Emergency management decision-making in a changing world: 3 key challenges

Peer reviewed

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Introduction

Emergency management can be taxing for individuals and teams due to the stress of making decisions in dangerous, high-stakes and time-constrained environments. Emergency management practitioners make decisions in environments that can be fast-moving, uncertain, ambiguous, complex and often chaotic (Hayes et al. 2022; National Ambulance Resilience Unit 2015; Rimstad and Sollid 2015; St George 2012; The Centre for Army Leadership 2024). Decisions in these environments are made in the context of high expectations from communities, politicians and the media and can be subject to intense post-incident scrutiny (Steen and Pollock 2022; Commonwealth of Australia 2023; Bosomworth et al. 2017). At the operational level, emergencies can be dangerous, traumatic, emotionally charged and highly pressured (Health and Safety Executive 2009; 2010). Moreover, emergency services personnel attend emergencies 24 hours a day and some emergencies can last for days or weeks.

Emergencies can also be difficult to coordinate because of the complexity and dynamism of the situation and the resulting stress. Frequently, the numerous people involved may have roles and goals that conflict (e.g. fire suppression versus crew safety). Emergency management practitioners work in single or multi-service response teams and, at large incidents, these may be managed by higher-level coordinating teams. Decisions are made at all levels with information passing up, down and laterally throughout the hierarchy (Bearman et al. 2018; Weick 1993). Emergency management at all levels (from operational to executive) typically involves people from different agencies who need to effectively cooperate, communicate and coordinate their actions. People from different agencies often bring different organisational doctrine, training, norms and values and may not have the same understanding of the situation

Abstract

Managing emergencies is taxing for individuals due to the stress of making decisions in dangerous, high-stakes and time-constrained environments. These complex, dynamic environments also make it difficult to coordinate as other responders perform different roles that may have conflicting goals. This study explored some of the challenges faced by emergency management decision-makers through a literature review of 70 papers identified from SCOPUS and EBSCO database searches. Three major challenges for emergency management were identified: stress and fatigue, interoperability and ethical decision-making. Each of these challenges is examined to explore their nature and how they are likely to evolve in the future. This paper provides helpful advice on how to mitigate these challenges. We argue that to better meet these challenges, emergency services organisations need to develop and maintain appropriate doctrine and training, develop a supportive organisational culture and effectively learn the lessons of previous critical incidents.

and may prioritise or pursue different goals (Penney et al. 2022). These can compromise the operational response and careful attention to cooperation, coordination and communication processes is required to maintain interoperability (Bearman et al. 2023).

Emergency management operates in a wider context of climate change that brings larger, more complex emergencies more frequently. Increasing globalisation brings more threats from terrorism and biosecurity failures that manifest in different and unexpected ways. This occurs in the face of fiscal austerity, where agencies are asked to do more with less. These competing pressures increasingly require emergency managers and practitioners to make decisions about the allocation of resources. Difficult decisions need to be made about which assets are prioritised for protection and which ones are not (Woinarski et al. 2023; 2024). Researchers have argued that more consideration of community values needs to be made in decision-making (e.g. Goddard et al. 2016; Government of NSW 2020), however, real-time operational decisions may not permit time for consideration of community values and needs. Woinarski et al. (2024) observed that emergency management decisions tend to represent societal or community values and sometimes may be shaped by legal constraints or directions. This presents ethical dilemmas for emergency management practitioners that may have dramatic consequences for both the people affected by the decisions and the decision-makers themselves (Boin and Nieuwenburg 2013).

This paper reviews the literature on stress and fatigue, interoperability and ethical decision-making to explore how these challenge the decision-making of emergency management practitioners, how these issues are likely to evolve in the future and how the challenges can be mitigated.

Method

Recent systematic reviews by Penney et al. (2022) and Reale et al. (2023) explored emergency management decision-making. The former focused on military and emergency services whereas the latter considered all occupations involved in safety critical decision-making. This study extends the timeline of Penney et al. (2022) up to 2023 and identifies emerging themes associated with emergency management practitioner decision-making.

Two SCOPUS and EBSCO database searches were conducted using the search terms for military and emergency services used by Penney et al. (2022). These terms were modified for the EBSCO search to reduce the number of publications to a manageable level. A total of 4,287 publications (EBSCO, 3,627; SCOPUS, 651) were identified. Title and abstract reviews were conducted on each database to select articles for further review.

This resulted in 115 published papers being identified as relevant. An additional 25 papers recommended by members of the research team were added to reduce the risk of missing relevant studies. The 140 articles were screened to remove papers from journals with less rigorous editorial controls by excluding those delisted by the Web of Science or listed on their 2023 predatory journals database, or articles that overlapped with other parts of the broader review (e.g. decision-making training). A total of 64 articles were removed, leaving 70 papers to undergo a full-text review. During this process, 3 themes emerged that significantly affect emergency management decision-making being stress and fatigue, interoperability and ethical decision-making.

Results

Stress and fatigue

Salas et al. (1996) define stress as a 'process by which certain environmental demands…evoke an appraisal process in which perceived demands exceeds resources and results in undesirable physiological, psychological, behavioral, or social outcomes' (p.6). Dietz et al. (2017) described 4 categories of emergency management stressors:

- Task demands: the time and need for a team to perform and switch between multiple tasks.
- Coordination demands: tasks associated with coordinating others.
- Threat demands: maintaining composure and performing well under pressure in difficult situations.
- Novelty demands: coping with rare or unique situations and uncertain environments.

Dietz et al. (2017) also produced a framework to illustrate how stress impacts on performance (see Figure 1).

Stress has significant consequences for situational awareness and decision-making (Sallis et al. 2022, Steen and Pollock 2022). Sallis et al. (2022) showed how the responses of fire and rescue incident commanders to stressful simulated incidents indicated information bias and distorted what information was accepted for decision-making. An interview study of police commanders by Steen and Pollock (2022) investigated the perceived effects of stress on decision-making and performance. The participant incident commanders reported that stress impaired their sense making by compromising their ability to perceive a situation and could have other effects such as making them over- or under-reactive. To mitigate these effects, the incident commanders relied on sourcing additional information from within the team or from other sources (e.g. police databases). They also reported that their impaired sense making could affect

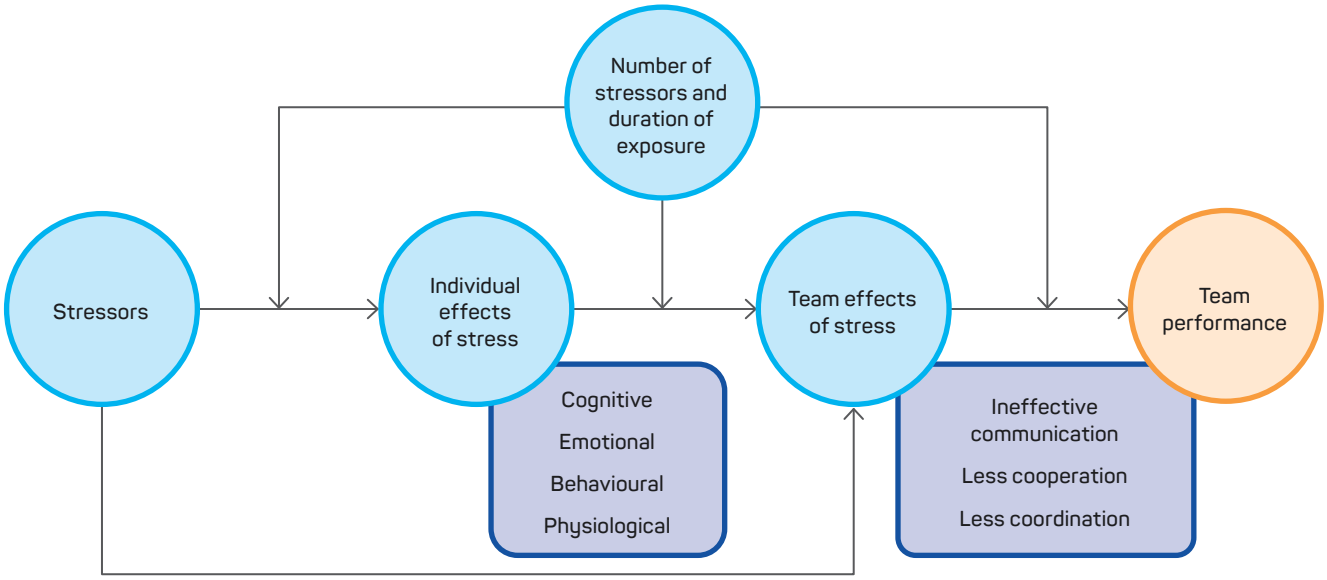

Figure 1: A model framework of the effects of stress on performance.
Source: Adapted from Dietz et al. (2017)

situational awareness, team collaboration and coordination effectiveness as well as organisational support for the use of professional judgement. Further, stress could result in inaction or inappropriate decisions to avoid the appearance of being indecisive.

To mitigate the effects of stress, Butler et al. (2021) recommended that personal resilience training should be added to existing firefighting training programs. One approach is the use of mindfulness techniques such as oneED (Braganza et al. 2018) and Attention Regulation Optimisation (Darses et al. 2023). Mindfulness is the purposeful paying of attention to the present moment, without judgement, that results in elevated levels of awareness (Crosweller 2022). Recent studies involving firefighters (Denkova et al. 2020; Waldron and Ebbick 2015), police (Hoeve et al. 2021; Withrow et al. 2023) and the military (Jha et al. 2020; Nassif et al. 2023) have found such techniques to be beneficial.

Another proposed solution is the use of wearable devices connected to a decision support system (Lai et al. 2021). Sensors in the wearable device measure the body's stress response and, if it exceeds a certain risk level, the decision support system is alerted and produces a recommendation to the wearer to assist his or her decision-making. While such interventions may support decision-making under stress, more research is required to determine a suitable product and to consider any potential unintended consequences of such systems.

Fatigue has been defined as an 'overwhelming, sustained sense of exhaustion and decreased capacity for physical and mental work' (Cella et al. 2002, p.528). Fatigue can result from physical and cognitive tiredness (Enoka and Dechateau 2016), poor sleep quality (Bentley and Levine 2016) and/or exposure to temperature extremes (Donnan et al. 2023). Related to this, sleep inertia (grogginess upon waking) has been found to impair decision-making up to 2 hours after waking (Dawson et al. 2021).

Fatigue can significantly influence emergency management decision-making. Brooks et al. (2018) found that fatigue was a contributing cause of decision-making errors at 3 bushfire disasters in Australia. Yung et al. (2021) highlighted that a drop in performance due to fatigue endangered both emergency managers and the public. Dawson et al. (2021) pointed out that the likelihood of fatigue resulting in a high risk of error is not necessarily linked directly but dependent on context. They also highlighted that there is often a false perception of fatigue as low risk (due to an inherent coping capacity).

Yung et al. (2021) identified 4 fatigue risk factors being work organisation; physical environment; personal, social or cultural factors and task characteristics. They found that these risk factors differ across the various emergency services. Medical first responders mainly experienced issues with personal, social or cultural aspects compared to the police where it was work organisation and firefighters experienced all factors equally. Fatigue outcomes also varied. Police and firefighters mainly experienced physical health issues whereas medical personnel experienced physical and mental health issues and performance issues (e.g. accidents) equally. This emphasised the importance of fatigue risk management and that it should address workplace, personal and domestic risk factors to prevent short- and long-term outcomes. However, a review by Dawson et al. (2021)

highlighted that the work of first responders made managing fatigue-related risk inherently difficult.

Both Yung et al. (2021) and Dawson et al. (2021) recognised that cultural change across the emergency management organisations was necessary to understand fatigue as a high-risk phenomenon needing to be managed. Dawson et al. (2021) made recommendations to combat the effects of fatigue and its risks, including access to caffeine, facilitation of nap opportunities and education and training. They also acknowledged that successful implementation of these strategies needs to be targeted to account for differences between emergency management organisations and individuals and suggested that fatigue should become a feature of safety management systems. For example, Ferris et al. (in press) identified the fatigue-mitigation strategies recommended by Dawson et al. (2021) within the fatigue management strategies of a sample of ambulance services in Australia.

Interoperability

During an emergency, the lead response agency and other participating organisations must work together effectively to exploit areas of expertise and deliver a cohesive multiagency response (Brown et al. 2021). How effectively these organisations routinely work together is based on their interoperability (Pollock and Coles 2015). Interoperability can be defined as 'the capability of organisations or discrete parts of the same organisation to exchange operational information and to use it to inform their decision-making' (ACPO 2009, p.14). Power et al. (2023a) proposed an alternative definition where interoperability is 'a shared system of technology and teamwork built upon trust, identification, goals, communication, and flexibility' (p.4). In both accounts interoperability is essential for effective collaborative decision-making (Kapucu and Garayev 2011).

Despite its importance, interoperability remains a challenging aspect of emergency management. Pollock (2013) identified several common causes of interoperability failures based on a review of incident reports. These included ineffective communication, poor leadership, issues associated with situational awareness, and questionable decision-making. The Royal Commission into National Natural Disaster Arrangements (Commonwealth of Australia 2020) and Cole et al. (2017) found similar shortcomings. For example, the need for compatible communication and information transfer systems so emergency management practitioners can communicate across jurisdictions as well as to improve the use of internet-based technologies and applications to access digital information sources.

Waring et al. (2020) studied a major incident exercise to explore the multi-agency decision-making processes. They found that decision-making was compromised by issues associated with the development of situational awareness. These included withholding information, delays in sharing information, incompatible communication technologies and a lack of familiarity with other agency roles (so people

Figure 2: The UK Joint Decision Model overlayered with the phases of decision-making.

Source: Adapted from JESIP (2021)

don't know who to share information with). Each of these issues effect the ability of teams to execute their plans, which, in turn, contributed to decision delays.

In response to the problems of interoperability, the Government of the United Kingdom established the Joint Emergency Services Interoperability Programme, which developed a doctrine and a framework for joint working between the UK emergency services and other organisations supporting them such as local councils (JESIP 2013; JESIP 2016; 2021). To enhance interoperability, the doctrine introduced a set of principles to be adopted by all organisations involved in a major incident response. For example, to co-locate as soon as practicable and to establish shared situational awareness. The latter is to be achieved with the aid of an analytical Joint Decision Model (see Figure 2). An interoperability framework is also available in Australia; the Australasian Inter-service Incident Management System (AFAC 2017), based on 3 key principles, functional management, span of control and unity of command.

However, Pollock (2013) recognised that merely introducing new procedures was not enough to improve interoperability. In a follow-up review, Pollock (2017) compared observations from a large-scale exercise in 2016 with those recorded in a similar exercise in 2010 and found that several problems with interoperability remained unchanged, including those associated with information sharing. Also, there had been no improvement in learning lessons from incidents to enhance future interoperability. Pollock (2013) and Power et al. (2023a) advocated that for interoperability to be improved, cultural change needs to take place within the emergency management sector so that working together becomes part of what they value and believe. Power et al. (2023b) interviewed emergency managers to evaluate the UK framework and concluded that, to achieve the desired organisational changes across the emergency services would require 'adequate financial investment, a review of organisational structures, and metacognitive skills training on the social psychological components of interoperability' (p.30). It was acknowledged that this would take a considerable amount of time to achieve.

The literature of this review outlines several principles that may serve to enhance interoperability. House et al. (2014) found that effective interoperability is based on information sharing that leads to shared situational awareness and a common operating picture, which serves as the basis for joint decision-making. Similarly, Power et al. (2023a) found that ensuring an accurate common operating picture required clear and effective exchanges of information and communication practices. Both groups of authors advocated a decentralised approach to emergency management to enable teams to react appropriately to rapidly developing emergencies. It better facilitates decision-making by empowering individuals to make decisions without referring to a rigid chain of command. The approach can accommodate differences between agencies but requires each one to understand the work of the others to reduce uncertainties about interagency team processes (House et al. 2014).

Power et al. (2023a) identified 3 psychological principles that inform how interoperability may be embedded in a team: building cohesive goals, trust and secure team identities. Building cohesive goals helps establish trust and develop secure team identities. These principles directly influence multi-agency decision-making and teamwork. Three types of trust were found to be integral to interoperability:

- interpersonal trust
- cognitive trust (a belief that others can perform their role/tasks)
- group-based trust (developed between strangers sharing a social category such as emergency management practitioners).

A strong team identity encourages individuals to work with strangers to achieve overarching team goals and develop a sense of belonging to a multi-agency team rather than to an emergency service organisation (Power et al. 2023a). They concluded that all 3 psychological principles highlight how individuals accept working in a multi-agency team and when targeted in high-fidelity simulation training contribute to embedding interoperability into organisational culture.

Ethical decision-making

The reality of limited resources in emergency management means that decisions often have to be made about where assistance can be provided and where it cannot. For the decision-makers involved this can involve ethical dilemmas. Ethical decision-making can be especially challenging when a person's ethics and moral compass are at odds with the situation. A systematic review by Leider et al. (2017) showed how frontline medical personnel who adhere to ethical principles such as non-maleficence (do no harm) and a duty to provide care can, at times, have these severely tested. For example, where demand for medical treatment exceeds available resources, triage may include factors like an individual's age to prioritise patient treatment.

Ethical decision-making is particularly difficult in emergency management. The scale, complexity, dynamism, dangerousness and uncertainty involved have the potential to be overwhelming (Leider et al. 2017; Shortland et al. 2020). Emergency management practitioners may be operating within a degraded system of safety because of the lack of resources (Brooks 2014) and can be confronted

with least-worse (Shortland et al. 2020) or worst-case scenarios (Sunstein 2007). Further, novel situations can evoke stress and fatigue that compromises decision-making (Dawson et al. 2021) and people may have limited experience to inform their decision-making (Johnson 2014). Yet, emergency management practitioners are expected to be capable of making ethical decisions (Boin and Nieuwenburg 2013). These conditions are particularly unfavourable because ethical decision-making typically needs to be deliberative whereas emergency management and combat conditions tend to evoke intuitive responses (Messervey et al. 2023).

Ethical dilemmas can also have consequences for the people making the decisions. Boin and Nieuwenburg (2013) examined the events of the 'Memorial Hospital Tragedy' in New Orleans following Hurricane Katrina. They focused on the use of discretion by frontline medical personnel when making ethical decisions and how the outcomes significantly affected the lives of those involved and the decision-makers. They referred to the human costs as 'the moral costs of discretionary decision-making on the front lines' (p.368) (see Jacobsson et al. 2015). According to Ryu et al. (2023), these moral costs are moral injury and distress. Moral injury is derived from a substantial conflict between the critical situation and an individual's ethical principles and values and moral distress is defined by overwhelming feelings of powerless to do the right thing. In combat deployments with high volumes of casualties, they found the causes of moral injury and distress for military surgeons included guilt and seeing dreadful injuries.

Leider et al. (2017) in a review of ethical guidance for US healthcare providers, highlighted that at some point during critical incidents and disasters, emergency managers realise that they need to move away from meeting the needs of individuals to focus on the needs of the wider community. Thereafter a utilitarian approach is adopted, for example, to save as many lives as possible. Thompson et al. (2018) used scenarios with Canadian military personnel and described this process starting with recognising that ethical issues are involved, which then enables moral judgements to be made based on principles, values and perceptions of how fair/unfair, right/wrong and good/bad the situation is. Other influential factors include making judgements about how much harm would be caused, how ethical actions would be perceived, how ethical a choice was, the military 'rules of engagement'/ orders (e.g. to remain neutral) and the perspective adopted by a decision-maker when considering harm (i.e. from their perspective or from that of others). Leider et al. (2017) identified several principles associated with medical ethical decision-making. These included a duty to care, duty to plan, utilitarianism and equity.

Several ethical frameworks have been proposed that provide guidance for decision-makers to reduce ethical conflict (Caspar et al. 2020; Cuthbertson and Penney 2023). Ethical frameworks are well-established in health care and include guidance on how clinicians can best provide care during critical incidents and disasters as well as acknowledging the circumstances that may lead to moral distress (Lieder et al. 2017). One such framework for humanitarian workers (Clarinval and Biller-Andomo 2014) addressed ethical issues from the strategic to the operational level based on a defined set of ethical values: a collaborative, deliberative, ten-step approach to ethical decision-making and how to achieve and maintain high ethical standards. Boin and Nieuwenburg (2014) found collaborative crisis deliberation was a key factor of ethical decision-making, namely a process of collective reasoning to determine practical guidelines to deal with ethical dilemmas. Cuthbertson and Penney (2023) highlighted how the moral judgements of emergency management practitioners can vary based on their individual beliefs and perceptions of the communities involved. They noted a lack of ethical frameworks for the emergency services organisations. With respect to training, most military ethics training focused on awareness and was classroom based. There was little evidence this training would prove successful on the battlefield because it could not replicate the stressors of combat (Messervey et al. 2023). Appropriate organisational support for ethical decision-making in emergency management remains one of the key challenges for the sector.

Discussion

Three major emergency management decision-making challenges were examined that emerged from a comprehensive literature review. These were stress and fatigue, interoperability and ethical decision-making. Each challenge was discussed together with proposals to reduce their adverse effects on the quality of emergency management decision-making.

The volatile, hostile working environments of an emergency response evokes stress and fatigue, both of which influence the decision-making and performance of emergency management practitioners. Stress and fatigue can impair cognitive and physiological functions and can lead to human error and jeopardise the safety of emergency service personnel and others. This review highlighted fatigue as a significant hazard. Opportunities exist to develop fatigue management tools to mitigate the effects and accountability for fatigue management to become a feature of organisational cultures. Appropriate training is required to develop understanding of, and techniques to combat, the effects of stress and fatigue on decision-making (e.g. mindfulness training).

Interoperability problems that have not been resolved reflect the intransigence of the challenges they pose. Dominating is the failure of the emergency management sector to learn from past incidents to improve interoperability and the need to establish ways to address this to reduce the frequency of repeated errors and their consequences. The introduction of doctrine is not sufficient to overcome the challenges caused by interoperability. This review highlighted opportunities to enhance interoperability through cultural change, developing effective communication and information sharing systems, adopting a decentralised approach to emergency management, targeting key psychological principles in high-fidelity simulation training, financial investment and a review of the organisational structures.

Ethical decision-making is difficult and stressful and has the potential to cause moral injury and distress. The practicalities of the application and moral consequences of such decision-making during critical incidents are not well-established nor understood. There are opportunities to develop ethical frameworks to provide guidance to emergency management practitioners alongside ethics training that focuses on awareness and includes realistic simulations.

The development of appropriate training was a common thread running through each challenge; from high-fidelity simulations to enhance interoperability and mindfulness training to help people cope with stress and fatigue, to ethics awareness training to aid ethical decision-making. Similarly, changes to organisational culture were signalled to embed interoperability to reduce stress and fatigue and to support ethical decision-making. Yet, one safety critical issue bound the challenges together, that the emergency management sector fails to learn from critical incidents. Overcoming this failure would enhance and develop emergency management practitioner decision-making and improve safety during emergencies.

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