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Exploring communication inefficiencies in disaster response: Perspectives of emergency managers and health professionals

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ABSTRACT

During disasters, emergency management and health agencies are typically the key providers of healthcare services, yet communication breakdowns between the two sectors often hinder response. This qualitative study explores the experiences of emergency managers and health professionals to identify challenges in cross-agency collaboration. Semi-structured interviews were conducted with professionals from New Zealand and the United Nations Office for the Coordination of Humanitarian Affairs. Inductive thematic analysis revealed three key challenges: structural, operational, and information exchange barriers. Weak interpersonal relationships and lack of prior liaison were found to impede information sharing, reducing situational awareness. Coordination was further undermined by inadequate training, insufficient funding, and reliance on untrained personnel. Rigid planning structures, limited community engagement, and the exclusion of vulnerable groups also weakened response efforts. Overly complex reporting structures and fragmented information systems restricted effective data sharing, with privacy concerns further constraining access to critical information. Interoperability challenges further disrupt the seamless flow of information across disaster response agencies. Finally, the absence of robust auditing and accountability mechanisms highlighted the need for reinforced governance frameworks and institutionalised performance evaluations to enhance disaster resilience and response effectiveness. Identifying barriers to effective communication and information sharing among key disaster response stakeholders provides valuable insights for refining emergency response strategies including the development of clear protocols, improved data integration, and the adoption of AI and digital tools to streamline reporting and enhance decision-making. These enhancements can lead to improved quality of care, faster recovery, and more efficient resource allocation during disasters, ultimately benefiting affected populations.

1. Introduction

Disasters are becoming more frequent and intense, likely due to the impacts of climate change, globalisation, and urbanisation [1]. According to the WMO Atlas of Mortality and Economic Losses from Weather, Climate, and Water Extremes (1970–2019), over 11,000 disasters worldwide were attributed to climate and water extremes between 1970 and 2019, resulting in more than 2 million deaths and economic losses amounting to US\$ 3.64 trillion [2]. The COVID-19 pandemic and the January 2025 California wildfires exemplify the scale and devastation of recent disasters. The COVID-19 pandemic claimed over seven million lives and significantly reshaped the global economy, medicine, education, and social interaction [3]. The recent January 7th California wildfires ravaged over 40,000 acres, displaced thousands, and inflicted substantial physical and emotional tolls [4]. These devastating impacts underscore the importance of enhancing preparedness for future disasters to mitigate their effects and ensure the delivery of quality healthcare to survivors.

Healthcare is not limited to the provision of clinical care to patients, but rather refers to a state of complete physical, mental, and social wellbeing [5]. The broad spectrum of healthcare functions covers the provision of safe drinking water, reliable food, shelter, adequate hygiene, and mental health support. Disasters impact health system demand and supply by altering the disease burden,

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access to and acceptability of services, and the system’s capacity to meet the population’s needs [6]. The primary agencies responsible for disaster response are emergency management and health agencies.

Despite having different mandates and mission statements, the primary focus of emergency management and health agencies is on responding to population needs, forecasting potential problems, and preventing future disasters. These goals require adequate cross-agency communication and efficient information exchange to coordinate the response efforts when a disaster strikes. Moreover, several more agencies and organisations may be involved in the response at varying levels depending on their ability to respond to the type and scale of the event.

The more complex the incident is, the greater the number and variety of responding organisations [7]; a situation that requires cross-agency coordination to optimise limited resources and prevent duplication of tasks. However, coordination failures, compounded by challenges in situational awareness and training, can exacerbate response inefficiencies, as demonstrated in the 2014 Oso landslide in Washington State. The response involved 119 agencies and over 1000 responders, yet significant operational difficulties emerged, including jurisdictional confusion, insufficient situational awareness, and inconsistent implementation of the Incident Command System (ICS) structures. A lack of standardised training and varying levels of familiarity with ICS and the National Incident Management System (NIMS) among responders further contributed to fragmented decision-making and delays in operational execution [8]. Delays in resource allocation were exacerbated by unstandardised request procedures, and federal resources remained underutilised due to late requests from state and local authorities. Furthermore, inadequate situational awareness hindered the accurate assessment of needs and resource distribution. Some agencies were also reluctant to collaborate, which further impeded the efficiency of response operations. These challenges highlight the critical role of comprehensive training, real-time situational awareness, and robust interagency coordination in ensuring a timely and effective disaster response.

Coordination refers to the process through which organisations align their actions with each other to achieve a common objective [9]. It aims at eliminating fragmentation and duplication in services, harmonising separate disaster actions or activities, and clarifying roles and responsibilities to ensure the delivery of humanitarian assistance in a cohesive and effective manner [10]. In a coordinated effort, people and units know “what they are to do” and “when they are to do it” and they see the relationship between what they do and what the coordinated whole achieves [11]. In disasters and complex incidents involving agencies with diverse operational modalities, capabilities and organisational cultures, effective coordination necessitates a designated structure to facilitate communication. Incident management structures provide standardised frameworks encompassing functions, processes, and terminology to coordinate the activities of various response agencies during emergencies and disasters [12]. In New Zealand, the Coordinated Incident Management System (CIMS) framework defines how agencies coordinate, command, and control responses to incidents of varying scales. CIMS is structured hierarchically, with each level supported and coordinated by the level above it. The hierarchy consists of four levels: national, regional, local, and incident. Although hierarchically structured through the control function, CIMS functions must collaborate and coordinate response activities with each other.

This networked hierarchical coordination structure is illustrated in Fig. 1 below.

Information exchange reveals unforeseen risks for which plans can be developed or adjusted to minimise suboptimal decisions such as unnecessary evacuation [13]. While vertical information exchange through command-and-control structures facilitates coordination and resource sharing, horizontal information exchange, occurs among entities at the same level, enhances situational awareness minimising cost and sharing expertise [14]. Situational awareness is defined as “all knowledge that is accessible and can be integrated when required into a coherent picture to assess and cope with a situation” [15]. This knowledge is crucial for disaster response, as it consists of cumulative information that, when analysed, forms the foundation for optimal decision-making [14]. Situation awareness is attained through the facilitation of effective communication. This refers to the availability of relevant and timely information and the ability of the information recipients to interpret and utilise it in making appropriate decisions [16].

In a broad sense, cross-agency collaboration aims at coordinating disaster response through planning, training response personnel, and securing necessary funding. D. E. Alexander describes emergency planning as an art and a science that involves ‘thinking the unthinkable’ [17]. Since no single agency can achieve this on its own, disaster planning certainly requires a holistic approach that involves all agencies responsible for response before, during, and after the disaster occurs.

Despite governments’ extensive knowledge and expertise in disaster management, disaster communication remains complex, and

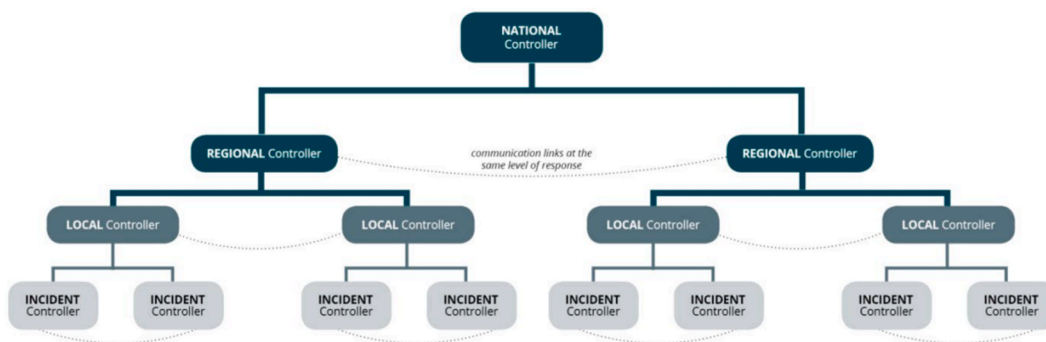


Fig. 1. The Relationship between the different response levels in New Zealand [12].

poor cross-agency collaboration is often cited as an obstacle to effective response [18]. For example, during the COVID-19 pandemic, fragmented interprofessional communication hindered the coordination of response efforts, leading to inefficiencies in resource distribution and frontline healthcare provision [19]. Similarly, during infectious disease outbreaks, the lack of structured coordination between emergency management and public health agencies has been shown to impede infection prevention efforts, exacerbating the crisis [20]. This can be attributed to the different structural and operational modalities of the emergency management and health agencies [21]. Although the two sectors share common goals and similar operational characteristics, health and emergency management agencies have failed to effectively share tools and personnel, leading to inefficiencies in disaster response [22].

This research investigates the factors contributing to communication inadequacy and inefficiencies in information exchange between disaster response agencies. Highlighting these challenges provides insights into improving cross-agency collaboration thereby enhancing the overall effectiveness and efficiency of disaster response efforts. This can lead to more coordinated and timely disaster responses, ultimately resulting in improved healthcare provision for disaster survivors.

2. Methods

In-depth semi-structured interviews were conducted with senior disaster managers and health professionals from key disaster response agencies in New Zealand and the United Nations to explore challenges in cross-agency communication and information exchange during disasters. Participants were selected based on their expertise, determined by their leadership roles and decision-making authority in major disaster responses, rather than factors such as age or professional tenure. Eligibility was determined by the seniority of their roles which indicated expertise, involvement in major disaster responses, and ability to provide relevant insights. Contact details were obtained from publicly available websites and invitations were sent via email. Some participants were identified through peer recommendations due to their recognised expertise in disaster response. Participants who were unable to participate due to concerns about potential identification through their responses or language barriers were excluded. Most interviews were conducted in person at the participants' workplaces, with two conducted via Skype. Each interview lasted between 60 and 90 min and was audio-recorded for accuracy.

In-depth interviews are intensive, one-on-one interviews with a small number of participants designed to explore their perspectives on a specific idea or situation [23]. Given the qualitative nature of the research, sample size was determined by data depth rather than frequency. According to Townsend [24], sample size for semi-structured interviews should be based on the richness of the data, and Creswell [25] recommends a minimum sample size of 5–25. The final sample size was 15 senior emergency managers and health professionals, including seven representatives from emergency management agencies and eight from health agencies. These agencies include the New Zealand Ministry of Health, Auckland Metro District Health Boards, Canterbury District Health Board, New Zealand Ministry of Social Development, Fire and Emergency New Zealand, Salvation Army New Zealand, WHO Emergency Medical Teams, New Zealand National Emergency Management Agency, New Zealand Police, and St John New Zealand, and the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). This diverse representation ensured a comprehensive understanding of disaster response practices across both emergency management and healthcare sectors.

The research aimed to answer the following question:

What are the main barriers to effective communication between emergency managers and health professionals during disasters?

To address this research question, the study employed the 3Cs model (Fig. 2), which encompasses communication, collaboration, and coordination. The model was used to examine participants' perspectives on the meaning of cross-agency communication and the challenges associated with its implementation in disaster settings. Communication refers to transmitting messages between or within organisations [26], while collaboration involves joint needs assessments, shared problem-solving, and coordinated practical responses [27]. Coordination, as defined by Comfort [9], refers to the alignment of organisational actions to achieve a shared objective. The 3Cs model was developed to facilitate discussions on the challenges of cross-agency communication in disaster response, with participants evaluating its effectiveness in representing the necessary processes of communication, collaboration, and coordination. They were also invited to reflect on the model's strengths and weaknesses and its applicability to disaster response.

2.1. Analysis

The interviews were analysed using inductive thematic analysis. Thematic analysis systematically identifies, organises, and offers insight into patterns of meaning across qualitative datasets [28]. Unlike deductive thematic analysis which tests predefined assumptions, inductive analysis derives concepts, themes, or models through interpretation of the collected data [29]. NVivo software (Version 12, QSR International) supported the analysis by facilitating detailed qualitative analysis and efficient data storage and retrieval.

Three primary approaches to thematic analysis were considered: coding reliability, codebook approaches, and the reflexive

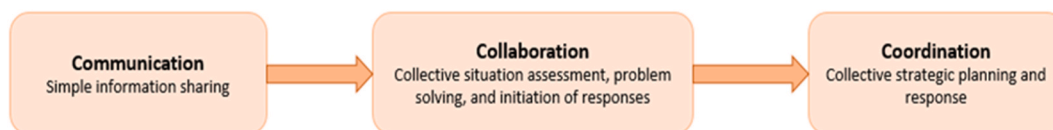


Fig. 2. The 3Cs model.

approach, commonly known as Braun and Clarke's six-phase approach [30]. Coding reliability emphasises consistency by using multiple coders and measuring inter-coder agreement with a structured codebook where themes are predefined. Codebook approaches also use predefined themes but do not emphasise inter-coder reliability. The reflexive approach, which was adopted for this study, conceptualises themes as analytic outputs created through the researcher's active engagement with the data, rather than predefined inputs [30]. Given that the aim of this study is to explore participants' perspectives rather than test pre-existing assumptions, reflexive thematic analysis was deemed the most appropriate analysis method. This approach follows six phases: familiarisation with the data, generating initial codes, constructing themes, reviewing themes, defining and naming themes, and producing the final report. Table 1 below outlines the six-phase analysis process that was followed.

Codes are labels that represent important features of the data relevant to the research question. These were identified and collated to form coherent themes. The analysis revealed five main themes: trust, authority and leadership, situational awareness, technology, and legislation. These themes were later refined into three overarching themes: structural challenges, operational challenges, and information-sharing challenges.

3. Results

Despite governments' extensive knowledge and expertise in disaster management, no single agency can manage a disaster on its own. This section presents the perspectives and opinions of senior emergency managers and health professionals about cross-agency communication and information exchange challenges in disasters.

3.1. Structural challenges

3.1.1. Lack of prior liaison

The efficiency of response is enhanced when connections are already in place with disaster stakeholders at the time of response and each agency has a clear understanding of the roles of other stakeholders.

Participant 1

It's easier to communicate with someone you know and understand. Having good relationships provides clarity about what people do, what they can't do, what they have resources for, what they don't have resources for. That relationship is fundamental for communication.

Findings show that emergency management and health professionals rarely interact in normal circumstances due to the fundamental differences in the way their agencies are structured and the way they operate during normal circumstances. This distance makes communication problematic when the need to collaborate arises. Prior liaison helps build personal relationships which were found to be instrumental for effective disaster response. The impact of having good personal relationships between decision-makers across the response spectrum is extremely influential to the extent that it can, in some cases, substitute for the need to refer to formal agreements or guidelines. Good personal relationships can overcome the weaknesses and gaps in formal guidelines. A participant attributed the effectiveness of formal agreements and guidelines not to the emergency plans per se but rather to the relationships created in the process of going through them.

Participant 6

Challenging the point of how much is communication an issue, I would daresay that sometimes the ineffectiveness is largely due to personality clashes. If people have a good rapport, they naturally talk and communicate. If they don't get on, then they don't engage, and that's probably their biggest issue.

The lack of prior liaison between emergency management and health agencies leads to lack of understanding of operational modalities, priorities, and capabilities. Prior liaison involves sharing preparedness plans which inform decision-makers of where the resources that might be required in a certain disaster scenario reside. Participants explained that most of the confusion that leads to false expectations and the underutilisation of resources in disasters stem from a lack of knowledge about capabilities, what agencies'

Table 1

Braun and Clarke's six-phase approach to thematic analysis [30].

Phase	Description
Getting familiar with the data	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas
Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire dataset, collating data relevant to each code
Constructing themes	Collating codes into potential themes, and gathering all data relevant to each potential theme
Reviewing potential themes	Checking if the themes work in relation to the coded extracts and the entire dataset, generating a thematic map of the analysis
Defining and naming themes	Ongoing analysis to refine the specifics of each theme and the overall story the analysis tells, generating clear definitions and names for each theme
Producing the report	Selection of vivid compelling extract examples, final analysis of selected extracts, relating back to the research question and literature, producing a scholarly report of the analysis

business as usual is, what their roles in a disaster context are, and how they can relate to each other in the readiness and response stages.

Participant 10

Everybody needs to know everybody else's capabilities. I guess some other agencies don't quite know what we can do. I guess, one hand isn't quite sure what the other hand is capable of doing.

3.1.2. Auditing and accountability

Successful disaster response is rooted in having well-designed preparedness plans. Coordination frameworks and emergency plans contain information that guide decision-makers on the possible scenarios, the existing response plan, and the role of each agency should a certain disaster occur. A participant highlighted the complete absence of a mechanism to check the quality and, more seriously, the existence of emergency plans. Even when an emergency plan exists, the absence of compliance with the specified plan incurs no consequences or liability on the agency. Like emergency plans, there is no mechanism that ensures a response agency is trained on or will be using CIMS when required. New Zealand also lacks formal processes and mechanisms for assessing the qualifications and performance of emergency managers.

Participant 6

There is a process called monitoring and evaluation, but the reality is that someone from the Ministry goes down. They get all the key players in the room and basically ask them, "How well do you think you're doing on this?" It's really open to people being honest. If they say: "Oh yeah, we're doing really well. We think we're at 8 out of 10", then it sort of becomes an 8 out of 10. So even if you're found to be not following the requirements or not meeting expectations, basically, you'll be sent a naughty letter and that's all about it.

Funding

The abundant funding of disaster response activities cannot overcome the lack of preparedness programmes. Collaboration between disaster response stakeholders involves several activities, including planning and training, and requires substantial funding. Funding disaster preparedness and development programmes remains problematic due to the reluctance to invest in probabilistic scenarios.

Participant 2

The question is how willing are we to fund the efforts of mitigating a huge disaster when it's only a probability and not a reality?

Funding restrictions can significantly impact the adoption and implementation of useful technologies thus preventing emergency management and health professionals from harvesting their benefits. For example, although the civil defence and the health sectors would both benefit from utilising GIS for disaster information management, the associated cost of implementing the technology prompts the question of who will benefit more from the system and, hence, who should be paying for it.

3.2. Operational challenges

3.2.1. Business-as-usual capabilities in surge mode

The ability of an organisation to shift from routine operations to a heightened response mode is critical for effective disaster management. Participants explained that the underpinning factor of emergency management in New Zealand puts the same business-as-usual resources into a surge activity. In the health sector for instance, this means that employees step out of their regular roles to act as disaster responders with minimal to no training in emergency management.

Participant 7

So, you'd get a senior manager within council. Well, then that senior manager is usually looking after wastewater systems and infrastructure and then suddenly after just one or two days of training, we tell them, 'Oh, by the way now, you're going to be in charge of this massive disaster with only one- or two-days' training'.

According to participants, this disaster management setup, which is often due to staff shortage, has two significant implications. First, the shift between business-as-usual and emergency management activities creates considerable confusion about roles and responsibilities, and accountability lines. Second, disaster responders who are not adequately trained in emergency management often become a burden themselves when deployed externally. This situation, despite the pressing need for external resources in disasters, prompts some decision-makers to refrain from utilising resources beyond their boundaries leading to further resource limitations in the disaster boundary.

3.2.2. A unilateral approach to disaster response

Some interviewees shared their frustration about what they referred to as '*the existing unilateral approach to problem-solving*'. Local decision-makers explained that, despite spending considerable time and effort on developing response plans according to the situation on ground, they sometimes feel disappointed when their plans are rejected by regional authorities who do not have enough

understanding of the situation at hand.

Participant 8

I think the biggest problem is that the Ministry of Civil Defence actually think they know much better than everybody else. A would know better than the Ministry of Civil Defence how to manage its own emergency if they've got the resources and training.

Another Civil Defence officer criticised the generic approach to disaster relief. He gave an example of the increased fish activity closer to the coast following Pacific storms. He explained that instead of providing the affected population with materials for fishing, which is both practical and cost effective, response agencies automatically follow the traditional approach of providing food instead of consulting the affected population on the best way they could be assisted.

Participant 2

You cannot have a fully effective response without engaging the concerned community because they always know better. Communities need to be engaged in the planning for disaster response rather than enforcing the response on them.

Rigid, top-down approaches to disaster preparedness often fail to recognise the unique knowledge, needs, and contributions of indigenous communities. Despite their rich ancestral knowledge, findings show that their wisdom in managing disasters is underutilised.

Participant 14

At the marae level, given that most of us will immediately open their doors to take in people, to act as welfare centres, we need a geared-up relationship where we're talking. Where we have protocols and communication lines in place so that we can immediately start to engage.

In New Zealand, the level of Māori representation in disaster management governmental organisations in New Zealand remains limited. This creates a sense of uneasiness with indigenous responders who do not see themselves as part of the big response picture. In an interview with a Māori senior responder, she mentioned how uneasy she felt when she looked around her in an emergency operation centre and realised that the response team was full of responders none of whom was Māori other than herself.

The implications of top-down disaster response also extend to Non-Governmental Organisations (NGOs) whose services are often underutilised possibly due to operating outside the command-and-control umbrella. Moreover, NGOs often find themselves confused about who might be interested in the information related to their activities. This unintentional withholding of information and the lack of communication and coordination between government agencies and NGOs, result in duplication of tasks and underutilisation of resources.

Participant 5

Emergency management is about being clever with the resources. New Zealand is a small country and as Red Cross has indicated we're all trying to use the same resources at the same time. I would love to see NGO's getting a higher platform.

3.2.3. Lack of training

Participants frequently attributed poor coordination of disaster response in New Zealand to the lack of training and absence of compliance with the standard coordination framework namely CIMS. CIMS is used in incidents that require the response of multiple agencies to identify the command-and-control top-down coordination structure during response. Despite the criticality of CIMS, a significant number of emergency management personnel do not use it. Reasons include preference for another incident management framework, such as the UK's Gold-Silver-Bronze structure, familiarity with alternative systems, lack of CIMS training, or the belief that coordination can be achieved without external guidance. In addition, CIMS is falsely perceived by emergency managers as a disaster framework and hence is not used organically, causing responders to be unfamiliar with it during disasters.

Participant 1

People think they know what they're doing so there's no need to do this course and there's no compliance across the country to enforce CIMS.

Participant 7

Emergency responders absolutely hate attending those exercises because they see them as sort of theoretical and nebulous. They see them often as enthusiastic volunteers pushing paper around the table.

In addition, Joint disaster training, according to the interviewees, is critical not only for capacity building, but also for establishing personal relationships and closing the terminology gap among response personnel from different agencies. Participants explained that confusion about emergency management terminology stems from the fact that the terms used by one agency may not necessarily refer to the exact meanings or processes followed by another. Nevertheless, budget constraints were cited as a reason for lack of joint disaster training.

Participant 2

Standardised terminology is key to collaboration. If you parachute people from different backgrounds, cultures, institutional frameworks and force them to work together because there is a crisis, what will happen is that the first few days will be spent in meetings to familiarise people with the languages other speak while people are dying outside the meeting rooms.

3.3. Information sharing challenges

3.3.1. Privacy and confidentiality restrictions

Official information sharing is often subject to strict privacy regulations that can sometimes hinder the ability of government response agencies to enhance the efficiency of civil response efforts. A typical example is the limited access to existing government databases that contain vital victim information during disasters. Participants explained that allowing access to this data could significantly save time and resources for disaster responders, enabling faster and more coordinated relief efforts.

Participant 3

I'd be comfortable with any data that we capture being shared but what you want to be able to do is make sure that people requesting the data have got it for the right purpose.

Findings show that disaster response personnel often lack information about when and how to ask for the release of sensitive information during a disaster event. Usually, strict privacy and confidentiality measures can be relaxed if "sufficient" reasons to release information exist. However, the relaxation of some information sharing measures under a certain act does not automatically guarantee release if the information is subject to multiple acts. Several interviewees emphasised the need to educate disaster response personnel about the privacy act and data sharing protocols.

Participant 6

In the Civil Defence Act, it says that this act does not affect other acts so that means the privacy act still applies.

3.3.2. Situation awareness

Situation awareness is about building up a holistic picture out of current and reliable information owned by the different agencies to ensure that all disaster response agencies are seeing the same picture in terms of needs, risks, and available resources. According to participants, decisions based on poor situation awareness, especially in the health domain, can have catastrophic implications. In a multi-stakeholder disaster scenario, the challenge is often related to having enough information about the situation and the pressing needs. Information sources that facilitate situational awareness include situation reports, emergency plans, and emergency information systems. Participants criticised these three sources as follows.

A situation report compiles response information from various agencies to enable effective and efficient coordination. It compiles information about the situation as it evolves, the expected consequences, and their associated challenges. Situation reports are accumulative documents that keep increasing in size as the disaster unfolds. As the report gets lengthy and the information within it becomes less specific, it becomes difficult to obtain the required information without going through the whole report. A disaster response professional confessed that these reports are often ignored when response personnel are pressed for time.

Participant 5

That's the problem we have at the moment as leaders and responders, we've got to scroll through massive documents and situation reports when all we really want to know is a couple of quick numbers to help us make a decision.

To access the right information when the need arises, emergency response personnel need to be aware of who needs to be contacted to provide the required data. Emergency plans provide structures for mutual aid and complementary actions between responding agencies, including the designation of roles and responsibilities to individuals and organisations. Despite their critical purpose, findings of this research reveal that emergency plans are often ignored during disasters. This can be attributed to the design of these plans is heavily criticised as being too detailed (wordy) and not clear about specifying roles and responsibilities. Similar to situation reports, when there is limited time to make decisions and heightened levels of stress, decision-makers ignore plans that do not provide them with the information they need easily. Moreover, emergency plans are still not available in a digital format. Being paper-based and not regularly used, emergency plans rarely get updated.

Participant 7

A lot of this information sits in folders on desks or in offices. They sit there and get out of date. We've got to change this concept of large folders and lots of forms to be far more responsive. Could there be an app where some of this resource availability or capability is identified? Everyone uses their phone now for everything, so maybe it is.

Participant 11

If the plans for national and international response has too much information, people won't read them. It's got to be the absolute minimum that they need to do their job instead of wasting time going through sheets. Simple information on what's required for response.

Information systems are crucial in fostering situational awareness during emergencies by offering decision-makers platforms that deliver accurate, up-to-date information. These systems enable timely and informed responses, ensuring that critical data is accessible when needed most. Despite their need to communicate and exchange situational information in a timely manner, disaster response agencies are restricted by interoperability barriers as versions of the standard emergency information system used by the main government response agencies sit on different servers and are hence unable to connect to each other seamlessly. In addition, design and usability features such as text colours, visualisation and available functionality are found to be key factors in the uptake of these systems. Seen as complex, unappealing, and lacking major functions of disaster response such as national staffing requests, emergency information systems are rarely used routinely. Hence, responders find themselves unfamiliar with their use when the need arises.

3.3.3. Underutilisation of information and communication technologies

Despite the widespread availability of advanced digital tools, disaster response agencies have not succeeded in fully integrating these technologies into their operations.

A frustration experienced by both emergency managers and health personnel is the lack of real-time reporting. The ability to get real-time updates from disaster scenes is crucial for efficient response. Currently, several health agencies lack an automated patient tracking system that reports the number of injured individuals, the priority of their injuries, and the hospitals they have been sent to. Data such as age, presentation, administered drugs, and discharge disposition can make a huge difference to the quality of care provided to disaster victims when reported in a timely manner. Real-time reporting is also lacking in the emergency management sector, resulting in significant delays in resource utilisation. The ability to locate potential human resources who can be called upon as the need arises, and the ability to match supply of and demand for materials, are examples of crucial activities that are still being done manually in most agencies.

Participant 3

We need to have a patient tracking system to show us from where we've picked them up because that has significant implications from a public health perspective. You want to track them, you want to know their age cos that has significant implications on whether they're vulnerable or not. If they're under 5 or under 3 or over 60. Where the patients currently are and where they've been within the tracking ability.

Multiple participants explained the importance of geographical information systems (GIS) to visualise and retrieve data and gave examples of areas that can be improved through utilising GIS capabilities. GIS can be used in risk reduction by mapping the locations of health providers who are vulnerable to certain types of hazards in addition to helping them prepare for the possible occurrence of these hazards. In the health context, GIS can be used for gathering, managing, and analysing health data including assisting with disseminating data such as the number of wards, intensive care unit (ICU) beds, and non-functional facilities along with their expected repair time. GIS can also be used to map the locations of individuals who are vulnerable to disasters. GIS can present these data in a visually appealing format that facilitates the process of data retrieval and decision-making.

Despite the huge potential of GIS, the capability is underutilised, and the majority of disaster responders are not trained on its use. Moreover, the costs and complexities associated with its adoption and implementation prevent emergency management and health professionals from harvesting its benefits.

Participant 5

The GIS functionality is a huge communication tool. People see it as a 'Planning and Intelligence' tool. No, it's a communication tool.

Victim registration, which involves recording details of affected individuals, assessing their needs, and designating the responsible agency, remains a manual process. This information is collected from scratch, and it requires days to be reflected in a database. Automating this process by using existing government databases can make a significant difference in the speed of response. Another aspect that has been pointed out during interviews is the need to convert emergency plans into a responsive format, using multimedia for example, to encourage disaster responders to use and update them regularly.

Participant 8

If you can see it visually it's a lot easier to determine your response impact. You get a little bit more as well and understand what all of the contingencies are in that response.

Social media were also found to be underutilised in disaster management. A health emergency manager explained that social media platforms can be used to: gauge the public's opinion in emergencies, helping decision-makers to re-adjust their recommendations when needed; address communities and assess the clarity of the instructions broadcasted online; use the public's appreciative comments to raise the morale of disaster responders; or raise awareness about health-related issues, especially during response time when the public's attention is increased. However, despite their benefits, social media platforms can be used to disseminate false or exaggerated information. Participants emphasised the need for governments to ensure the credibility of public information. Moreover, lack of familiarity with social media platforms may be an obstacle for older generations of disaster responders as these technologies are relatively new.

Participant 6

One of the biggest things that will influence the public’s behaviour positively is whether the source is trusted. And if they don’t have trust in the source they won’t listen.

4. Discussion

Recent evaluations of emergency management frameworks reveal key deficiencies, including the lack of shared situational awareness, insufficient interoperability across agencies, and the cumulative complexity of situation reporting [31].

The study identified multiple cross-agency communication and information exchange challenges in disaster management categorised into structural, operational, and information sharing challenges. Structurally, the lack of prior liaison between emergency management and health agencies hinders cross-agency communication and collaboration as personal relationships and familiarity with roles play a crucial role in establishing interpersonal and institutional trust. The absence of auditing and accountability mechanisms results in non-compliance with emergency plans and inadequate evaluation of emergency managers. Funding constraints stemming from reluctance to invest in probabilistic disaster scenarios hinder technology adoption and joint training efforts. Operationally, agencies struggle to transition from business-as-usual operations to emergency response due to tasking personnel with minimal training in emergency management roles resulting in confusion and inefficiencies. A unilateral approach to disaster response also leads to frustration among local responders who feel their ground-level expertise is overlooked by central authorities. Furthermore, limited Māori representation in disaster management results in underutilisation of indigenous knowledge and contributions. The lack of standardised training and resistance to adopting coordination frameworks such as CIMS further impairs disaster response capabilities. Information sharing challenges include privacy and confidentiality restrictions that prevent agencies from accessing critical data for disaster response efforts. Moreover, a lack of situational awareness due to complex situation reports, outdated emergency plans, and interoperability issues in emergency information systems hinder smooth cross-agency information flow resulting in suboptimal decision-making. Additionally, the underutilisation of information and communication technologies, such as real-time reporting, patient tracking, and GIS capabilities, limits efficiency in disaster response efforts. Addressing these challenges requires improved inter-agency collaboration, better training, increased investment in preparedness, and enhanced integration of technology to optimise disaster response and recovery. Table 2 summarises the findings of the study.

Addressing these issues requires a multifaceted approach, integrating technology solutions such as a Common Operating Platform and AI-driven reporting tools, with organisational practices that promote standardisation and collaborative readiness. Together, these innovations and practices offer potential pathways to streamline information sharing, foster inter-agency cooperation, and enable quicker, more informed decision-making; aspects that ultimately enhance resilience in disaster response.

4.1. Prior liaison

Effective information sharing in disaster response cannot rely solely on technology; the strength of relationships between agencies is equally critical. Routine networking, complemented by regular exercises and workshops, provides a foundation for building enduring relationships essential to inter-agency cooperation [32,33]. These engagements foster familiarity and trust among stakeholders, creating a shared understanding of each other’s roles, responsibilities, and capacities. Embedding these activities within organisational business plans and interagency agreements ensures they are prioritised, recognising that sustained engagement and preparedness are integral to achieving a cohesive and adaptive disaster response system [34].

The absence of prior liaison and weak interpersonal relationships can significantly impede the effectiveness of incident management teams (IMT). As hierarchical groups of trained personnel, IMTs rely heavily on successful interaction, sound decision-making,

Table 2
Key findings

Theme	Challenges	Key findings
Structural challenges	Lack of prior liaison	Relationships between agencies enhance communication and efficiency; lack of prior interaction leads to confusion and potential misunderstanding.
	Auditing and accountability	No mechanism to check quality or compliance with emergency plans; agencies are not held accountable for non-compliance.
	Funding	Disaster preparedness is underfunded due to reluctance to invest in probabilistic scenarios; funding constraints impact adoption of useful technologies.
Operational challenges	Business-as-usual capabilities in surge mode	Local decision-makers feel sidelined by higher authorities; indigenous knowledge and NGO capabilities are underutilised.
	Unilateral approach to disaster response	Many emergency personnel are not trained on CIMS; joint training is limited by budget constraints.
	Lack of training	Strict regulations hinder timely access to critical disaster data; personnel lack training on data-sharing protocols.
Information sharing challenges	Privacy and confidentiality restrictions	Situation reports and emergency plans are often too detailed and outdated; digital access is lacking.
	Situational awareness	Lack of real-time reporting systems for patients and resources; GIS and automated tracking tools are not widely adopted.
	Underutilisation of information and communication technologies	Local decision-makers feel sidelined by higher authorities; indigenous knowledge and NGO capabilities are underutilised.

and situational awareness to resolve emergencies [35]. However, when team members lack established trust or familiarity, these critical functions are compromised. Interpersonal trust, which develops through prior interactions and fosters predictability in behaviour, is key to collaborative decision-making. Concurrently, institutional trust, supported by strong interpersonal dynamics, creates a shared foundation for understanding organisational behaviours and actions [36]. Without these elements, IMTs may struggle to function effectively, particularly in high-pressure scenarios.

Prior liaison between disaster response personnel is fundamental in building the trust necessary for reducing transaction costs and reliance on formal agreements [37]. Informal activities, such as joint social events or routine interactions, strengthen personal professional relationships and facilitate knowledge-based trust [38]. Formal initiatives, such as shared training sessions, workshops, or collaborative planning exercises, reinforce institutional links by providing clarity on roles, responsibilities, and resource capabilities [39]. Both types of liaison are vital, as they address interpersonal and institutional dimensions of trust and cooperation.

Emergency response agencies often lack a thorough understanding of interoperability, which impedes collaborative efforts [40]. Adopting standardised operational approaches, such as (CIMS), can further enhance interoperability. By aligning terminology, structures, and responsibilities, CIMS provides a common framework for collaboration, reducing confusion and improving efficiency in multi-agency responses [12]. However, the success of such frameworks depends on the quality of relationships and the willingness of stakeholders to work cohesively. Strengthening these relationships through regular liaison and engagement is essential for realising the full potential of standardised systems and achieving more effective disaster response outcomes.

4.2. Training and funding

Incident management is a critical component of effective disaster response and recovery, defined by the Australasian Fire and Emergency Service Authorities Council (AFAC) as “those processes, decisions and actions taken to resolve an emergency incident and support recovery that will enable the community to return to normality” (AFAC, 2017, p. 8). This definition underscores the importance of coordinated actions and decisions to mitigate the impact of disasters and facilitate a swift return to stability. However, the effectiveness of incident management depends heavily on the capacity and preparedness of those involved in these processes. The reliance on untrained or inadequately trained personnel, as well as the use of inflexible organisational structures, can significantly undermine incident management efforts, leading to delays, inefficiencies, and compromised outcomes for affected communities [41]. These challenges highlight the need for robust training, professionalisation, and organisational adaptability within incident management frameworks to ensure optimal performance in times of crisis.

The reliance on business-as-usual structures for emergency response poses significant challenges to effective disaster management, as these frameworks often lack the flexibility and preparedness required to handle dynamic disaster scenarios [42]. Many agencies utilise volunteers who shift from their regular management roles to become part of the incident management structure during emergencies. However, these individuals typically lack the specialised training and expertise of professional emergency managers, resulting in less effective decision-making and operational efficiency. This reliance on untrained or minimally trained personnel can increase risks, prolong recovery times, and undermine organisational resilience [33].

The lack of adequate training and professional development in emergency management, particularly in areas such as coordination frameworks and emergency information management, is a major factor contributing to suboptimal disaster response [43]. In New Zealand, a review of the civil defence system revealed that many key roles in the sector are part-time, with inconsistent training and no mandatory professional standards or accreditation [44]. The scarcity of qualified emergency managers due to a lack of a recognised professional pathway and funding [45,46] exacerbates these issues, forcing agencies to rely on non-specialised personnel who may be unfamiliar with the structures and processes required for effective response [47]. Moreover, staffing shortages often prevent the co-location of information officers in Emergency Operations Centres (EOCs), further hindering coordination efforts. The challenges posed by understaffing extend beyond the emergency management sector, with similar issues observed in healthcare. A 2017 study predicted a global shortage of 15 million healthcare workers by 2030, emphasising the strain on resources during emergencies [48]. This vulnerability was starkly highlighted during the COVID-19 pandemic, where the risk of infection among health workers intensified the demand for qualified responders [49]. Furthermore, the absence of assessment mechanisms, professional standards, and accreditation for emergency managers compounds the problem, raising questions about the overall preparedness of the system. Addressing these issues requires strategic investment in workforce development, the establishment of accreditation standards, and the prioritisation of training to build a more resilient and capable emergency management workforce [50,51].

The funding of preparedness remains a persistent challenge in disaster management, often hindered by the reluctance to invest in mitigating events that are probabilistic rather than certain. Effective preparedness requires substantial resources to support activities such as training, planning, and the adoption of advanced technologies. However, these investments are frequently deprioritised in favour of immediate response and recovery efforts [52]. The absence of adequate funding not only restricts the professionalisation of emergency management roles but also limits access to critical tools and systems, such as GIS and real-time reporting platforms, which can significantly enhance situational awareness and coordination [53]. Furthermore, preparedness funding must also address equity concerns, ensuring that vulnerable populations, including people with disabilities and indigenous communities, are integrated into disaster planning [54]. Prioritising preparedness funding as an essential component of resilience-building enables governments and organisations to enhance operational efficiency and mitigate the multifaceted impacts of disasters.

4.3. Rigid planning

While many jurisdictions have established doctrines to guide the operations of IMTs [55], these frameworks often operate within

rigid, top-down decision-making structures that stifle innovation and hinder effective collaboration. Research highlights that such hierarchical cultures limit employee input and discourage adaptive, risk-taking behaviours that are crucial in dynamic disaster environments structures [56]. Decentralised decision-making and cross-functional collaboration are often sacrificed in favour of maintaining control and adherence to traditional structures [57,58]. This rigidity not only undermines the effectiveness of IMTs but also marginalises valuable contributions from diverse stakeholders, including indigenous communities, whose knowledge and practices offer culturally nuanced and contextually relevant insights into disaster preparedness and response [59]. Similarly, meaningful community engagement remains underdeveloped, with affected populations often excluded from planning and decision-making processes despite their intimate understanding of local needs and vulnerabilities [60,61]. Furthermore, the perspectives and needs of people with disabilities are frequently overlooked in standard IMT frameworks. In many parts of the world, this can be attributed to inaccessible disaster preparedness plans, systemic discrimination, and widespread poverty leading to severe consequences [62]. Disaster response systems must embrace more inclusive and flexible approaches, integrating indigenous knowledge, fostering community-driven initiatives, and ensuring accessibility for all. Such a shift requires not only policy reform but also cultural change within organisations to prioritise diversity, inclusion, and decentralised leadership.

4.4. Information sharing

4.4.1. Privacy & confidentiality

Cross-agency information sharing is crucial for coordinated and efficient disaster response. Nevertheless, strict privacy regulations often hinder the ability of agencies to access critical data, such as victim information or resource availability, which can delay decision-making and reduce the efficiency of relief efforts [36]. While such measures are essential for protecting individual rights, their rigidity can impede the timely exchange of information that is vital in emergencies [63–65]. Responders often lack clarity on how to request sensitive information or the circumstances under which privacy rules can be relaxed for public benefit. Additionally, overlapping legal frameworks can create further ambiguity, leaving vital data inaccessible when it is most needed. To address these issues, disaster management systems require clear protocols that balance privacy protection with operational needs, including pre-established agreements and training for responders on data-sharing regulations. Fostering a shared understanding of privacy frameworks and ensuring transparency in their application can improve compliance and increase accountability, thus reducing the risk of data breaches as well as strengthening organisational trust [66].

4.4.2. Situation awareness

To acquire Situation Awareness, organisations must 'collect the dots', i.e. collect alerts and raw details of the incident-related environment, 'connect the dots', i.e. synthesise elements of the incident with existing knowledge and assess criticality and overall significance of the incident, and 'project from the dots', i.e. construct possible incident scenarios in the immediate future to inform appropriate response [67]. The processes of Situation Awareness run continuously, in parallel, and can be data-driven and goal-driven at the same time [67]. In a disaster management context, a Common Operating Picture (COP) has the potential to significantly enhance response effectiveness by synthesising diverse information sources into a centralised, easily accessible, and interrogable dashboard. Such a platform could streamline situational awareness, enabling decision-makers to assess and interpret critical data in real time [68, 69]. Recent findings from the New Zealand Government's review of the severe weather event underscore that a fundamental issue within the emergency management system is the lack of shared situational awareness between response agencies [40]. Addressing this gap is vital for enhancing cross-agency collaboration in disasters, as it would directly improve resource allocation and enhance life-saving capacities during critical response operations [70]. A COP requires the integration of various technologies including GIS, analytical applications to support decision-making, use information display technologies, and artificial intelligence (AI) tools.

Despite the availability of advanced digital tools such as GIS and automated reporting systems, their adoption remains limited due to high costs, implementation complexities, and insufficient training among responders [69]. Participants in recent studies emphasised the importance of real-time reporting and data visualisation for improving situational awareness [71], yet many agencies still rely on manual processes for critical activities, such as patient tracking and resource allocation [72]. This underutilisation not only delays decision-making but also diminishes the capacity to deliver timely and efficient responses [73]. Additionally, while social media and digital platforms have the potential to enhance communication with affected communities and among responders, their inconsistent use reflects a broader challenge in integrating innovative technologies into standard operating procedures [71]. To address these gaps, greater investment in user-friendly ICT systems, alongside targeted training and funding allocation, is essential to unlock the transformative potential of these tools in enhancing disaster response outcomes.

4.4.3. Situation reports

Situation reporting can become repetitive and cumulative, making it challenging for decision-makers to locate clear and concise information [43]. The development of AI models offers a solution by streamlining this process, allowing for the identification of trends, highlighting of emerging risks, and reduction of static information to high-level summaries [74]. Through AI-driven tools that summarise and prioritise essential data, and synthesises multiple reports, agencies can ensure that decision makers have access to the most pertinent information without needing to sift through lengthy reports [75]. The underuse of technology, including AI is a challenge in disaster response systems globally, where the cost and complexity of adoption often serve as barriers [75]. Big data, described as information assets distinguished by their large volume, high speed of generation, and diverse types, encompassing personal, medical, survivor, and geographic data [76], also offers a significant opportunity for utilisation to enhance situational awareness [77]. Therefore, increased investment in training, technology integration, and the creation of more user-friendly platforms that can be

quickly and effectively deployed in emergency situations is essential for improving response efficiency and effectiveness during disasters.

4.4.4. Emergency plans

Emergency plans, while fundamental to disaster preparedness and response, are often underutilised due to their cumbersome design, lack of regular updates, and limited accessibility [78]. Many plans remain paper-based, leading to challenges in ensuring their relevance and usability during emergencies [34]. Their overly detailed and static nature can discourage responders from referencing them in time-sensitive situations, where concise and actionable information is crucial [79]. Additionally, the absence of standardised digital formats or integration into interactive platforms diminishes their utility, leaving them outdated and difficult to adapt to evolving disaster contexts [80]. The lack of regular training on these plans further exacerbates the issue, as responders are unfamiliar with their contents or applicability during critical moments. Automating and digitising emergency plans, coupled with the adoption of responsive multimedia formats, could significantly enhance their accessibility and effectiveness. Ensuring emergency plans are concise, regularly updated, and supported by routine training exercises allows disaster response agencies to better align their operational readiness with the dynamic demands of disaster scenarios resulting in effective disaster response.

4.4.5. Information systems

Information systems play a critical role in disaster response by facilitating situational awareness, enhancing decision-making, and improving coordination among agencies [81]. However, their potential is often underutilised due to challenges such as poor interoperability, user-unfriendly designs, and limited training on their functionality [36]. Many systems operate on disparate servers, hindering seamless data sharing and integration across agencies. Additionally, design flaws, such as confusing interfaces and a lack of essential features like real-time staffing or resource tracking, reduce their practical utility during emergencies [82]. These limitations result in responders relying on outdated or manual methods, which delay critical actions and impede efficient resource allocation. Addressing these gaps requires prioritising the development of interoperable platforms that consolidate data and provide user-friendly dashboards for rapid decision-making. Moreover, regular training on these systems is essential to ensure familiarity and effective use during crises [31]. The use of adaptive and intuitive information systems is therefore pivotal for enhancing operational efficiency and promoting collaboration during multi-agency response efforts.

4.5. Auditing and accountability

The lack of auditing and accountability in disaster response often leads to inefficiencies and missed opportunities for improvement [40,83]. This issue is primarily a structural challenge, rooted in systemic factors such as inadequate governance frameworks, poorly defined roles, and cultural norms that discourage transparency [84]. Organisations frequently lack robust policies to enforce accountability or the legal infrastructure necessary to support thorough auditing practices [85]. This absence creates an environment where non-compliance with preparedness plans or coordination frameworks incurs minimal consequences, undermining efforts to standardise and improve response capabilities [86]. For example, even when monitoring mechanisms exist, they often rely on self-assessments and subjective reporting, which can dilute their effectiveness and perpetuate a cycle of inadequate preparedness. Establishing clear accountability mechanisms, such as mandatory audits, performance evaluations, and compliance incentives is therefore paramount. Strengthening governance frameworks to institutionalise these practices, alongside fostering a culture of transparency and continuous improvement, can ensure that disaster response systems are better equipped to meet the demands of complex and high-stakes scenarios [87].

To improve cross-agency communication and collaboration in disasters, this study recommends the following actions. Establishing communication protocols with community representatives to ensure timely information exchange and resource utilisation. This involves identifying representatives in advance, maintaining updated contact information, and utilising multiple communication channels such as local and social media platforms. Additionally, the inclusion of persons with disabilities in disaster planning and response should be mandated through a legal framework to prevent exclusion and to ensure no one is left behind. The professionalisation of emergency management is another critical step as many key roles are currently part-time with no standardised accreditation or training. Implementing formal education and certification standards can make a significant improvement on the quality of care provided to the affected populations. Furthermore, simplifying and modernising emergency plans through digital solutions such as mobile applications and process modelling can enhance usability and efficiency. Auditing and accountability mechanisms should also be established to ensure compliance with coordination frameworks and emergency plans. The integration of social media into disaster management strategies is recommended to improve situational awareness and decision-making although safeguards are required to verify the accuracy of the shared information. Additionally, investing in GIS capabilities can enhance data integration and real-time communication thus improving the effectiveness and efficiency of disaster response. Lastly, funding joint training programs can strengthen collaboration, build trust among response organisations, and identify gaps in the existing response framework. Collectively, these measures aim to improve communication, collaboration, and coordination which ultimately enhances the quality of disaster healthcare provision.

This study acknowledges two limitations. The collected data was primarily obtained from disaster response personnel, most of whom are based in New Zealand. While their experiences may not be exclusive to New Zealand, the study could have benefited from insights gathered across more diverse political and social settings. Furthermore, the study focuses on common challenges in multi-agency disaster response regardless of the type of disaster. As a result, it may not fully capture issues specific to particular disaster scenarios. Expanding the scope to include more diverse settings and disaster types could enhance the comprehensiveness of the

findings.

5. Conclusion

During disasters, poor communication between emergency management and health agencies often hinders response efforts leading to inefficiencies, poor decision-making, and inadequate healthcare delivery. Addressing the persistent challenges in cross-agency communication requires a comprehensive approach that integrates technological advancements with enhanced organisational practices and stronger interpersonal relationships. While tools such as COPs, AI-driven reporting, and advanced information systems can streamline situational awareness and decision-making, their efficacy is contingent on the quality of relationships between agencies and the preparedness of responders. Prior liaison, routine training, and fostering trust through interpersonal and institutional collaboration are fundamental to overcoming barriers in interoperability, coordination, and information sharing. Equally critical is the inclusion of diverse perspectives, such as indigenous knowledge, community insights, and considerations for vulnerable populations, to create equitable and adaptive disaster response frameworks.

Furthermore, overcoming systemic issues like insufficient auditing and accountability, a lack of professional standards, and inadequate preparedness funding is essential for long-term resilience. Governments and organisations must prioritise investments in workforce development, modernised emergency plans, and inclusive policies that address the needs of all stakeholders, including people with disabilities and underrepresented groups. Adopting a holistic and collaborative approach that combines technological, human, and structural solutions enables disaster management systems to build greater agility and capacity to respond to the complexities of future emergencies. These measures not only strengthen immediate response capabilities but also lay the foundation for sustainable recovery and enhanced community resilience.

CRediT authorship contribution statement

Reem Abbas: Writing – original draft, Methodology, Data curation, Conceptualization. **Todd Miller:** Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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