Defining performance and competency requirements for army responders to domestic flood response operations

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Abstract

Purpose – The *a priori* identification and development of army personnel competencies are necessary to enable effective and efficient responses to rapidly changing climate conditions. Accordingly, this study aims to identify the performance requirements of a military flood responder and the competencies (knowledge, skills and abilities) required to perform it.

Design/methodology/approach – Using an abductive approach, the authors conducted both secondary and primary research to generate a validated framework of performance criteria and competencies for army personnel responding to floods. This literature review integrated both the peer-reviewed academic literature and public sector grey literature. Using the critical incident technique, the authors then conducted semi-structured interviews with 15 members of the Canadian Armed Forces (CAF) who had previously been tasked with flood response operations. Participants were asked about the tasks required while conducting flood response operations. Interview transcripts were then content analysed to identify themes regarding those tasks, and the competencies needed to perform those tasks were then extracted and contrasted with the literature review findings. Inter-rater reliability for the analysis was established via iterative discussion between the two co-authors.

Findings – The primary data reinforced and expanded the list of performance expectations that the authors deductively identified from the integrated literature review, adding granularity to each. It also identified competencies (including both hard and soft skills) and highlighted previously neglected contextual antecedents of military flood response effectiveness.

Research limitations/implications – though knowledge saturation was achieved from the 15 interviews conducted, further research with larger samples could more deeply ground the evidence discovered in this study. Nevertheless, the competencies identified in this paper could serve as a starting guide to staffing and/or training interventions targeted at improving these competencies for personnel responding to flood scenarios.

Practical implications – The theoretical findings also have immediate practical relevance to training for flood response operations. In particular, the subtle challenges in competency crossover from military operations to flood response operations may facilitate not only more efficient, targeted training (that could improve the effectiveness of army personnel involved in humanitarian roles), but could be applied to the selection of army personnel as well. This study may also help provincial/municipal operators and emergency planners by better communicating the strengths and limitations of army personnel in addressing civilian military cooperation for humanitarian operations. Thus, the findings of this research study represent an important first step in prompting attention to the strategic human resource planning studies required to make all responders more efficient and effective in their respective division of labour within the humanitarian domain.

Social implications – Peering a little beyond these research findings, human-induced climate change is expected to continue increasing the frequency of such events (IPCC, 2021), and a timely, national force is likely to be increasingly required for Canadians impacted by major disasters stemming from natural hazards when local resources become overwhelmed. Yet, there is some concern from the CAF that increasing responsiveness to disaster operations will affect their military readiness (Leuprecht and Kasurak, 2020). One can indeed envision a paradox whereby the CAF is both a "force of last resort" while increasingly becoming a "first choice for domestic disaster and emergency assistance". The practical implications from

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this research also suggest that military personnel, while fully capable of successfully conducting flood response operations, may become overburdened and less able to adopt yet greater capacity and training for other additional humanitarian work. Nevertheless, the competencies highlighted by participants can help inform the next flood response operation in Canada.

Originality/value – Most literature in the field of emergency response focuses on cooperation between civilian and military resources and other strategic-level themes. The findings address critical granularity missing at the operational and tactical levels of humanitarian assistance and disaster relief research. The authors also draw implications beyond the military context, including for local/regional governmental players (operators and emergency planners) as well as for volunteers in flood response roles.

Keywords Natural hazard, Flood response, Relief operations, Military personnel, Human resource planning, Climate change, Emergency preparedness

Paper type Research paper

1. Introduction

The Canadian Department of National Defence (DND) and the Canadian Armed Forces (CAF) serve as an operational force for provinces in the event of large-scale disasters. They do not lead the strategic plan, but their informed input and workforce de-gendered contribution are vital to it. For example, floods increasingly impact Canadians and require military intervention (see Table 1). Although some researchers dispute whether the current trend in increased flooding is because of anthropogenic causes (Bush and Lemmen, 2019), it is indisputable that there has been a clear increase in demand for the CAF to respond to domestic humanitarian assistance and disaster relief (HADR)-related missions. In other words, regardless of the causes for more floods impacting Canadians, the growing need to respond is clear.

Accordingly, the CAFs' responses to such disasters have also evolved. Op. LENTUS was established as DND/CAF's operational designation for missions pertaining to "natural disaster" assistance in Canada (Department of National Defence, 2014a, 2014b). This operation falls under *core mission 7* of DND's 2018–2023 defence plan, which is to "[p]rovide assistance to civil authorities and non-governmental partners in responding to international and domestic disasters or major emergencies" (Department of National Defence, 2018). The following table is limited to the information provided by DND on the Government of Canada website.

As flooding continues to increase in frequency and magnitude (IPCC, 2022), and the DND/CAF is increasingly relied upon to respond to such hazards, the need to grow the capacity to respond to this demand has also become imperative. This has been identified in both the DRDC report titled *Calm Before the Storm* (2020) and in the Director Land Environment's *Canadian Army's Climate Change Adaptation Roadmap* (2019). This has also been noted in the humanitarian operations literature on forecasting (Altay and Narayanan, 2022).

The requirement for improved response entails being able to strategically increase both the efficacy and efficiency of force generation for the future of Op. LENTUS. To be most *effective* in its contribution to any such mission – to be able to recruit, train, deploy, evaluate and manage its human resources effectively – a comprehensive understanding of competency requirements (KSA – knowledge, skills and abilities) for such missions is necessary. If the DND is also to become more *efficient* in disaster response, then the *a priori* identification of those competency requirements for floods will become increasingly valuable to ensure the capacity is there to provide timely advance preparedness for mitigation of humanitarian and property damage.

To date, the DND has not yet systematically researched the competency requirements for personnel engaged in disaster responses for floods. It is therefore unclear how well suited the assigned personnel have been for such tasks. To obtain a fully content-valid set of competencies for the work involved and assess personnel's fit with those, the full set of performance tasks required in such flood response missions must first be identified. Hence, the purpose of this study was to answer the following three questions:

RQ1. How is the construct of "effective participation in flood response operations" defined? (i.e., What are the performance criteria for flood response operations?)

RQ2. How do individual-level competencies contribute to effective participation in flood response operations? (i.e., What individual KSAOs – knowledge, skills and/or abilities – do responders need to meet these performance criteria?)

RQ3. To what extent do Canadian Army responders possess the competencies required for flood response operations?

2. Literature review

Although there may be foreseeable overlap in the approach needed to strategically manage floods, wildfires and other natural hazards, each type of hazard may involve its own specific set of key outcomes and competency requirements. As Munir *et al.* (2022) suggest, it would be helpful to gain a deeper understanding of the performance requirements for each specific hazard type. Addressing the relevant performance criteria can then help to fully identify the pertinent, and potentially unique, human resource competencies required for participation in disaster management. This, in turn, can facilitate the training of disaster response personnel, which has the potential to save more lives through improved job performance (Ming *et al.*, 2019). Training with specific, targeted goals (Locke and Latham, 2006) may also help preserve both the mental and physical health of personnel (Ein *et al.*, 2023). With the above in mind, this study focused on flood response in particular because of the recent prevalence of Canadian military responses to domestic floods (see Table 1).

Table 1 Domestic flood response operations in Canada involving military personnel [1]

Year	Operation	Place/Event
2010	LAMA	Restoration in Newfoundland following Hurricane Igor
2011	LUSTRE	Flooding of the Assiniboine River in Southern Manitoba
2012	LOTUS	Flooding in the Montérégie region of Québec
2013	LENTUS	Major flooding in Southern Alberta
2014	LENTUS 14–01, 02, 03, 05	Multiple spring flood events in Ontario and intense flooding in Manitoba
2015	LENTUS 15–01	Spring flooding in Ontario
2016	nil	Nil
2017	LENTUS 17–02, 03	Severe flooding in Québec and Newfoundland and spring flooding in Ontario
2018	LENTUS	Multiple floods in Ontario, New Brunswick and British Columbia
2019	LENTUS	Multiple floods in New Brunswick, Ontario, Québec and Nova Scotia
2021	LENTUS	Flooding in the Yukon and Newfoundland, severe flooding in BC

Source: Table created by the authors using information from www.canada.ca/en/department-national-defence/services/operations/military-operations/current-operations/operation-lentus.html; accessed March 2022

To guide empirical investigation of both criteria (performance requirements) and predictors (pertinent competencies), both academic and public sector literature on this subject were reviewed and synthesised. Specifically, established knowledge on the topic was sought from secondary sources such as peer-reviewed academic journals, FEMA (EMI, 2024) and the Government of Canada (Department of National Defence, 2014a, 2014b). To conduct this investigation, the authors' university library database was used in conjunction with a list of Boolean search terms (e.g. "flood response", "military", "civil assistance", "emergency response" and "relief operations"). This process was repeated using different combinations of the search terms. Database searches were limited to peer-reviewed academic journal articles and books published in the past 21 years. Twenty-one years was selected as the cut-off because this is the period in which the growing trend of Canadian military involvement in domestic response operations has become established. Google search and government website searches were used to find the most up-to-date government-related documentation. Our resultant article database spanned the peer-reviewed academic literature and public sector documents.

The findings of the literature review indicated that the peer-reviewed academic literature on emergency responses to flooding tended to focus on strategic issues related to mitigation, planning and response management, albeit with relative neglect of important human resource issues (Fiorini *et al.*, 2022). For example, Tabaklar *et al.* (2015) review of theories in humanitarian supply chain management listed a range of strategic theories but not a single human resource management framework. Likewise, although Agarwal *et al.*'s (2019) review of humanitarian supply chain frameworks merely mentioned training, it neglected the broader context of strategic human resource planning. More recently, Munir *et al.* (2022) formulated a three-part framework for inter-organisational flood-related disaster management, which included:

- agility (e.g. with regard to materials sourcing);
- alignment (e.g. resolution of competing organisational interests); and
- adaptability (e.g. enabling flexible shifts in the supply chain).

However, while they (like Agarwal et al) flagged the strategic importance of training, their discussion on alignment still did not address the underlying human resource planning processes required to adequately forecast training needs. The most recent systematic review of the challenges faced by relief workers (military, medical and public safety personnel) offered a constructive direction, as it more explicitly recognised human resource challenges as a top priority (Ein *et al.*, 2023). Specifically, their review indicated that a handful of articles have addressed the importance of training by focusing on ethical objectives in training and/or training methodologies (e.g. how distance learning may help with a variety of on-the-spot training needs, including logistics and teamwork). Yet, training – or indeed any high performance human resource function – inevitably relies on a sound context-valid job description, along with clear identification of the competencies needed to perform it, and these issues were overlooked.

Thus, in spite of human resources being acknowledged as vital to humanitarian contexts and in spite of the fact that training in particular remains a challenge, the academic literature continues to neglect the foundational strategic human resource planning processes (i.e. the job description and job specification) required to help forecast training needs in advance. The most fundamental aspects of strategic *human resource* planning, for the purposes of flood response, would include identification of flood response performance requirements at the operational or tactical level (essentially, the job description), and identification of the personnel competencies required for the same (essentially, the job specifications). Both are needed in the strategic human resource planning process to determine the numbers and types of workers to be deployed and to plan for succession of the same. Most academic studies fail to enumerate the specific performance tasks required for different players in a flood disaster management context to the level that a job description requires. In the absence of any flood-responder job description, only the most generic listing of job specifications (competencies) have been identified. Accordingly, attention to the tactical human resource performance requirements and their associated competencies is long overdue.

Competencies that would normally be derived from a job description and included in a job specification include

knowledge, skills (which may be learned) and abilities (which tend to be fixed, and can pose an upper limit on skill acquisition). Further distinction can be made between hard and soft skills. Moss and Tilly (1996, p. 256) defined "soft skills" as those competencies "that pertain to personality, attitude and behavior rather than to formal or technical knowledge." Rainsbury *et al.* (2002), as cited in Hendarman and Cantner (2018, p. 141), defined "hard skills" as "skills related to [the] technical aspect [...] in the job." Job specifications would normally include these distinctions, along with a description of the conditions under which such competencies are to be applied.

It is also important to note that the competencies are not meant to be understood as entirely independent of one another. For example, Rainsbury *et al.* recognized that "hard skills" *also* "frequently take account of the acquisition of knowledge" (Hendarman and Cantner, 2018, p. 141). Such technical knowledge is often referred to as "procedural knowledge" and is integral to the capacity to apply the hard skill. Likewise, Fiorini *et al.* (2022) observed that soft skills may enable relationship building with other players in the context, which can facilitate the coordinated application of hard skills and, by extension, achievement of task performance. The main relevance of this hard versus soft skills distinction, for the purposes of our paper, is that it holds implications for skills transferability to the performance context at hand. While soft skills may be situationally transferable, hard skills (and the knowledge related to it) may be less so, and may require additional training to enhance skill transferability.

In contrast with the academic literature (described above), most of the public sector (government) research pertaining to the operational needs in flood response operations often did not take a strategic perspective of any kind. The published governmental literature that was reviewed was developed within predominantly English-speaking countries (e.g. Canada, the USA and the UK). It largely focused below the strategic emergency management levels of command and control, coordination and cooperation, communications and organizational structuring (McMaster and Baber, 2012). It devoted attention to the more operational and tactical aspects of flood response, including descriptions of how the response is structurally organized, and the nature of the work processes found within emergency response standard operating procedures.

In summary, the two bodies of literature have been fragmented. The findings of the public sector research have not, to date, been integrated with the academic literature in this area.

2.1 Identification of the performance criteria for the military flood responder role

In view of the incompleteness of each literature, published government sources from a variety of countries were integrated with the more strategically oriented academic references in the literature review to provide a more complete picture of the strategically required performance requirements (i.e., essentially the key criteria of a job description). This integration step, which is depicted in the left column of Table 2, yielded a novel summary of several key performance tasks for emergency responders in flood situations:

First, emergency responders are required to identify and mitigate operational or environmental hazards (CDC and NIOSH, 2018; Government of UK, 2019; Ein *et al.*, 2023; Tint *et al.*, 2015). There are a host of such hazards for emergency responders and victims of floods. Beyond the obvious risk of drowning, there exist a multitude of environmental hazards from fire, ranging from explosions and electrical shock (Gouvernement du Québec, 2021) to operational risks associated with working around heavy equipment and traffic, stress and exhaustion and exposure to chemical or biological contaminants (CDC and NIOSH, 2018). Emergency responders work in a variety of potentially compromising environments, including those at height, underground, confined and near, over or in water of various depths (OSHA, 2024). Accordingly, mitigations also entail using personal protectvie equipment (PPE) effectively.

Second, they are expected to operate specialized rescue equipment. Teams not affiliated with air transportation would be required to perform tasks relating to Urban Search and Rescue (USAR), including ladder operations, rope rescue, animal rescue, coastal operations, paramedics and clearing debris in a safe and effective manner (Government of UK, 2019), as well as operating heavy equipment (Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2019). Public documents indicate that the CAF is aware of the necessity for operators of special equipment as a part of its history of engagement under Operation LENTUS. Such missions have listed a variety of tasks requiring specialised training, including route clearing, power restoration, protective works (e.g. constructing dykes), etcetera (Department of National Defence, 2014a, 2014b).

Third, intra- and inter-team coordination and management were required (CDC and NIOSH, 2018; Government of UK, 2019; Tint *et al.*, 2015). The overall health and well-being of emergency responders must be monitored, and well communicated, between managers (Non-commissioned Officers (NCOs)/Officers) to ensure personnel are operating effectively and safely, as regular breaks and adequate rest are recommended during flood response operations (CDC and NIOSH, 2018). Operation LENTUS deployed personnel are expected to perform wellness checks, work within interdisciplinary teams (Department of National Defence, 2014a, 2014b), and coordinate and collaborate amongst themselves. From an emergency responder perspective, it is vital that communication be fluid among teammates and managers, particularly in relation to situational awareness of hazards (CDC and NIOSH, 2018).

Finally, it was noted that the working conditions could be classified as performance under duress (Tint *et al.*, 2015). These tasks must often be performed under challenging conditions that place considerable demands on both physical and mental fitness (CDC and NIOSH, 2018; Government of UK, 2019).

2.2 Extraction of competencies required for these performance criteria (job specifications)

Given that neither the academic literature nor the government literature explicitly specified the competencies needed to perform the required tasks, we independently deduced competency requirements from the literature's documented performance criteria (in the left column of Table 2), and then subjected our competency lists to inter-rater (co-author) reliability. Specifically, differences in interpretation were discussed until the list was refined in a way that represented

Table 2 Contrasting performance criteria with competencies [2]

Literature-derived performance criteria	Deductively hypothesized competencies
Identification and mitigation of hazards: • **Hazards related to floods (shock, drowning, explosions)** • **Working around heavy equipment** • **Exposure to biological/chemical contaminants**	*Identification and mitigation of hazards* • Knowledge about potential risks and how to mitigate them • Skill to perform the mitigation steps
Operation of specialized rescue equipment [hard skill]: • **Tool operation for rescue (e.g. rope, ladder, power tools)** • **Heavy equipment operations** • **Tools/equipment required for route clearing, power restoration, protective works**	*Operation of specialized rescue equipment [hard skill]:* • Knowledge of any provincially led specialist functions • Technical knowledge of how to operate specialized equipment • Skill to actually perform the operation of that equipment
Intra- and inter-team coordination and management: • **Working with interdisciplinary teams** • **Fluid communication between teams and managers**	*Intra- and inter-team coordination and management:* • Communication skills are clearly essential, both within teams and between various agencies (but precise skills neither identified nor prioritized, for example, conflict resolution, nonverbal coordination, etc.)
Working conditions: • **Tasks performed under challenging working conditions**	*Performance under duress:* • Long hours and challenging conditions demand both physical and mental fitness

Source: Table created by the authors

inter-rater agreement. This analytical process produced a novel set of suggested operational- or tactical-level competencies (depicted in the right column of Table 2), that may enable military personnel deployed to flood response operations to perform those tasks effectively (i.e., the individual-level antecedents of flood responder performance):

First, in regard to the identification and mitigation of hazards, it is the responsibility of both the leadership and responders to be knowledgeable about the potential risks and about how to take the appropriate risk mitigation precautions (CDC and NIOSH, 2018), such as identifying a suite of PPE relevant to each situation (OSHA, 2024). They also need to be skilled at using the PPE effectively.

Second, regarding the operation of specialized rescue equipment, we note that technical competencies [knowledge and skills pertinent to hard skills] are also essential for conducting these flood response operations. For example, in the UK, knowledge and skills are needed for the USAR tasks noted earlier (Government of UK, 2019). In a variety of flood response operational contexts, the capacity to operate heavy equipment (e.g., dozers, excavators, etc.) properly is essential (Ministry of Forests, Lands, Natural Resource Operations and Rural Development, 2019). In addition, even in circumstances where local teams can fulfill specialized roles during a flood response operation, CAF members' capacity to support these local workers may be improved by having knowledge of provincially/locally led specialist functions prior to deployment (Department of National Defence, 2014a, 2014b).local

Third, to support coordination both within teams and between various agencies during a disaster scenario, communication skills are clearly essential (Salmon *et al.*, 2011). Among the important interpersonal communication skills required, conflict resolution and leadership have previously been identified (Tint *et al.*, 2015). However, the literature did not otherwise specify other types of interpersonal communication skills (e.g. negotiation, nonverbal coordination, etc.).

Finally, both physical/mental fitness [Skills] AND health [Ability] were also essential because the scale and scope of tasks can be taxing physically and mentally (CDC and NIOSH, 2018; Ein *et al.*, 2023; Government of UK, 2019). It is important that personnel possess a "level of health and fitness that ensures they are capable of carrying out their role" (Government of UK, 2019, p. 55) under such working conditions. It is further recommended that physical health and fitness be verified by a doctor (e.g., via fitness tests) (Government of UK, 2019). Although the CAF does enforce their annual FORCE evaluation for all CAF members, research on a broad physical testing standard has suggested that fitness tests specific to occupation may be warranted (Reilly, 2010). The need to assess the mental health of emergency responders for flood mitigation was also emphasized. Exposure to prolonged work hours over a days or weeks can leave responders exhausted, stressed and distracted, which can place themselves and others at risk (CDC and NIOSH, 2018).

In summary, Table 2 offers a novel framework that advances existing knowledge by synthesizing fragmented literature regarding flood responder performance requirements (i.e., the job description) and by integrating speculations about the competencies required to perform those duties (i.e., the job specifications). Nevertheless, it remains unclear whether the competencies identified represent a completely content-valid set of the competencies required for military flood responders or what their relative importance is. Hence, we also undertook an empirical investigation to test the validity of our framework. Specifically, we used a qualitative research approach to collect primary data on whether/how these literature-derived performance tasks and competency requirements would stand up to scrutiny by participants in the field. The details of our methodology for the primary study now follow.

3. Methodology

3.1 Design

Research questions that address the "how" and "why" of an understudied phenomenon warrant a qualitative methodology (Yin, 2013). In addition, a phenomenological approach is

recommended to gain diverse perspectives on this issue (i.e., all those engaged with the phenomenon of addressing an urgent flood situation). This was a qualitative study in which 15 semi-structured interviews were conducted to identify critical tasks. The critical incident approach to the semi-structured interviews, the interview protocol used and the methods for analysis are all described further below.

3.2 Participants

Participants included 15 CAF personnel who have been involved in humanitarian/disaster response operations for floods, including multiple levels (e.g., non-commissioned members to senior-level officers). Specifically, those interviewed included the following: Five commissioned officers up to the rank of Major, seven NCOs up to the rank of Master Warrant Officer and three Non-Commissioned Members. They represented a range of army trades, from logistics to infantry. They were recruited using a list of qualified individuals provided by the DND, from which they were invited to participate via email.

3.3 Procedure

To verify whether the literature-derived knowledge, skills and abilities were pertinent to the Canadian flood response context, the critical incident technique (CIT) was selected as the interview method. CIT was originally established as a method for the evaluation of critical job requirements for the US military by psychologist John Clemens Flanagan (Flanagan, 1954). This method is described as follows:

> The critical incident technique is a qualitative interview procedure which facilitates the investigation of significant occurrences (events, incidents, processes, or issues) identified by the respondent, the way they are managed, and the outcomes in terms of perceived effects. The objective is to gain understanding of the incident from the perspective of the individual, taking into account cognitive, affective, and behavioral elements (Gremler, 2004, p. 66).

The CIT interviews were semi-structured and targeted the potential KSAs indirectly. Namely, to tap the various performance criteria (and accompanying essential competencies), questions were posed about critical incidents to elicit the nature of the situational challenge, how it was responded to and what helped and hindered. If participants did not explicitly provide competency information, they were probed more directly (e.g., asked about appropriate application of both metacognitive knowledge, such as *knowing which* procedures and which kinds of PPE are called for in a given hazardous situation and procedural knowledge, such as *knowing how* to mitigate personal risk in such situations).

The interviews were conducted face-to-face over a videoconferencing medium (Zoom). Conducting the interviews face-to-face was important for two reasons: First, it was helpful because highly detailed accounts were critical to the success of certain CIT investigations; respondents may have been less willing to take adequate time entering such responses in a written survey (Edvardsson and Roos, 2001). Second, it offered additional nonverbal cues, which guided further exploration of participants' responses.

3.4 Measures: the interview protocol

With CIT research, it was important to have "no preconceptions or idiosyncratic determination of what will be important to the respondent" (Gremler, 2004, 66). Hence, as noted above, the interview protocol (see Table 3) was designed to be more semi-structured rather than rigidly structured based on the performance criteria or KSAOs derived from the literature. This approach also provided participants with the opportunity to reject any of the literature-derived criteria/predictors that they deemed irrelevant/less relevant, and/or prioritize any important performance criteria, competencies, or contextual issues that the literature review might have missed.

3.5 Data analysis

The interview recordings were transcribed *verbatim*. Prior to data analysis, 14 of the 15 participants then verified their transcript to ensure accuracy; the remainder simply accepted the researcher's account. A mixture of qualitative and quantitative analytic techniques was then applied to the qualitative interview data, as follows:

Table 3 Interview protocol [3]

***Incident example* (positive/negative)**	First, think of a major (critical) incident that was *beneficial/positive* in outcome and that occurred as the result of your work during your Op. LENTUS tasking, and consider the following questions *(NOTE: Second iteration of same question would then ask same participant for elaboration about an incident that was detrimental/poor in outcome. And "possible probes" are to be asked after each question only if participant does not address these issues with sufficient detail.)*
Nature and outcome of incident	• What specifically happened that was beneficial/positive (or detrimental/poor) in outcome? a) *Possible probe:* Where did it happen? b) *Possible probe:* What circumstances existed that caused this? • *Possible probe:* Describe any other significant events happening when you did this?
Actions of the individuals	• What did you do that helped/was effective (or didn't help/was ineffective)? – *Possible probe:* Why did this help (or not) the incident? • How did you learn the outcome of these actions? – *Possible probe:* Did you observe actions done by others?
Reasons for consequences of actions	• Why do you think the actions were effective or ineffective (i.e. had a positive or negative outcome)? – *Possible probe:* What knowledge was essential/missing? – *Possible probe:* What skills were essential/missing? – *Possible probe:* What attitudes were essential/missing?

Source: Table created by the authors

Qualitatively, thematic analyses of the task-related responses were undertaken to enable a full understanding of the tasks required, as well as of their associated required competencies. Leveraging the qualitative research software NVivo, interview transcripts were coded and then analysed to identify first-level topics discussed by participants (themes discussed in each paragraph of each interview transcript). Subsequently, an analysis of recurring codes and themes was conducted to identify higher-level themes from the study group. Using this approach, the associated competency requirements emerged. See Table 4 for the data structure diagram, using the Gioia method (Gioia *et al.*, 2013).

A more quantitative content analysis of the interview data was then conducted to determine the competencies most frequently identified by the respondents. A frequency bar chart was then generated to permit visualisation of these findings regarding the most significant KSAOs for military flood responders (see Figure 1). Overall, this analytical process captured a general sense of the tasks required as a member of the army during a flood response operation. These findings are consistent with Ein *et al.*'s (2023) rankings of deployment challenges faced by diverse groups of relief operators. However, it hones in more specifically on the relative importance of the competencies needed to perform those tasks.

3.6 Data quality

The risk of subjectivity in judgments is always a possibility with qualitative data interpretation. This was mitigated via several steps (in addition to the participant transcript verification step noted earlier). First, the authorship team included one researcher who has experience as a CAF Combat Engineer as a non-commissioned regular force member, which assisted in the understanding and comprehension of incidents described in interviews. Second, inter-rater agreement was established early on to ensure reliability among the two individuals involved (researcher and supervisor) during the analysis process. As per Miles and Huberman (1984), given that we had two coders, our goal was an 80% agreement rate. Therefore, this process of independently coding extracts from transcripts, identifying the percent agreement in coding for those extracts (both number and labelling of codes), and revising the codebook accordingly continued until we achieved the percentage agreement that we sought between researcher and supervisor for the scoring of identified skills. Finally, triangulation of the primary data against the literature also served as a check and balance. Multiple and different sources of data (including DND documentation) were used to provide corroborating evidence on the themes (Whittemore *et al.*, 2001). According to Eisner (1991), such "structural corroboration" (i.e., triangulation of data) provides a confluence of evidence that breeds credibility (i.e., confidence in the validity of the data). Iteration between primary and secondary data further enabled the evolution of question probes for the interview protocol. This enhanced the validity (quality/pertinence and depth) of the overall findings in relation to the existing literature. A remaining potential risk to validity was the limited sample size of 15 interviews. A participant size of at least 20 interviews is the normal recommendation to help reach some level of "knowledge saturation" (Yin, 2013). However, the authors observed that the collected data had reached sufficient saturation to support the list of core competencies summarised in the discussion.

4. Results

4.1 (RQ1) How is the construct of "effective participation in flood response operations" defined? (i.e., what are the performance criteria for flood response operations?)

The following section outlines the performance criteria identified by the research participants. A summary of the emergent data on performance criteria is shown in Table 5 (see right column), where they are contrasted with the deductively generated performance criteria from the literature (in the left column of Table 5). Below, we discuss each of them in turn.

First, regarding environmental and operational hazards, participants identified hazards related to the manual labour, which included lifting and tools swinging in the vicinity. Other flood-related environmental hazards identified included fire, shock, biological or chemical contamination, and working around heavy equipment. Personnel need to be able to effectively mitigate such hazards.

Second, participants also had to effectively use a variety of equipment. The term "equipment" was used in a broad sense. It included basic tools required for the job, such as shovels, heavy machinery and PPE, each of which is discussed below:

Most participants reported only being expected to use basic hand tools while on a flood response task site. However, those who were Combat Engineers had to use a more expansive set of tools, including basic power tools and, in some cases, gas-powered chainsaws, which they were trained to use. There was no mention of the need to use hydraulic tools. However, participants also noted that sandbags are a critical tool in current flood mitigation efforts. Sandbags were essential to build walls for flood mitigation, to minimize their vulnerability to vehicle wakes in flood waters nearby. Because water being displaced by a fast-moving vehicle can not only damage buildings but also has the potential to knock down sandbag walls, sandbags must be properly and efficiently filled/compacted/moved/combined into a structurally sound sandbag wall, with waterproofing membrane applied for effective flood mitigation. A few responders mentioned using sandbag fillers for this purpose, either improvised or manufactured; however, most accounts described hand-filling individual sandbags with simply a shovel.

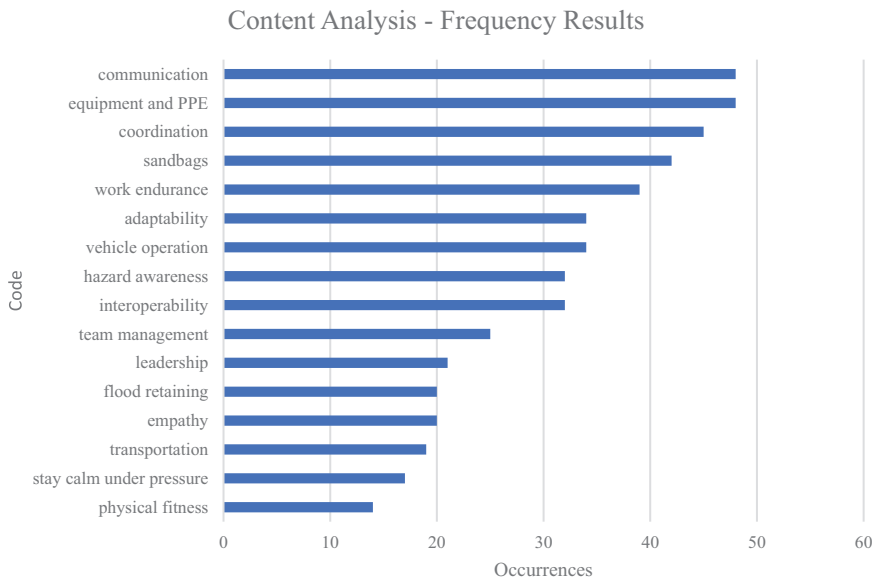
In some instances, heavy equipment also had to be operated to enable the movement of sandbags (e.g. loading large amounts of filled sandbags, using a front-end loader, from the ground to a truck for transport). In other instances, heavy equipment was used for Jersey barriers lined with waterproof membrane instead of sandbags, for flood protective barriers. Specifically, heavy equipment was used to move barriers into place and was assessed as significantly more efficient for both wall placement and remediation. Two of the most discussed vehicles considered essential to the flood response operations were the medium support vehicle system (MSVS) logistical support truck and the light armoured vehicle III (LAVIII), which were used for transporting soldiers or supplies. The MSVS, being designed for logistics, could carry a greater load; however, it was mentioned on several occasions that it simply

Table 4 Data structure [4]

First-order concepts	Second-order themes	Aggregate dimensions
• **A lot of electrical substations were flooded out, so there was a possibility of going into an area we could have been electrocuted [P12]** • **That becomes a significant hazard for anyone that tries to drive through it [P9]** • **It took the sewage with it and the water was contaminated [P8]** • **. . .get that equipment out to soldiers to kind of protect them from any disease or sickness they can get, by operating in the water [P5]**	Mitigating hazards (procedural knowledge)	Knowledge
• **. . .without [proper] PPE [. . .] there were a lot of people getting sick [P13]** • **. . .the biggest thing they needed were guys with chainsaws [P4]** • **Get the right equipment maybe a little bit too late [P10]** • **Make sure you park the truck so it's not going to end up in the water [P11]**	Equipment and PPE (procedural and metacognitive knowledge [5])	
• **Figuring out when people were leaving, where they were leaving from [. . .] so a lot of coordination and a lot of talking [P1]** • **Our CIMIC coordinator [. . .] They do all the coordination with the civilian agencies [P5]** • **If we don't have good communication with the locals [. . .] you're going to butt heads [P15]** • **Once the flow and support was there, it worked really well [P11]**	Protocols for communication/ Coordination (Procedural & metacognitive knowledge)	
• **. . .making sure the guys knew the in and out route [. . .] Making sure that they knew that they can't just jump in front of the line [P11]** • **We have a very strong way to communicate amongst ourselves and hold each other accountable [P3]** • **Communication's always the biggest key to all of this [P4]**	Following communication/ Coordination protocols (Interpersonal)	Skills
• **Essentially, if you're to be in charge, well the civilians come to see the person in charge [P13]** • **. . .calming people down and saying we're doing everything we can [P8]** • **communicate whatever abilities we have to help them [P15]**	Leadership (Interpersonal)	
• **[Driving], we'd have to go through farmer's fields and what not, trying to get to these areas [P11]** • **. . .drive through water to bring it (sandbags) to the closest spot where troops were working [P13]** • **. . .putting them into a vehicle and moving them to an evacuation point throughout the city. [P12]**	Vehicle operation (Technical [hard] skill)	
• **So basically, physical fitness was the number one thing [P12]** • **Physical fitness is huge, on and of itself [P9]** • **. . .I think maybe just the average soldier's general fitness isn't necessarily up to par [P7]** • **Physical fitness is also really important, because we're in ice cold water [P13]**	Physical fitness (Related to working conditions)	Abilities
• **It was just, could I keep my calm? I could because I had the schedule, and it was facts [P1]** • **. . .dealing with stress, and dealing with the civilian population [P13]** • **. . .if you're down because you're tired, and they're down because their house is about to flood, it's a recipe for clashing disaster [P15]**	Capacity for self-regulation (Related to working conditions)	
• **. . .we can just keep adapting and keep changing until we get it right [P1]** • **Flexibility and dedication, I'd say [P2]**	Adaptability (Related to working conditions)	

Source: Table created by the authors

Figure 1 An illustration of the number of times participants discussed the given codes for the study overall. A limitation of this representation is that it accounts for the frequency a code was referred to, without regard for the duration (1 count per paragraph)



Source: Figure created by the authors

lacked the off-road and fording capabilities offered by the LAVIII. The LAVIII, being eight-wheeled, was more capable at traversing adverse terrain, and was more capable of fording deeper water.

In certain other circumstances, the availability and use of army assault boats were found to be of substantial benefit by Combat Engineers. For example, an assault boat was used in coordination with police and medical services, allowing responders access to homes. This allowed the boat team to conduct door-to-door checks, which reportedly resulted in saving the life of a civilian who was having a medical emergency.

In regard to PPE, participants underscored the importance of eye protection, gloves and perhaps most notably, hip/chest waders. These forms of PPE, which are relatively standard in their jobs, were used with a high frequency.

Regarding the third performance criterion of inter- and intra-team coordination and management (interoperability), a distinction emerged between followership and leadership, and the latter was sufficiently distinct to warrant its own new performance category. More specifically, at the operational and tactical level, army personnel need to coordinate a variety of actors (and teams of actors) to get the job done. Interactions occurred with a range of military trades (e.g., infantry and engineers) or between the military and other provincial responders (e.g., firefighters or civilian volunteers) who may need to be called in and assigned to perform specialised tasks. Whether working with local public officials, military personnel or civilians, respondents were required to rely on established protocols to communicate calmly with the information they had. When low-level interactions with those other responders were not going smoothly, military personnel needed to be prepared to reach up their own chain of command to help resolve the issue. For some platoon commanders, this meant understanding their mission mandate and effectively coordinating with public officials within what was considered appropriate flood remediation or mitigation. For those interacting with civilian volunteers or locals, it meant being clear, concise and empathetic in their communication, while not confusing or overpromising what could be done by themselves or the military.

At the level of strategic logistics, it was apparent from interviews that supportive team leadership was essential. A lot of the success of a flood response operation relies on strategic team leadership, whether it be the establishment of the teams, or the direct management and supervision of personnel on the ground. For example, management required long hours of planning and inter-team coordination (e.g., chartering buses to transport soldiers from and to their home base or working with municipal governments to find temporary housing arrangements, such as arenas or fire halls). Thus, the nature of the external communication/coordination demands varied somewhat, depending not only on the specific actor but also on the level of the army personnel's role.

Our data also revealed further granularity about the challenging working conditions. Personnel had to adapt to rapidly changing physical and logistical scheduling challenges throughout this process. The military does its best to predict severe floods and assign personnel for an immediate response unit (IRU) as soon as possible; however, personnel may still experience large disruptions to their personal lives, as they are sometimes provided little notice (days) prior to their deployment. During the operation, personnel were occasionally required to adapt in several other ways as well, including by acquiring and developing orders for new daily taskings, applying their military knowledge for humanitarian contexts (rather than military ones) and adapting to different (and novel) supervisory and labour roles. Moreover, each of these

Table 5 Contrasting performance criteria for flood responders [6]

Performance criteria derived from literature review	Performance criteria derived from this study
Identification and mitigation of hazards: • **Hazards related to floods (shock, drowning, explosions)** • **Working around heavy equipment** • **Exposure to biological/chemical contaminants** • **Working in compromising environments**	***Mitigating hazards:*** • Hazards related to floods (shock, drowning) • Exposure to biological/chemical contaminants • Manual labour safety (e.g. *safe lifting technique, safe tool operation*) • Working in compromising environments (*working in and around murky water of unknown depths, potentially swift water*)
Operation of specialized rescue equipment: • **Tool operation for rescue (e.g. rope, ladder, power tools)** • **Heavy equipment operations** • **Tools/equipment required for route clearing, power restoration, protective works**	***Effective use of equipment and PPE:*** • Use of hand tools, power tools, *PPE* • Heavy-equipment operations • *How to properly fill and place sandbags* • *Operating in (wading) and/or on water (boating)* • *Vehicle operation* (*off-road, in water, carrying loads, carrying people*)
***Intra- and inter-team coordination and management*:** • **Working with interdisciplinary teams** • **Fluid communication between teams and managers**	***Interoperability (adherence to protocols for communication/ coordination):*** • Working with interdisciplinary teams • Fluid communication between teams and managers (*need to coordinate with a variety of actors/stakeholders)* • *Strategic-level logistic management* • *Operational-level interagency task coordination* (*capable of responding to orders*)
Leadership: • **Not explicitly noted**	***Leadership:*** • *Establishment of teams and direct supervision (generating teams, effective allocation of teams, and ensuring effective performance, monitoring well-being, assigning breaks)*
Working conditions: • **Tasks performed under challenging working conditions** • **Considerable demands on both physical and mental fitness**	***Working conditions:*** • Tasks performed under challenging working conditions (*long hours, rapidly changing circumstances*) • Considerable demands on both physical and mental fitness (*physically demanding, facing hostile behaviour from people under duress, heavy manual labour*)

Source: Table created by the authors

challenges had to be met while potentially facing hostile behaviours from people under duress (citizens, other personnel): Personnel are occasionally subjected to adverse (sometimes hostile) behaviour from civilians and/or from peer responders who experience challenges remaining calm under pressure/hardship.

In summary, the findings from this study largely support the literature's identification of the main performance tasks. However, our empirical data reveals additional, richer detail about each of those, including noting additional performance requirements related to leadership and working conditions for military flood relief operations.

4.2 (RQ2) How do individual-level competencies contribute to effective participation in flood response operations? (i.e., what individual KSAOs – knowledge, skills and/or abilities – do responders need to meet these performance criteria?)

This section reviews the major themes regarding key competencies (knowledge, skills, abilities) that emerged from the interviews. Table 6 shows a comparison between the literature-derived competencies (in the left column) and the emergent competencies (in the right column).

Table 7 further categorizes the emergent competencies by their type (e.g., K, S or A). Our ensuing review of the results concerning the emergent competencies will follow the order of Table 7.

4.2.1 Procedural and metacognitive knowledge competencies

4.2.1.1 Procedural knowledge. Procedural knowledge was required regarding three main types of activities: mitigation of environmental and operational hazards, proper use of equipment and the protocols for interoperability protocols in volatile contexts. Each of these is addressed below.

First, with respect to mitigating hazards, context-specific knowledge was required about safety operating procedures, such as not walking under the bucket of a front-end loader at any time. Tools swinging in the vicinity required awareness of one's surroundings. Heavy lifting required knowledge that lifting should not be done with one's back. Safety knowledge from diverse trades unaccustomed to working in such circumstances and/or with other responder groups' equipment cannot be assumed to arise spontaneously. Knowledge of how to work safely in contaminated water was the top hazard discussed.

Second, in light of these hazards, procedural knowledge about how to use PPE properly and operate the equipment

Table 6 Contrasting competencies for flood responders [7]

Deductively hypothesized competencies	Emergent competencies (from this study)
Identification and mitigation of hazards ***[pertinent to hard skills]*** • **Knowledge about potential risks and how to mitigate them** • **Skill to perform the mitigation steps**	*[ALL pertinent to hard skills]* • Know proper physical labour *safety protocols (e.g. heavy lifting techniques, situation awareness)* • *Know how to safely operate around heavy equipment* • *Understand hazards of working in contaminated water, limitations of PPE*
Operation of specialized rescue equipment ***[pertinent to hard skills]*** • **Knowledge of any provincially led specialist functions** • **Technical knowledge of how to operate specialized equipment (but only partial identification of which kinds of equipment)** • **Skill to actually perform the operation of that equipment**	*[ALL pertinent to hard skills]* • *Factual knowledge regarding the mission and responder's role* • *Knowing which expert responders to call upon (social capital)* • *Know how to use PPE and basic hand tools* • *Know how to properly handle and place sandbags as water barriers* • *Know how to operate and/or safely operate around off-road capable logistical and combat vehicles* • *Know how to operate inflatable, motor-operated watercraft* • *Know how to operate heavy equipment* • *Know which PPE/tools to use and when* • *Capacity to apply above knowledge correctly*
Intra- and inter-team coordination and management • **Communication skills are essential within teams and between various agencies (but precise skills neither identified nor prioritized)**	[soft skills] • *Capacity to communicate effectively* (internally and externally to the organization) • *Understanding how a chain of command works* • *Know protocols for working as a highly interdependent team* (e.g. conflict resolution, nonverbal communication)
Leadership • ***Not evident from literature***	[soft skills] • *Understanding how to meet and manage the basic needs of a large workforce (up to thousands)* • *Knowing how to manage a task force and meet the needs of individuals* • *Capacity to lead with reassuring confidence*
Performance under duress • **Long hours and challenging conditions demand both physical and mental fitness**	[soft skills] • *Physical fitness* (important for injury prevention, heavy manual labour, extensive work hours) • *Mental fitness* (important for self-regulation–staying calm under pressure and adaptability: adapting to new roles, instructions and techniques)

Source: Table created by the authors

was needed *prior* to deployment. In addition, personnel needed to know how to fill and compact a sandbag, how to move filled bags safely and efficiently, how to build a structurally sound sandbag wall and how to apply waterproofing membrane for effective flood mitigation. Personnel also needed to know how to operate large vehicles off-road and in water (while carrying passengers or supplies and while wearing standard PPE properly), as these also represent essential competencies for flood response operations. Some of these, such as heavy equipment operation (including LAV IIIs) or assault boat training, are capabilities that fall within the Combat Engineer trade. Several respondents highlighted the value of boats to perform wellness checks or to ferry stranded individuals, and that without this capability:

> [. . .] you just have to wait until the fire department gets there with their boat [P9].

A third important form of procedural knowledge suggested by the research findings was how to work the chain of command and contribute to strong team cohesion so as to support the interoperability of flood responders. Namely, familiarity with organisational protocols for working in a volatile, highly interdependent team environment with other first responders was considered essential.

Relatedly, metacognitive knowledge, which refers to knowing which resources to use and when, was also required. This included when to draw upon different resources (be they material/equipment resources or human resources). Personnel needed to know not only *how* to apply their hard skills to use the tools/PPE for the job but also *when* to use them. Similarly, although knowing how to coordinate with other first responders was important, they also needed the social capital to know which external expert responders to call upon for different situations because different categories of actors are needed at different times during a flood response operation.

4.2.2 Interpersonal skills

There were three types of interpersonal skills that emerged as relevant from the data: the capacity to follow communication/coordination protocols, the capacity to supportively lead others and technical skills (e.g., equipment operation). While this is

Table 7 Competency requirements grouped by KSA type for design of training methods [8]

Knowledge	
Procedural knowledge	*Mitigating hazards [pertinent to hard skills]* • Know proper physical labour safety protocols (e.g. heavy-lifting techniques, situation awareness) • How to safely operate around heavy equipment? • Understand hazards of working in contaminated water and limitations of PPE *Operation of specialized rescue equipment [pertinent to hard skills]* • How to use PPE and basic hand tools? • How to properly handle and place sandbags as water barriers? • How to operate and/or safely operate around off-road capable logistical and combat vehicles? • How to operate inflatable, motor-operated watercraft? • How to operate heavy equipment? *Team interoperability (knowing protocols for communication/coordination)* • Understanding how a chain of command works • Know roles/protocols for working as a highly interdependent team
Metacognitive knowledge	• Knowing which PPE/tools to use and when *[pertinent to hard skills]* • Knowing which expert responders to call upon (social capital)
Skills	
Following communication/coordination protocols	• Effectively communicating internally and externally to the organization (via judicious use of nonverbal communication and conflict resolution skills)
Leadership	• Leading a task force with confidence • Understanding how to meet and manage the basic needs of individuals in a large workforce (up to thousands)
Technical *[hard skills]*	• Capacity to apply procedural and metacognitive knowledge about equipment
Abilities	
Related to the capacity for performance under duress	*Physical fitness* • Injury prevention, mental resilience and morale • Heavy manual labour • Extensive work hours *Capacity for self-regulation:* Staying calm under pressure *Adaptability:* Adapting to new roles, instructions and techniques

Source: Table created by the authors

closely related to procedural knowledge, knowing how to do something and actually possessing the skill to perform it are two distinct competencies. Accordingly, each is summarised below.

4.2.2.1 Following communication/coordination protocols (followership skills). The capacity to communicate internally and externally in accordance with protocol was critical. This went beyond possessing knowledge about the normative protocols for interacting with other emergency responder professionals (both internal and external to the military); it also required the skillful application of that knowledge. For example, it entailed the use of appropriate nonverbals, such as the capacity to react to situations with little communication at all (e.g., expected/taught reactions, implied instructions, etc.), and/or to convey verbal messages calmly (i.e., which represents paralanguage/vocalics, another form of nonverbal communication). In the military, subordinates undergo training to increase discipline, which strengthens their followership skills. As one respondent succinctly described it:

> You have to be a diplomat [P9].

4.2.2.2 Leadership skills. A second key interpersonal skill was team leadership. However, the nature of this competency varied by organisational level. Those in charge of strategic and operational level logistical management had to attend to the needs of personnel working at the tactical level, and manage the ongoing support for their needs, such as housing accommodations, food and transportation. For team management at the operational level, such as Junior Officers or Senior NCOs tasked with building sandbag walls or performing wellness checks, a different knowledge base was required, including intimate knowledge of individual subordinates' capabilities, training history, personality, etc., as well as knowing how to coordinate schedules of teams and individuals to ensure workers were not burning out. In both cases, the need for army leadership to provide rapid, confident and enduring assistance through team management and providing clear instructions was key to successful flood response operations. Leaders in the military are provided the benefit of leadership training, which strengthens their leadership skills. This combination of leadership and discipline enables personnel to reach their area of operation and commence working immediately. In contrasting the difference between military and volunteer leadership, one respondent noted:

> [. . .] the volunteers are a good manpower source and everything else, but they're not as solid or reliable as, say, the military would be [P4].

4.2.2.3 Technical skills (e.g. equipment operation). Sandbagging posed a negligible challenge for most of the soldiers in this study, as army personnel are trained on their general use for protective works:

[. . .] for rockets, bullets, stuff along those lines [P13].

However, sandbag wall techniques used for *flood mitigation* vary somewhat from *military* contexts. Unfortunately, some respondents noted they were only being taught how to perform these alternate techniques when on the ground for disaster response. A similar challenge arose with regard to the operation of the heavy equipment, including large armoured vehicles such as the LAV III. This was described as the vehicle most often used by combat soldiers, and trades such as the Combat Engineers and the Infantry will frequently assign sections of their soldiers to LAV IIIs. Soldiers are used to working with and around this vehicle, as it is very familiar to them. Likewise, assault boat training is currently provided to Combat Engineers. However, other trades deployed to flood-afflicted areas would benefit from having the skills to operate this type of equipment, as this would expand the capacity of the Army to aid in large flood response scenarios.

4.2.3 Abilities

The ability category of the KSAOs/competencies was also important, particularly in relation to the need to endure difficult working conditions. Within this category, the following three types of abilities stood out: physical fitness, the capacity for self-regulation (i.e., maintaining composure under pressure), and adaptability.

4.2.3.1 Physical fitness. Possessing appropriate levels of physical fitness was most frequently mentioned as essential to injury prevention. Participants noted:

> [t]here's a lot of stuff that happens that requires a good level of physical fitness [P15].

The benefits of physical fitness, according to some respondents, were also correlated to mental fitness and resilience. Work can include:

> [. . .] a 12–14-hour shift moving sandbags [P15],

which for the less fit can take a toll on morale. Respondents were adamant that physical fitness was a key contributor to successful outcomes during flood response operations. Physical fitness was discussed as important for the performance of personnel, whether it be injury prevention, working long hours, or maintaining a high morale. Although heavy, combat-related personal equipment is not present for flood response (e.g., firearms and ammunition), the main need for a high standard of fitness was described as having to lift and move heavy:

> [. . .] sandbags probably 8, 10, 12 hours a day [P13].

For personnel who maintained a high level of physical fitness, less supervision was required to motivate, and they better represented the Army and a sense of security for victims and bystanders.

4.2.3.2 Capacity for self-regulation. Many respondents noted that the ability to stay calm was critical to successful outcomes such as effectively managing logistics or deescalating conflict with locals. The ability for personnel to empathise was also deemed relevant to the capacity to stay calm under pressure in flood scenarios. Numerous times, respondents described cases where their capacity to stay calm while interacting with locals defused challenging situations.

4.2.3.3 Adaptability. Finally, adaptability emerged as a critical ability. This emerged in relation to acquiring and developing orders for new daily tasks, the ability to apply their military knowledge for humanitarian and disaster response purposes and adapting to different (and novel) supervisory and labour roles.

4.3 (RQ#3) To what extent do Canadian Army responders possess the competencies required for flood response operations?

The following section is compiled from the respondents' perspective, and is summarised in Table 8. The left column provides unique insights into the troops' preparedness to undertake tasks related to flood response operations. The focus in the next section is on instances when some aspect of personnel preparedness needed improvement (using a subset of quotes pertinent to the right column of Table 8). Overall, it underscores the importance of the *a priori* identification of performance requirements and associated competencies to ensure a good fit between them.

4.3.1 Knowledge and skill preparedness

First, regarding procedural knowledge about the mitigation of hazards, recounts of events indicated there were few injuries among responders, and most such injuries occurred in isolation. Nevertheless, in some instances, responders had to rely on their intuition in the absence of advance procedural knowledge. In addition, lifting heavy objects/equipment was regarded by respondents as a source of major injury (albeit infrequent).

Regarding procedural knowledge for the operation of specialised rescue equipment, respondents relied heavily on adapting their warfighting knowledge to flood mitigation. Typically, those interviewed felt they were well prepared for sandbagging, a proven and effective technique. However, another respondent expressed some doubt about whether this was the most efficient approach:

> [F]illing sandbags to mitigate a flood is what we do [. . .] but I'm not sure how much we're understanding that there's new technologies and what they mean [P6].

Similarly, one respondent also mentioned a failed attempt to use Hesco bastion as a flood barrier while experimenting with alternative techniques to sandbagging:

> [W]e used Hesco Bastion [. . .] the water actually went under the Hesco [P13].

Notably, from discussions, it was revealed that heavy equipment operations, such as loaders, mostly fell to local capabilities from the municipalities. Participants remarked on a few occasions that there was a low level of trained army personnel required for the vehicle's operation at times; this included both crew commanders and drivers for LAV IIIs. Although it was not entirely clear whether the limited use of heavy equipment by the military was more a matter of poor availability (i.e., insufficient numbers of military with this knowledge) or a lack of necessity for the military to operate these, what was clear was that the participants perceived delays in the arrival of PPE.

With respect to procedural knowledge about protocols for communication/coordination (to meet the challenges of interoperability), reports about preparedness varied according to the direction of communication required. For example, for strategic communication between organisations (external), the general sense was that much has greatly improved in interoperability of military resources and provincial emergency

Table 8 Canadian Army participants' perceived preparedness for the task [9]

Indication of feeling fit (quotes)	Indication of feeling unfit (quotes)
Procedural knowledge: *Mitigating hazards:* • . . .**you got a big heavy truck with a bunch of troops in it. If it's soft (ground), or it's been eroded because of the water, you definitely have to watch that [P11]** • . . .**we've internalised a safety culture, and we understand taking risks [P6]** . . .**being aware of, you know, some of the injuries that you can get from filling sandbags and lifting improperly. That's the stuff that we think is dumb. But, it's really important, because you do it so much. [P4]**	. . .we weren't exactly sure. There were some things that were intuitive, like if this flood water is touching houses, then they're things in houses that are bad [P14]
Operation of specialized rescue equipment [pertinent to hard skills] • . . .**for infantrymen, just their basic DP1, development period one, that goes over the basic things they need. So being able to work hard. Being able to work long hours. Being able to handle the field [. . .] use hand tools, filling sandbags, moving things from A to B [P14]**	• When we started, we had absolutely no PPE [P13]
Knowing protocols for communication/coordination (team interoperability): • **Everything else went pretty good. In the town, the OC and the Sergeant Major linked in pretty close to the fire department guys [P10]** • . . .**we would decide our plan for the next day with the civilian emergency response unit. We'd decide which fire stations, which were kind of sandbagging places and hubs of all the activity, we'd decide with them, where we were going to go, what was the highest priority, and I would assign sections. . .[P2]** • **I know we got down there right quick. We had our area put together right quick. I know the guys were right into their job. The next day there was not wait time. Everyone moved really smoothly [P11]**	• We would wait usually a pretty long time to find out if [. . .] what EMO had for us, or what type of updates they had [P14]
Metacognitive knowledge: • **When/where to use PPE/tools: In all the operations I've done, equipment has never really been a concern. . . .Sometimes, there was delays [. . .] we can just do other tasks, while we're waiting for that kind of equipment to show up [P5]**	n/a
Skills: *Skills at following communication/coordination protocols:* • **So, from what I understood, at that lower level, was there was good communication. . . [P7]** • . . .**if you have to ask questions, you're asking the right kind. You're not just being some staff guy that has no idea what's going on, but you're talking to the right person, so that they understand that. And that's really at all levels too [P4]**	• Definitely communicating, because regardless of where we go, if you don't speak the language [. . .] I'm not going to be able to communicate effectively [P3]
Leadership: • **Typically, we have the ability to work people pretty hard. We balance it by not working them very hard, when they don't need to be worked hard [P14]** • **I have to make sure that all the soldiers that are deployed [. . .] are taken care of. They have all their medical needs met. They're all being fed. They're being housed. [I am concerned with:] (a) how my boys were doing, because I am their supervisor and I need to look after their well-being, and (b) what the feel**	• n/a

(*continued*)

Table 8

Indication of feeling fit (quotes)	Indication of feeling unfit (quotes)
was from each of the volunteer fire departments that we were working with and making sure that their worries and concerns were addressed [P2]	
Technical skills [pertinent to hard skills]: • **So, what do we do when we need chain sawing on scale?. . .We basically end up with a train the trainer [. . .] We line up a bunch of soldiers, and we say this is how to safely use a chainsaw [P6]** • **We were in that frame of mind where we can get into it, we've done that before. We know how to fill sandbags. We can get from point A to point B, filling Zodiac assault boats with sandbags [P12]**	n/a
Abilities: *Physical fitness*: • **. . .the people that were fit were able to pace themselves better and have fewer injuries [P8]**	• . . .there's definitely people that were on that operation, that had succumbed to many injuries, or fatigue a lot sooner than other soldiers, because of a lack of fitness [P7]
Capacity for self-regulation: • **I've never experienced security guards being the victim of violence, but normally police and/or security, and/or city workers are normally berated every now and then by someone who is quite upset, who's had a long, hard day. It's understandable [P9]** • **They knew the stress we were coming upon each day [P12]**	n/a
Adaptability: • **Canadians' ability to adjust and adapt quickly is something that, no matter what service you're in in the CAF, it just [. . .] it's taught to you so quickly in your career. [P1]**	n/a

Source: Table created by the authors

management offices since the 1990s. At the operational and tactical levels, interoperability was also cited as being quite good, with one respondent indicating provincial responders getting along well with military personnel:

> [t]hey were the same way we were. We were helping each other, lending each other equipment [P13].

There were recognisable similarities in work ethic, chain of command structures and discipline among various government responders, which made interoperability natural. In spite of any differences in civilian volunteers and army personnel, there were no major concerns raised in workers' ability to interoperate with civilian volunteers either. Experiences were good, and civilians were astounded at military personnel's ability to rapidly fill sandbags for hours with little rest. However, it was stated several times that communication with local civilians who were not volunteers required considerable empathy.

In terms of internal communications within the CAF organization, it was mostly described as very smooth and effective. Army personnel understood how to communicate well with one another, across trades, and within the chain of command. Often, this communication was mostly implicit. For example, one respondent described how, when his team arrived on-site, everyone knew what had to be done; all members worked rapidly and diligently to set up their refuelling station. This example is indicative of effective training and good communication prior to deployment. Nevertheless, there was a sense of delay in receiving updates from the Emergency Management Office (EMO).

Regarding metacognitive knowledge, the requirement for knowing which tool to use posed a negligible challenge for the soldiers in this study. For example, participants reported that their training had been effective in enabling them to recognise what type of PPE must be worn for different tasks. Likewise, the respondents indicated they possessed strong knowledge on how to request support (who to contact and how), whether for logistical reasons or otherwise. When a coordination problem did emerge, participants were confident in their chain of command to resolve the issue satisfactorily. Indeed, some described their way of maintaining calm was to rely on their familiarity with the mandate – namely, of helping:

> [. . .] the most number of people in the best way [P2].

They knew that if they encountered problems or criticism, they could rely on their chain of command for support.

Regarding team leadership skills, several respondents in operational or tactical level team leadership positions, such as Junior Officers or NCOs, indicated that their training had been effective in enabling them to manage their personnel's fatigue and to identify which subordinates were most competent for each task. It was also apparent from interviews that army managers were well trained and practised in teamwork and team management in austere working conditions.

Overall, there was no indication that army officers lacked knowledge of how to manage teams during flood response operations or that personnel were lacking in their capacity to follow. As one respondent put it, "the guys were right into their job" [P11].

4.3.2 Ability preparedness (fit with context)

Participants noted that physical fitness was generally high among responders, and they recognised the positive value this brought to their team's task outcomes. Contrasting the ability of those in good physical condition to those regarded as less fit, participants observed a causal link exists between physical fitness and mental resilience. As one respondent put it:

> Some people suffered because of not being in the greatest shape [P7]

while another discussed the ways that they were:

> [. . .] mentally strained out from the task itself [P12].

Members also generally reported being able to adapt quickly in spite of the requirement to deploy to novel circumstances and that empathy assisted their ability to self-regulate (maintain composure under pressure). For example, one respondent went so far as to state that empathy was perhaps the most important ability for soldiers conducting flood response operations:

> [. . .] understanding that the people there have gone through a crisis [P5].

Empathy appeared to be facilitated by the fact that participants recognised that soldiers' presence in a flooded area could provide residents with a sense of safety and security, and that personnel can help provide a sense of calm during a time of crisis by exhibiting empathy and providing a sense of security for victims.

4.3.3 Emergent contextual facilitators/hindrances

Although not directly queried, the above findings illustrate that participants spontaneously shared their thoughts on how organisational factors helped or hindered their capacity to perform effectively. These emergent findings, which included issues related to timely PPE procurement, timing of military response, political interference and mission distinctiveness from civil–military cooperation (CIMIC), are presented in more detail below.

One organisational logistical issue that stood out was in relation to timely PPE procurement. For example, for PPE, hip waders were unreliably sourced. Although participants often lauded the efforts of their logistical support for acquiring and distributing hip waders rapidly, the fact remained that some troops were deployed, often without any practice, to flood zones without hip waders. In the words of one respondent:

> We should deploy with it (hip waders). It shouldn't be that we arrive and then a couple of days or even a week later we get it with the Canadian Tire tags still on it [P15].

Another issue noted was how the timing (deployment) of the strategic military response and the politics of flood response operations appeared to interact at times. Respondents acknowledged their limited understanding of river flow and flood dynamics but felt they nonetheless had valuable observations to share on the timing of their deployment to flooded areas. Specifically, they noted that arriving at a location "on-time" versus "a little late" influenced how effective they felt as responders. In cases where soldiers arrived "on-time," participants described situations where troops were able to play a pivotal role in the construction of sandbag walls, and they felt they had helped a lot of people by protecting critical infrastructure and property. By contrast, in cases where soldiers showed up "late," they spoke about arriving at situations where

the major flood mitigation works had already been completed or where the areas were already flooded and nothing further could be done. It was mentioned that this had a demoralizing effect on soldiers sent to respond. There were a few accounts from individuals who noted:

> We sat on our rucksacks for maybe two days [P12]

at the outset, because of alleged disorganisation from city and provincial officials. This included a situation where soldiers could feasibly have arrived at a good time but were delayed because of mismanagement or interagency misunderstandings. If a call from a province for aid comes as a flood is breaching the provincial capacity to cope, it still:

> [. . .]takes 72 hours for the [military] IRU (Immediate Response Unit) to get into in place [. . .] three days is a long time for things to start ramping up [P4].

The more advance lead time that military planners and IRUs are provided, the easier it is to begin the coordination between military liaison officers and a province's EMO. It can also enable section commanders to retrain their section members on the fundamental skills required for flood response operations prior to deployment, such as those mentioned in the previous sections of this paper. Overall, participants agreed that the sooner they arrived, the better it was for outcomes.

Relatedly, another issue that was mentioned repeatedly was interference (perceived or alleged misuse of military resources) by political entities, which took a variety of forms. One example was procrastinating with the release of military resources from their duty by leveraging army responders as "free labour" as long as possible at the end of the response and pushing into the recovery phase. There were several other instances reported where municipal officials were cited as pressing army resources to conduct seemingly personal or private taskings. Opportunities for misunderstandings and potential labour exploitation were discussed as occurring exclusively at the municipal level.

A final yet important issue raised by participants with regard to military humanitarian and disaster relief is the ability for the military to coordinate with external civilian agencies (Heaslip and Barber, 2014). This is known as CIMIC. It was noted, in general, that the CIMIC capabilities of the CAF have improved significantly since the 1990s. Contrasting statements from those involved in the Red River Flood in 1997, where one participant acknowledged questions surrounding:

> [. . .] how we fit into domestic context & governance [. . .] I could see those were struggles [P6]

to New Brunswick in 2018 where a section was working:

> [. . .] attached to a fire department, under the provincial EMO [P14]

it was clear that the military's distinctive mission has gained significantly greater clarity over the past two decades, particularly with respect to its role in enhancing Civil Military Cooperation (CIMIC) capabilities. Nevertheless, as noted above, political interference sometimes remained a problematic issue for the timing of deployment (and release).

5. Discussion

5.1 Executive summary

Floods have been increasingly impacting Canadians, and the Canadian Armed Forces (CAF) has increasingly been called in to respond to domestic HADR-related missions. Accordingly, the capacity to rapidly respond to such missions has become imperative. If the DND is to become both efficient and effective at deployment for this purpose, then it is essential to identify, *a priori*, the requirements needed to perform the flood responder role, as well as to specify the personnel qualifications (competencies) needed to fulfill those requirements. In spite of the evident need for this important strategic human resource planning task, neither the DND nor academics studying this phenomenon have systematically researched the full set of performance requirements or associated competencies.

To address this need, our paper asked three questions: First, how should we define the construct of "effective response to flood operations" (i.e., What are the performance requirements)? Second, what are the individual-level predictors of that performance (i.e., What are the necessary competencies)? And finally, how well do Canadian Army responders feel they possess these required competencies? Although our focus was on the Canadian context, these questions are potentially relevant for all nations that must grapple with such disasters.

Accordingly, to investigate the first question, we conducted a review of the academic and public sector literature on the matter. By integrating the fragmented literature in this area (i.e., academic research and public sector research), we identified a preliminary set of flood-related performance requirements and then extrapolated the underlying competencies. Then, using semi-structured interviews, we subjected these literature-derived results to a qualitative empirical study of 15 Canadian Army members with experience in flood response operations. Although the empirical results support many of the same broad categories of performance requirements identified by the literature review, and our participants' perspectives are consistent with Rainsbury *et al.* (2002) (cited earlier, who observed that many soft skills are often inextricably relevant to the effective application of the hard skills), our empirical findings offer several important contributions. These include an additional performance category (distinguishing supportive leadership from supportive followership) and considerably greater granularity for all performance categories. The empirical findings also validated our speculative competencies and provided rich, granular insight on the pertinent hard and soft competencies as well. Finally, data emerging from respondents' assessments of their preparedness highlighted ways in which various contextual stakeholders (e.g., politicians) may inadvertently impede responders' effectiveness. A more detailed look at the theoretical and practical implications arising from our findings now follows.

5.2 Theoretical implications

This study contributes to the sparse academic literature on human resource planning considerations pertinent to military disaster relief missions. First, in focusing on preparation for flood response disasters in particular, our paper responds to Munir *et al.*'s (2022) remarks about the importance of paying greater attention to distinct types of disasters. Second, in spite of Altay and Narayanan's (2022) call for improved forecasting in the field in general, the literature has neglected to recognize the role of strategic human resource planning in forecasting for

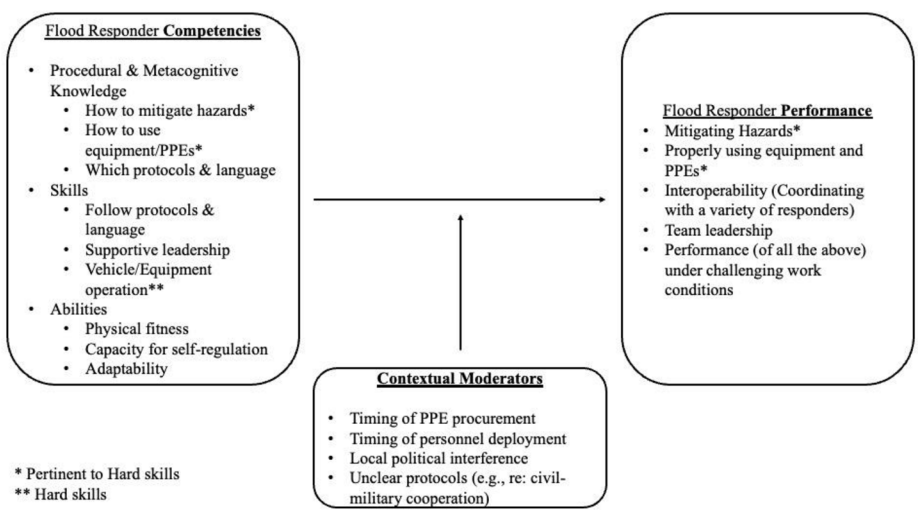
such disasters, the role of substantive "job descriptions" and "job specifications" in enabling such strategic human resource planning or, by extension, the connection between such strategic HR planning and the capacity to perform in a timely, effective manner. As Fiorini *et al.* (2022) suggest, a substantive understanding of what constitutes responder performance (and the antecedent competencies that influence it) has, to date, remained elusive. Some scholars (e.g. Tint *et al.*, 2015) had developed a list of targeted competencies mainly for humanitarian workers for disaster readiness and response, while others (e.g. Ein *et al.*, 2023) had synthesised the performance challenges for a range of relief workers. Our paper responds to this neglect not only via its integration of diverse literatures but also by revealing needed granularity in the critical soft and hard competencies required for military disaster response. It also contributes by structuring this granularity in a novel framework consisting of a robust set of performance requirements (that comprise the construct of flood responder performance), and their individual-level antecedents (both soft and hard competencies needed for this flood response). Third, some scholars had provided empirical evidence of first responders and military personnel coordinating effectively alongside one another (Kaneberg *et al.*, 2016), while others had flagged concerns about inter-organisational collaboration (e.g., Munir *et al.* (2022) framework, which mentions a need for alignment among competing organisational interests). What neither has done, however, is explicitly address how informal interference on the part of individual political actors with agendas – which represents more than merely competing formal organisational missions – can impede effective coordination of task-related performance. By revealing the emergent contextual factor of political interference, our empirical findings offer a deeper understanding of civil-military conflicts in the context of exercising authority (Kaneberg, 2017). This represents an extension to Munir *et al.* (2022) framework dimension of alignment and offers an additional direction for future research (e.g., power dynamics in flood response). Taken together, these findings build upon the very sparse academic research on personnel management for emergency response. Our resultant model of the antecedents of flood responder performance is depicted visually in Figure 2.

5.3 Practical implications

Our theoretical findings also have immediate practical relevance to training for flood response operations. First, it enhances awareness of the subtle challenges in hard competency crossover from military operations to flood response operations. This may prompt not only more efficient, targeted *training* (that could improve the effectiveness of army personnel involved in humanitarian roles), but can also inform the *selection* of army personnel as well. Second, in light of the emergent contextual constraint on performance related to PPE delivery delays, another practical consideration is that training could focus on procurement from alternate supply chains to empower responders to demonstrate greater agility. Third, this emergency procurement issue also reinforces Altay and Narayanan's (2022) suggestion that a possible complement to forecasting (for more predictable disasters) could be the pre-positioning of essential supplies in areas anticipated to be prone to such disasters.

Peering a little beyond these research findings, human-induced climate change is expected to lead to an increased frequency of such events (IPCC, 2021), and a timely, national force is likely to be increasingly required for Canadians impacted by major disasters caused by more intense and frequent natural hazards when local resources become overwhelmed. Although our study suggests that military personnel have proven capable of conducting flood response operations, the requirement to do so at an ever-increasing scale may become a burdensome distraction. Indeed, concerns have been raised from the CAF that increasing responsiveness to disaster operations will affect their military readiness (Leuprecht and Kasurak, 2020). One can thus envision a paradox whereby the CAF is both a "force of last resort" while increasingly becoming a "first choice for domestic disaster assistance." In this sense, our study's findings may be informative to local/regional civic personnel (i.e., provincial/

Figure 2 Emergent model of the antecedents of flood responder performance



Source: Figure created by the authors

municipal operators and emergency planners) and to volunteer organisations in at least two ways. First, it would better enable them to recognise the competencies required for such humanitarian operations; and second, it would enable them to recognise the strengths and limitations of relying on army personnel alone. Clearly, coordination among governmental, civic and volunteer organisations would benefit from proactive, joint strategic *human resource* planning. In short, the findings of this research study represent an important first step in prompting attention to the strategic human resource planning required to make all responders more efficient and effective in their respective division of labour within the humanitarian domain.

Notes

1 List of Military Flood Responses Under Domestic HADR Capacity (2010-2021) Source: Canada.ca/en/department-nationaldefence/services/operations/military-operations/current-operations/operation-lentus.html

2 Illustrates how the literary findings were leveraged to deduce hypothesised competencies. The competencies in the right column were not previously specified by the literature.

3 The interview protocol loosely followed this table's structure, adapting the phrasing of questions to work with the direction of the conversation.

4 This table demonstrates how first-order concepts described by respondents were aligned with the second-order themes and aggregate dimensions.

5 Directly pertinent to hard skills.

6 Contrasting the performance criteria found from interview results with the literature review. Italicized text in right column distinguishes novel findings distinct from literature.

7 Contrasts findings from the empirical data with what was extrapolated from the literature review.

8 Reflects the breakdown of findings related to competency requirements by KSA.

9 Contrasts quotes as evidence for respondents' feelings on their capacity to fulfill the competency requirements found in this study.

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