues

There is still little research about the challenges emergency responders may face when they try to both provide the public with information during emergencies and receive information from the public. Therefore, future research could aim to explore what practical and operational influencing factors may occur for emergency responders when providing information to the public in emergencies. For example, emergency responders must give and take information as quickly as possible, but not at the expense of accuracy and liability in crisis situations (Palttala et al., 2011). Although we screened over 2,000 papers, the final number of papers included in this study is relatively small (26). As such, we may need to update these three categories as the related literature expands in the future. Another limitation is that most of the included literature were academic papers. It may be that other policy documents were not included in the databases we searched, and these may provide information about how members of the public are characterised and what modes of communication are used. Further, we only used literature written in English which may have excluded government documents from non-English speaking countries. Moreover, face-to-face and radio did not appear in the literature as modes of communication even though they are possibly the most used (e.g., for fires and floods) (see Kerslake, 2022).

Conclusion

We conducted the first systematic review looking at views of the public and modes of communication, and asking how the views and modes impact the public's ability to provide input in the emergency. We also show how operational barriers may limit two-way communication, and we discuss distinctions among one-way, two-way passive, and two-way active communication. We identified challenges in implementing two-way communication and suggest that future research should explore what practical and operational influencing factors are for emergency responders when sharing information with the public in emergencies. Importantly, two-way communication between emergency responders/government agencies and the public should be available, allowing for dialogue where the public share information with emergency responders who in turn make use of the public engagement as zero-responders in order to enhance the public safety.

COMMUNICATION APPROACHES IN EMERGENCY RESPONSE

References

Alexander, D. E. (2014). Social media in disaster risk reduction and crisis management. *Science and engineering ethics*, *20*, 717-733.

Austin, L., & Jin, Y. (2016). Social media and crisis communication: Explicating the social-mediated crisis communication model. In *Strategic Communication* (pp. 163-186). Routledge.

Boholm, Å. (2019). Lessons of success and failure: practicing risk communication at government agencies. *Safety science*, *118*, 158-167.

Boholm, Å. (2019). Risk communication as government agency organizational practice. *Risk analysis*, *39*(8), 1695-1707.

Bonfield, T. J. (2009). Comments on "assessing and managing environmental risk: connecting local government management with emergency management". *Public Administration Review*, *69*(2), 194-197.

Boman, C. D., Valiavska, A., Bramlett, J. C., & Cameron, G. T. (2021). Exploring the US Coast Guard's stance agility on Twitter during Hurricane Harvey. *Journal of Contingencies and Crisis Management*, *29*(1), 47-53.

Bukar, U. A., Jabar, M. A., Sidi, F., Nor, R. N. H. B., Abdullah, S., & Othman, M. (2020). Crisis informatics in the context of social media crisis communication: Theoretical models, taxonomy, and open issues. *IEEE access*, *8*, 185842-185869.

Bukar, U. A., Sidi, F., Jabar, M. A., Nor, R. N. H. B., Abdullah, S., & Ishak, I. (2022). A Multistage Analysis of Predicting Public Resilience of Impactful Social Media Crisis Communication in Flooding Emergencies. *IEEE Access*, *10*, 57266-57282.

Carter, H., & Amlôt, R. (2016). Mass casualty decontamination guidance and psychosocial aspects of CBRN incident management: A review and synthesis. *PLoS currents*, *8*.

Carter, H., Drury, J., Rubin, G. J., Williams, R., & Amlôt, R. (2012). Public experiences of mass casualty decontamination. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science*, *10*(3), 280-289.

Chatfield, A. T., Scholl, H. J. J., & Brajawidagda, U. (2013). Tsunami early warnings via Twitter in government: Net-savvy citizens' co-production of time-critical public information services. *Government information quarterly*, *30*(4), 377-386.

Cheng, Y. (2018). How social media is changing crisis communication strategies: Evidence from the updated literature. *Journal of contingencies and crisis management*, *26*(1), 58-68.

Cocking, C. (2013). The role of "zero-responders" during 7/7: implications for the emergency services. *International Journal of Emergency Services*, *2*(2), 79-93.

Cornwell, B., Harmon, W., Mason, M., Merz, B., & Lampe, M. (2001). Panic or situational constraints? The case of the M/V Estonia. *International Journal of Mass Emergencies & Disasters*, *19*(1), 5-25.

Drury, J., Carter, H., Cocking, C., Ntontis, E., Tekin Guven, S., & Amlôt, R. (2019). Facilitating collective psychosocial resilience in the public in emergencies: Twelve recommendations based on the social identity approach. *Frontiers in public health*, *7*, 141.

Drury, J., Novelli, D., & Stott, C. (2013). Representing crowd behaviour in emergency planning guidance:'mass panic'or collective resilience?. *Resilience*, *1*(1), 18-37.

Durodié, B., & Wessely, S. (2002). Resilience or panic? The public and terrorist attack. *The Lancet*, *360*(9349), 1901-1902.

Eckert, S., Sopory, P., Day, A., Wilkins, L., Padgett, D., Novak, J., ... & Gamhewage, G. (2018). Health-related disaster communication and social media: mixed-method systematic review. *Health communication*, *33*(12), 1389-1400.

Frewer, L., Hunt, S., Brennan, M., Kuznesof, S., Ness, M., & Ritson, C. (2003). The views of scientific experts on how the public conceptualize uncertainty. *Journal of risk research*, *6*(1), 75-85.

Granatt, M. (2004). On trust: Using public information and warning partnerships to support the community response to an emergency. *Journal of Communication Management*, *8*(4), 354-365.

Hall, K., & Wolf, M. (2021). Whose crisis? Pandemic flu, 'communication disasters' and the struggle for hegemony. *Health*, *25*(3), 322-338.

Helsloot, I., & Groenendaal, J. (2013). T witter: An Underutilized Potential during Sudden Crises?. *Journal of Contingencies and Crisis Management*, *21*(3), 178-183.

Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., ... & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for information*, *34*(4), 285-291.

Hughes, A. L., & Tapia, A. H. (2015). Social media in crisis: When professional responders meet digital volunteers. *Journal of Homeland Security and Emergency Management*, *12*(3), 679-706.

Jamieson, T. (2020). "Go hard, go early": Preliminary lessons from New Zealand's response to COVID-19. The American Review of Public Administration, 50(6-7), 598-605.

Japan Broadcasting Corporation. (2013). *Kyodai Tsunami: Sonotoki hito wa dō ugoitaka* [the Great East Japan Earthquake in 2011: How people responded during the disaster]. *Iwanamishoten*.

Johnston, K. A., Taylor, M., & Ryan, B. (2020). Emergency management communication: The paradox of the positive in public communication for preparedness. *Public Relations Review*, *46*(2), 101903.

Liu, B. F., Iles, I. A., & Herovic, E. (2020). Leadership under fire: How governments manage crisis communication. *Communication Studies*, *71*(1), 128-147.

Lügering, H., Tepeli, D., & Sieben, A. (2023). It's (not) just a matter of terminology: Everyday understanding of "mass panic" and alternative terms. *Safety science*, *163*, 106123.

Meier, P. (2011). New information technologies and their impact on the humanitarian sector. *International review of the Red Cross*, *93*(884), 1239-1263.

MAiD, I. (2014). Managing Animals in Disasters.

Middleton, P. (2019). EMG506-Literature Review Assessment Item 4 Literature Review.

Norris, F. H., Stevens, S. P., Pfefferbaum, B., Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American journal of community psychology*, *41*, 127-150.

Ntontis E, Drury J, Amlôt R, Rubin JG, Williams R. Community resilience and flooding in UK guidance: a review of concepts, definitions, and their implications. J Conting Crisis Manag. (2019) 27:2–13. doi: 10.1111/1468-5973.12223

Owen, C. (2014). Leadership, Communication and Teamwork in Emergency Management. *Human Factors Challenges in Emergency Management: Enhancing Individual and Team Performance in Fire and Emergency Services*, 125.

Rake, E. L., & Njå, O. (2009). Perceptions and performances of experienced incident commanders. *Journal of Risk Research*, *12*(5), 665-685.

Reuter, C., Hughes, A. L., & Kaufhold, M. A. (2018). Social media in crisis management: An evaluation and analysis of crisis informatics research. *International Journal of Human–Computer Interaction*, *34*(4), 280-294.

Reuter, C., Marx, A., & Pipek, V. (2012). Crisis management 2.0: Towards a systematization of social software use in crisis situations. *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 4(1), 1–16.

Reuter, C., & Spielhofer, T. (2017). Towards social resilience: A quantitative and qualitative survey on citizens' perception of social media in emergencies in Europe. *Technological Forecasting and Social Change*, *121*, 168-180.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, *88*, 105906.

Palttala, P., & Vos, M. (2011). Testing a methodology to improve organizational learning about crisis communication by public organizations. *Journal of Communication Management*, *15*(4), 314-331.

Parsons, S., Weal, M., O'Grady, N., & Atkinson, P. M. (2018). Social media in emergency management: exploring Twitter use by emergency responders in the UK. *International Journal of Emergency Management*, *14*(4), 322-343.

Paton, D., Johnston, D., Rossiter, K., Buergelt, P., Richards, A., & Anderson, S. (2017). Community understanding of tsunami risk and warnings in Australia. *Australian Journal of Emergency Management, The*, *32*(1), 54-59.

Pechta, L. E., Brandenburg, D. C., & Seeger, M. W. (2010). Understanding the dynamics of emergency communication: Propositions for a four-channel model. *Journal of Homeland Security and Emergency Management*, *7*(1).

Prior, T. D., & Paton, D. (2008). Understanding the context: The value of community engagement in bushfire risk communication and education. Observations following the East Coast Tasmania bushfires of December 2006. *Australiasian Journal of Disaster and Trauma Studies*.

Schmidt, A. (2019). Tensions and dilemmas in crisis governance: Responding to citizen volunteers. *Administration & Society*, *51*(7), 1171-1195.

Simon, T., Goldberg, A., & Adini, B. (2015). Socializing in emergencies—A review of the use of social media in emergency situations. *International journal of information management*, *35*(5), 609-619.

Simon, T., Goldberg, A., Aharonson-Daniel, L., Leykin, D., & Adini, B. (2014). Twitter in the cross fire—the use of social media in the Westgate Mall terror attack in Kenya. *PloS one*, *9*(8), e104136.

Stewart, M. C., & Wilson, B. G. (2016). The dynamic role of social media during Hurricane# Sandy: An introduction of the STREMII model to weather the storm of the crisis lifecycle. *Computers in Human Behavior*, *54*, 639-646.

Sutton, J., Spiro, E. S., Johnson, B., Fitzhugh, S., Gibson, B., & Butts, C. T. (2014). Warning tweets: Serial transmission of messages during the warning phase of a disaster event. *Information, Communication & Society*, *17*(6), 765-787.

Kerslake. (2022). The Kerslake Arena Review. https://www.kerslakearenareview.co.uk/documents/

Kim, C., Atkinson, S., & Lee, J. Y. (2021). Facebook as an official communication channel in a crisis. *TheAUSTRALIAN JOURNAL OF EMERGENCY MANAGEMENT*, *36*(1), 92-98.

Tampere, P., Tampere, K., & Luoma-Aho, V. (2016). Facebook discussion of a crisis: Authority communication and its relationship to citizens. *Corporate Communications: An International Journal*, *21*(4), 414-434.

Tippet, V., Greer, D., Mehta, A., Christensen, S., Duncan, B., Stickley, A., & Dootson, P. (2015). CONNECTING COMMUNITIES AND RESILIENCE: A MULTI-HAZARD STUDY OF PREPAREDNESS, RESPONSE AND RECOVERY COMMUNICATIONS.

Treurniet, W., Messemaker, M., Wolbers, J., & Boersma, F. K. (2015). Shaping the societal impact of emergencies: striking a balance between control and cooperation. *International Journal of Emergency Services*, *4*(1), 129-151.

Trnka, S. (2020). Rethinking states of emergency. *Social Anthropology*, *28*(2), 367.

Vari, A. (2002). Public involvement in flood risk management in Hungary. *Journal of Risk Research*, *5*(3), 211-224.

Walton, R., Mays, R. E., & Haselkorn, M. P. (2011, May). Defining fast: Factors affecting the experience of speed in humanitarian logistics. In *ISCRAM*.

Wester, M. (2011). Fight, flight or freeze: Assumed reactions of the public during a crisis. *Journal of Contingencies and Crisis Management*, *19*(4), 207-214.

Whittaker, J., Handmer, J., & McLennan, B. (2015). Building community resilience through informal emergency volunteering. *Bushfire and Natural Hazards CRC*, 1-10.

Wukich, C. (2016). Government social media messages across disaster phases. *Journal of Contingencies and Crisis Management*, *24*(4), 230-243.

Zhao, X., Zhan, M. M., & Liu, B. F. (2019). Understanding motivated publics during disasters: Examining message functions, frames, and styles of social media influentials and followers. *Journal of Contingencies and Crisis Management*, *27*(4), 387-399.