VOLUME 4 ————

CJEM

CANADIAN JOURNAL OF EMERGENCY MANAGEMENT

———— NUMBER 1

ISSUED

FEB 2026

The Canadian Journal of Emergency Management acknowledges First Nations, Inuit, and Métis people. We recognize the contributions Indigenous peoples have made and offer gratitude for their care of these lands. CJEM affirms the mrightsof Indigenous peoples in this country. We also commit to supporting reconciliation, collaborating with Indigenous authors, and educating emergency managers on inclusive emergency management.

The Canadian Journal of Emergency Management (CJEM) is an open access journal that publishes peer-reviewed papers in the field of Canadian emergency management.

Importance of Protecting Reliable Knowledge in Emergency Management: A Letter from the Editor

About a month ago, Merriam-Webster's editors chose "slop" as the word of the year. Defined as "digital content of low quality that is produced usually in quantity by means of artificial intelligence," (2025) slop represents an inevitable outcome of the way that so-called 'artificial intelligence' makes it easy to produce raw volumes of content with little validation and verification, little context and respect for lived experience, and little accountability for the harms it does.

By contrast, the mission of an academic journal like CJEM – the Canadian Journal of Emergency Management – is exactly the opposite of 'artificial intelligence' and slop. As a journal, it is our raison d'être to help the emergency management community share, protect, and preserve knowledge that can be counted on. The defining features of a journal – like peer review, clear authorship, procedures for retractions and corrections, supplementary materials to document underlying instruments and data – are, at their heart, an effort to ensure that the publications under our 'masthead' are earnest attempts to produce as reliable, as high quality, and as dependable a corpus of knowledge as possible. They're a commitment to knowledge production, epistemic relations, and the earned trust of peers that is the opposite of AI slop.

This doesn't mean, of course, that the best available knowledge is perfect, or that knowledge doesn't evolve and change as we learn more. Indeed, it is our hope as a journal that others will build upon, innovate, advance, and correct the work featured in CJEM issues. But, what makes journals writ large, and CJEM in particular, so special is our commitment to being the antithesis of slop: CJEM is a place where you can trust that authors are engaged in a good-faith effort to further our collective understanding about the world of emergency management, and who warrant full authorship and take full accountability for the work they do and the peer reviews they offer as colleagues in this field.

The articles in this issue exemplify these values. The first article published under the new model, "Learning from COVID equity measures to increase community resilience" by Mongeon et al. (2024) documents lessons learned from a rural public health unit, capturing both challenges and ideas worth replicating by other practitioners. Similarly, Rowsell et al. (2025) provide a case study of Ottawa Public Health's approach to implementing an 'Equity Officer' as part of their emergency responses. Robert et al.'s investigation into creating facilitative tools for visualizing and discussing municipal electrical infrastructure (2025) paints the portrait of boundary objects that facilitate cross-sectoral and multi-sectoral deliberation. Together, these three articles embody CJEM's mission to bridge the divide between research and practice, documenting lessons learned from case studies that will have value to the entire emergency management community, in Canada and abroad.

The issue also includes three other articles that, similarly, provide both academic and practical inspiration through large scale reviews. Kikkert & Lackenbauer's synthesis of civil-military domestic disaster response in Canada's North (2025) offers a comprehensive review of how arctic emergency response in Canada is structured and implemented – a complex topic distilled into a very useful article for practitioners and researchers alike. Acenas et al. (2025) introduce a tool called "General Morphological Analysis," characterizing the ways that it has been used in public health emergencies and offering suggestions for future implementation. And, Greaves et al. (2025) provide a review of dimensions of sex, gender, and equity relevant to emergency management that provides a new tool – the Gendered Emergency Management Framework – that can help to incorporate these factors into emergency management practice. We are grateful to all of these authors (some twenty-one authors in total!) and the dozens of peer reviewers and editorial staff who have contributed so

much.

Long-time readers of the Canadian Journal of Emergency Management will have noticed that we have had something of a hiatus from publishing issues recently. In 2024 and 2025, the organization undertook a significant reworking of our publishing processes to better serve the community. The journal migrated to the Open Journal System thanks to its new partnership with York University, which provides a stronger back-end system for managing submissions, better indexation of the journal in key search engines and ranking systems, and a cleaner experience for readers. We also transformed from fixed dates for publishing articles to a system where individual articles are now published immediately upon completion of peer review as 'Online First' articles, before being bundled into the next available issue. This means that your work will be available to the community more quickly, to be used, to be cited, and to inspire the next project.

This transition was only possible because of an impressive and inspiring number of volunteers. Some, like Simon Wells, Alexander Fremis, and Rosemary Thuss sat in key editorial roles and provided the foundation for making these changes. Others, like Mesha Richard and Shannan Saunders, filled critical gaps during this transition to keep our editorial operations moving. Our editorial staff volunteers, operations volunteers, Editorial Board, and Board of Directors – too numerous to name here – played an essential role in providing vision and continuity of operations. And, others still, like Tiffany Leung (Executive Director) and Sarah Cowan (our new Managing Editor) have both played and are playing an absolutely critical role in shaping this next chapter of the journal. I, personally, and the journal and field alike are grateful for each and every volunteer's contributions to this issue and to the overall transformation.

In the months ahead, the speed of transformation will only continue to accelerate. While all journals face serious headwinds in soliciting reviews, we will keep working to speed turnaround times as much as possible – and ask you, the reader, to be willing to contribute to building this collective resource by serving as a peer reviewer for future articles. The Journal also has several new and exciting article types, including "Case Reports," which are meant to function as abridged after action reviews for practitioners to share lessons learned from responses, exercises, initiatives, or any other experience with the national and international community. We are also looking to increase the number of databases in which CJEM is indexed and to increase the frequency of both article and issue publication.

The Canadian Journal of Emergency Management is a special venue for knowledge production. Being a fully open access venue with no fees to read or to publish; providing free translation of all articles into both official languages; bridging the gap between research and practice; being a supportive venue for first-time authors and for constructive peer reviews; and, continuing to be the antithesis of slop – these are commitments that make CJEM worth investing in. We are grateful for your trust and contributions thus far, and hope you will continue to invest in building this special venue for knowledge production together.

Dr. Eric B. Kennedy

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Contents

General Morphological Analysis In Public Health Emergency Management: An Environmental Scan

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Abstract

Background: Uncertainty is inherent in public health emergency management (PHEM) due to the unpredictable nature of some emergencies and interplay of public health threats and their drivers. PHEM practitioners must continuously develop and adapt methods to manage this uncertainty. General morphological analysis (GMA) is a computer-aided scenario modelling method that can address complex, uncertain problems. GMA examines components of a complex problem and allows practitioners to consider potential connections and outcomes. Through iterative steps, GMA can generate new knowledge and insights in the development of scenarios to aid in decision-making and planning within PHEM.

Method: An environmental scan was designed to identify articles that applied GMA as one of the primary methodologies to support natural hazards management with potential extrapolation to PHEM. Academic databases included PubMed and ResearchGate. A broad search strategy was applied to scan grey literature, including Google Scholar.

Results: This environmental scan identified ten examples of GMA with PHEM relevance across multiple countries and organizations. Examples in the literature targeted either a specific natural hazard or more broadly all known natural hazards. The findings can be divided into three interconnected categories: (a) scenario modelling for managing natural disasters, (b) strategy development and prioritization tools, and (c) decision-making support tools for emergency management teams.

Conclusion: GMA can support the development of scenarios and strategies to inform decision-making on which course of action should be selected to address uncertainties. This modelling method leverages subject matter experts to uncover unforeseen connections and outcomes when navigating complex problems like those observed within PHEM. Future research can involve applying GMA to PHEM in a Canadian context. Currently, the Public Health Agency of Canada is applying GMA to cyclical events (e.g., wildfires, floods, extreme heat events, and extreme weather events) to create scenarios using a PHEM lens. Future practice should involve integrating GMA with other PHEM methodologies to enhance strategies to prevent, prepare, respond, and recover from future public health emergencies.

Keywords: GMA, public health, emergency management, natural hazard

1   Introduction

Effective Public Health Emergency Management (PHEM) is essential for mitigating the impacts of natural hazards, such as wildfires, which can lead to significant public health consequences, including increased demand for health services and risk of chronic diseases (Giorgadze et al., 2011; Rose et al., 2017). Specifically, PHEM can be defined as the integration of knowledge, techniques, and principles of public health (PH) and emergency management (EM) to address complex emergencies affecting the health system and population health (Rose et al., 2017). In addition, the COVID-19 pandemic has highlighted gaps within the PH system due to inadequate resources and tools, leading to critical challenges and vulnerability when dealing with new and emerging threats (Public Health Agency of Canada, 2021). Thus, a need has been identified specifically for EM organizations to promote continuous enhancement and innovation to increase resilience and better re-

spond to new threats (Public Safety Canada, 2025).

In Canada, PHEM is a shared responsibility among federal, provincial, and territorial governments, who are mandated to coordinate responses to mitigate, prepare, respond, and recover from a wide range of public health threats (Public Safety Canada, 2017). As part of this coordinated effort, scenario planning serves as a critical organizational framework, supporting activities such as capability-based planning, resource allocation, and other preparedness activities (Hales & Chouinard, 2011; Hoerger et al., 2022; Neiner et al., 2004). Scenario planning offers a forward-looking approach by developing and analyzing possible future scenarios to inform decision-making in the face of uncertainty (Bin Nafisah, 2021).

Uncertainty is an inherent aspect of PHEM due to the unpredictable nature of emergencies and the complex interplay of various factors involved (United Nations High Commissioner for Refugees, 2023). It arises when attempting to predict the likelihood, impact, exposure, and vulnerability of a PH threat due to the multitude and complexity of risk drivers, thereby complicating decision-making and planning processes (Handmer, 2008; Reisinger et al., 2020). These challenges make it essential for PH agencies to continually adopt robust methods that can effectively help manage such uncertainties (Handmer, 2008; Reisinger et al., 2020). However, current scenario planning practices within PHEM often rely on narrative-based formats which are less exploratory and rely on storytelling to develop a limited number of scenarios (Beach, 2021; Gaßner & Steinmüller, 2018; Kosow & Gaßner, 2008). This restricts the ability to systematically explore key elements and diverse outcomes. Introducing biases and restricting the consideration of alternative scenarios, can hinder the effectiveness of emergency responses (Beach, 2021; Gaßner & Steinmüller, 2018; Kosow & Gaßner, 2008).

General Morphological Analysis (GMA) offers a structured and adaptable method and

can be used as a tool for scenario development within PHEM (Lantada et al., 2020; Ritchey, 2022). GMA facilitates the deconstruction of complex problems into their core components, allowing for the exploration of various possible scenarios and their interconnections (Lantada et al., 2020; Ritchey, 2022). Unlike traditional narrative approaches which focus on limited scenarios and key elements, GMA leads to numerous scenarios that can be compared to one another and considers a wide range of core elements. Thus, as an innovative scenario planning tool, GMA can potentially support PH agencies to better manage uncertainties and enhance strategic planning efforts for various emergencies (Garvey, 2017; Lantada et al., 2020; Neiner et al., 2004; Ritchey, 2022).

This environmental scan will explore the application of GMA as a forward-looking tool through scenario development to aid in decision-making and planning in PHEM. This paper examines natural hazards, recognizing Canada's exposure to diverse natural hazards that are associated with complex PH consequences (Giorgadze et al., 2011). Furthermore, since the practice and principles of EM are grounded in an all-hazards approach, the findings of this paper—while focused on natural hazards—are broadly applicable across sectors. This cross-applicability implies that tools used in managing natural disasters can be adapted to address a range of other PHEM threats. The findings of this paper will be highlighted by examples of GMA's contributions through case studies from different countries and organizations. These case studies are provided later in this paper to illustrate the practical impact and adaptability of GMA across diverse contexts with relevance to PHEM. By examining the relevance of GMA for PH, this study aims to adapt these insights to strengthen scenario planning in the Canadian context.

2 Methods

An environmental scan is a method of searching, collecting, interpreting, and utilizing information from numerous sources (e.g., grey literature and journal articles) to provide evidence-based data to support strategic decision-making (Charlton et al., 2019; Graham et al., 2008). A primary benefit of an environmental scan is that information can be leveraged from various social, cultural, political, and technological fields, which provides the author the ability to address limitations and identify biases (Charlton et al., 2019; Graham et al., 2008). While there is no formal methodology to conduct an environmental scan, the primary purpose of this approach is to acquire new insights that inform the establishment of actionable objectives for an organization (Rowel et al., 2005).

An environmental scan was chosen for this paper as the information on how GMA has been applied in PHEM is not just limited to academic literature but also substantially discussed in grey literature. Furthermore, environmental scans allow for rapid collection of data on trends within a targeted population from multiple data sources such as key informant interviews (Rowel et al., 2005). In our initial search, we found that GMA is an already established best practice for scenario development in sectors outside PH (Álvarez & Ritchey, 2015; Ritchey, 2009b, 2022). Provided, our objective to enhance scenario development methods, we selected an environmental scan as the most suitable approach, as it can reveal the method's applicability in similar fields. We anticipate that insights from these applications can inform scenario development within PHEM.

To determine relevant papers for this environmental scan, the following inclusion and exclusion criteria were applied:

- Inclusion:

    - Reports on using GMA as one of the primary methodologies across different natural hazards.

- Has PHEM relevance, i.e., explicitly considers potential health impacts of hazards on human health or considers health systems, which in the context of an emergency, could affect or influence population health outcomes.

- Exclusion:

  - Reports not published in English.
  - No mention of GMA as one of the primary methods.
  - Study scope outside natural hazards.
  - Not of PHEM relevance.

The following databases and sources were utilized for this environmental scan.

- Key Databases and Search Engines: journal rotated page to display large table

  - PubMed/NCBI, ResearchGate, and Google Scholar.

- Key Terms:

  - GMA, Morphological analysis, Natural hazards, Decision-making support tool, Risk reduction, Disaster preparedness, Emergency Management, Scenario analysis/development/planning/modelling, and Disaster risk management/strategies.

- Sources:

  - Peer-reviewed academic papers, government reports, internet/grey literature, and the Swedish Morphological Society.

3 General Morphological Analysis

3.1 Definition

GMA is a computer-aided tool that supports the exploration of different connections between various components of a complex problem (Ritchey, 2022). These components are represented by parameters, which are further broken down into conditions. These conditions can then be combined in multiple ways to identify connections and solutions. The identification and investigation of these components involve engaging with subject matter experts (SMEs). For instance, when developing scenarios for a pandemic in the context of PHEM, the process of GMA can help identify parameters, such as infection transmission rates and health system capacity. Each parameter can have multiple conditions, such as high, medium, or low. These conditions can then be combined in various ways where connections and outcomes are examined, leading to a model with various applications (e.g., scenario development tool). GMA can provide PH agencies with a tool to support scenario development by comprehensively analyzing and integrating numerous key variables to create scenarios (Ritchey, 2022).

The process of GMA consists of two iterative steps, represented by cycles of analysis and synthesis phases (Ritchey, 2022). Figure 1 illustrates an overview of the GMA process. First, the problem is broken down into its components (i.e., parameters and conditions) and those components are then combined in various ways using GMA. As shown in Figure 1, within the GMA software, a model will be created that demonstrates several combinations of each component, allowing practitioners to consider different connections, resulting in multiple outcomes (e.g., various scenarios) of a complex problem (Ritchey, 2022).

For example, if GMA is applied to plan for a pandemic scenario, we can include multiple variables to consider what might happen if the disease spreads at a high rate and

whether hospitals and current infrastructure have the capability to respond or not. Thus, GMA's ability to facilitate a comprehensive understanding of complex scenarios demonstrates GMA as a versatile tool that can be applied across various sectors to address complex challenges (Ritchey, 2022).

3.2 Principles and Concepts of GMA

The basic principle of GMA involves taking a complex problem and breaking it down into its basic components (Ritchey, 2022). For example, an infectious disease scenario can be deconstructed into key components such as virulence and transmission mode. These components can then be systematically recombined in a structured manner, allowing for the exploration of new connections and solutions that may not be initially apparent (Ritchey, 2022). Since GMA provides a structured approach to identify the critical components that define a problem and systematically explores all possible configurations, it ensures that no essential aspects of a problem are overlooked, allowing for a comprehensive process in developing complex scenarios (Ritchey, 2022). Thus, GMA would be suitable as a scenario planning tool to tackle the multifaceted challenges found within PHEM.

3.3 GMA Process

GMA is an iterative process that consists of two phases and is typically conducted by a group of SMEs with relevant expertise (e.g., an epidemiologist for an infectious disease scenario) to the identified problem (Lantada et al., 2020):

1. Problem definition and analysis phase

2. Synthesis phase

Step 1: Problem definition and Analysis phase

The problem definition stage is where a question is identified that is intended to be addressed through GMA (Lantada et al., 2020). There is no specific way to define a problem, but it can involve working with relevant SMEs. It can begin by determining a specific issue with an understanding of the broader context of the topic. For example, a topic of interest could be a natural hazard such as floods and then further narrowing down the focus to a key challenge or uncertainty within that context to create a question. This process is often driven by predefined goals, such as improving emergency response or mitigating public health risks, which helps to ensure that the issue chosen aligns with the desired outcomes of the analysis. This step serves as a roadmap for SMEs in subsequent phases, where they will identify and explore the various components related to a problem (Lantada et al., 2020).

Once the problem has been defined, a facilitated discussion with SMEs will guide the analysis phase by breaking down the problem into parameters and assigning conditions (Lantada et al., 2020). In the analysis phase, a structured table or a morphological field is created to represent the different components of the problem through parameters and conditions (Figure 2) (Lantada et al., 2020). For example, to elaborate on the infectious disease scenario mentioned above, virulence and transmission parameters can be further broken down. Virulence can include conditions such as high infectivity, medium infectivity, and low infectivity. Transmission can include conditions such as airborne, droplet, contact, and vector-borne. This table facilitates a comprehensive analysis by providing a structured approach to identifying and understanding how these conditions interact with each other (Lantada et al., 2020). These conditional pairs can showcase potential connections and solutions within the table that will be further examined by SMEs in the next phase (Lantada et al., 2020).

Figure 1.1: Overview of General Morphological Analysis
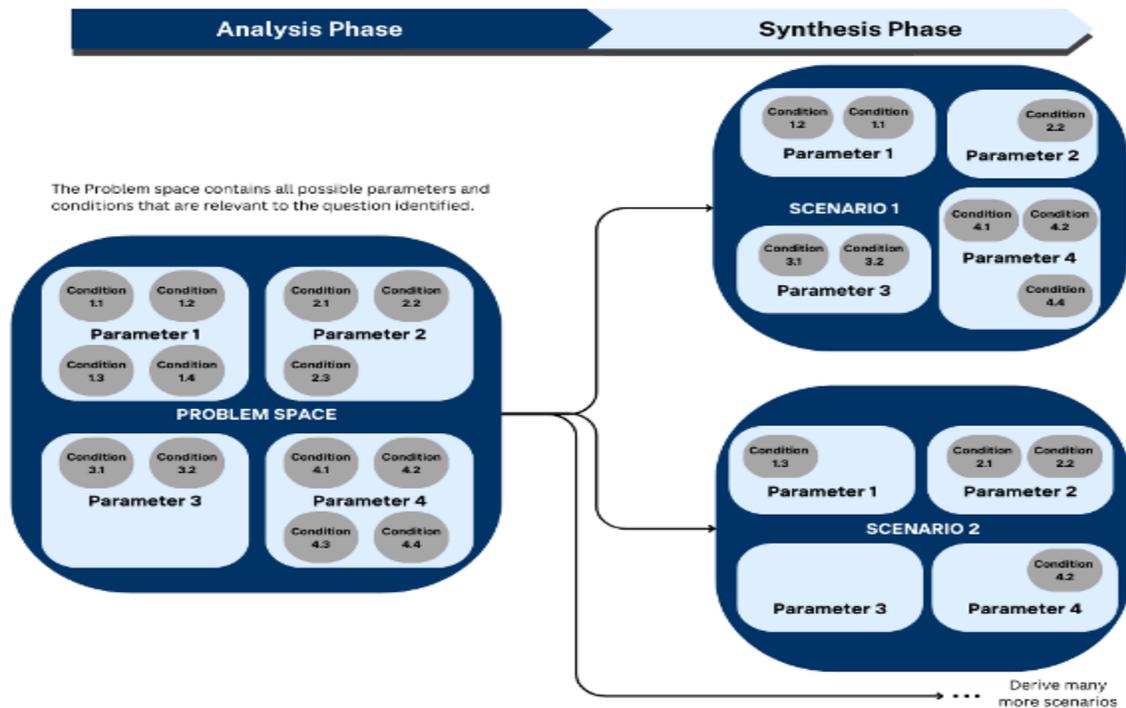
Note. A schematic representation of GMA, with the problem space containing the parameters and conditions resulting in multiple scenarios.

Step 2: Synthesis phase

The synthesis phase involves inputting parameters and conditions identified in the structured table from the analysis phase into the GMA software (Lantada et al., 2020; Ritchey, 2022). After these components have been entered, the software transforms the table into a cross-consistency matrix (Figure 3). This matrix supports discussions by enabling SMEs to systematically compare pairs of conditions to see if the elements in each conditional pair work together. Through these discussions, SMEs identify and remove conditions that contradict one another. SMEs are prompted to contemplate whether the conditional pairs can occur at the same time and fit together within the context of the problem. To do so, SMEs use one of three assessment keys (X, —, or K) and criteria to mark each pair of conditions. These assessment keys will be entered for each pair into the GMA software (Lantada et al., 2020; Ritchey, 2022):

1. X = Contradictory or impossible/incompatible pair.

2. "—" (hyphen) = Fully consistent; good or optimal pair.

3. K = Uncertain or conditionally possible, with specific criteria, for example:

   - Possible but far-fetched or uninteresting relationships.
   - Need more information to make a grounded assessment.

For example, in a PHEM pandemic scenario (Figure 3), SMEs can consider if fever (under direct health impacts) and high infectivity (under virulence) can co-exist during an emergency. Since a fever is a common symptom for an infection with high infectivity, this pair of conditions would be marked as a fully consistent pair and given a "—" in the software.

Figure 1.2: Infectious Disease Scenario Morphologiccal Field

Parameter A	Parameter B	Parameter C	Parameter D
Condition A1	Condition B1	Condition C1	Condition D1
Condition A2	Condition B2	Condition C2	Condition D2
Condition A3		Condition C3	Condition D3
Condition A4		Condition C4	
Condition A5			

Transmission	Virulence	At risk Populations	Direct Health Impacts
Airborne	High infectivity	Young children	Fever
Droplet	Medium infectivity	Older adults (65+)	Muscle pain
Contact	Low infectivity	Indigenous people	Dehydration
Vector Borne		Immunocompromised individuals	

*N*ote. Five-Parameters Structured Table or Morphological Field for an infectious disease scenario.

Once this process is complete, the software will analyze all possible assessment keys, removing any pairs marked with an "X" (Lantada et al., 2020; Ritchey, 2022). This creates an inference model or "what if" model, where one or more conditions can be selected as inputs, and an output is provided with multiple outcomes and connections, as indicated in the dark blue boxes (Figure 4). GMA consists of iterative steps allowing for continuous scrutinization of the inference model to adjust previously established parameters and conditions to further refine the model (Lantada et al., 2020; Ritchey, 2022).

3.4 Applications of General Morphological Analysis

GMA has been applied in various fields within emergency management. Some applications include decision-making tools to support national crisis management, disaster risk management for natural disasters, and scenario development in an earthquake crisis (Hosseinikhah & Zarrabi, 2021; Lantada et al., 2020; Ritchey et al., 2004). The three examples presented below highlight how GMA has been implemented in various countries and contexts.

Example 1: Sweden– Generic Design Basis Model for National Crisis Management

The Swedish Emergency Management Agency and the Swedish Defence Research Agency created a Generic Design Basis (GBD) model prototype using GMA (Figure 5) (Ritchey et al., 2004). The GBD model can support strategic decision-making and scenario planning for three hypothetical causes including natural, technological, and antagonistic, leading to adverse outcomes to society. Specifically, the GBD model can detect extraordinary societal events, determine the best crisis management measures, and create a national security strategy. Although

Figure 1.3: Cross-consistency matrix

		Virulence			Transmission			
		High Infectivity	Medium Infectivity	Low Infectivity	Airborne	Droplet	Contact	Vector Borne
Transmission	Airborne							
	Droplet							
	Contact							
	Vector Borne							
Direct Health Impacts	Fever							
	Muscle Pain							
	Dehydration							
At Risk Populations	Young Children							
	Older Adults (65+)							
	Indigenous People							
	Immunocompromised Individuals							

Note. A section of across-consistency matrix for a five-parameter morphological field.

still a prototype, this model has been tested at both local and regional government levels. It has shown value in enhancing risk and vulnerability assessments across various agencies, providing a framework for crisis management, and improving communication among different sectors (Ritchey et al., 2004).

Example 2: Venezuela – Disaster Risk Mitigation Tool

Utilizing two models of GMA, the authors created a decision-making support tool for disaster risk management for natural hazards in urban areas (Figure 6) (Lantada et al., 2020). This tool prioritizes the most effective risk-reduction strategies to support urban areas during an emergency. GMA was utilized to examine strategies that reduce physical damage and improve vulnerability and resilience. Some strategies involve risk identification, risk reduction, and governance. Each strategy was ranked according to influence, ranging from favourable to no influence. The authors highlighted that this tool supported the prioritization of the most effective strategy during an emergency, thereby improving their decision-making process (Lantada et al., 2020).

Example 3: Iran – Scenario Development in an Earthquake Crisis

Scenario planning through GMA was used in earthquake disaster management to identify factors influencing the severity and financial impact of an earthquake in rural and urban settlements (Figure 7) (Hosseinikhah & Zarrabi, 2021). Multiple scenarios were developed based on the most effective and probable parameters identified. Each relationship was scored on a scale from 0% (no impact) to 100% (high impact), facilitating the identification of ideal scenarios. The most influential factors that decreased casualty and financial loss included city-level crisis documents, improved warning systems, and earthquake-resistant building codes. Additionally, spe-

Figure 1.4: Morphological field or "What-If" Model

*N*ote. Five-Parameters morphological field or 'what-if' inference model, with multiple configurations (Ritchey, 2009b).

cific cities and villages were identified as vulnerable to earthquakes through GMA. The authors emphasized that the model assisted in pinpointing mitigation strategies essential for enhancing the resilience of cities and villages vulnerable to earthquakes (Hosseinikhah & Zarrabi, 2021).

The examples provided above, drawn from literature within emergency management, use different versions of specialized GMA computer software. The examples above do not encompass the full range of GMA's diverse applications, which extend across numerous fields of study (Álvarez & Ritchey, 2015). While applications of GMA within PHEM have been rare, the application of GMA in other fields can be adapted to develop this methodology within PHEM. Specifically, scenario development through GMA is a valuable tool that could support addressing the pervasive uncertainty surrounding numerous PH issues today (Neiner et al., 2004).

3.5 Benefits and Limitations of GMA

Benefits

The environmental scan observed that GMA has successfully been applied with other modelling techniques, demonstrating its compatibility with other methods (Ritchey, 2009b). GMA can be integrated with other methods as a first step or a follow-up to other modelling techniques. For example, mind mapping can identify parameters and conditions which can then be examined and linked through GMA to identify scenarios or strategies (Ritchey, 2009b). In addition, GMA can inter-link two models (e.g., scenario and strategy models) where one model is used as input conditions, and the other as set of output conditions (Ritchey, 2011). This is considered a duplex model where two models are concurrently assessed to see how they inform one another (e.g., establishing the most effec-

Figure 1.5: Scenario Model

Generic Analytical Examples: expressed as threat levels	Where taking place	Number of fatalities	Number of seriously injured	Consequences for environment	Consequences for capital and property	Number of persons needing social assistance
Threat to society's existence	Far from Sweden	> 1 million deaths	Millions	Large geographical scope/ permanent damage	> 1000 billion $	Millions
Threat of permanent major damage	Close to Sweden	100, 000 - 1 million deaths	Hundreds of thousands	Limited geographical scope/ permanent damage	> 100 billion $	Hundreds of thousands
Major societal damage Only partial recovery	Partially in Sweden	> 10,000 - 100,000 deaths	Ten of thousands	Large geographical scope/ slow recovery	> 10 billion $	Tens of thousands
Major societal damage Full recovery possible	Only in Sweden	> 1000 - 10,000 deaths	Thousands	Limited geographical scope/ slow recovery	> 1 billion $	Thousands
Major accident		100 - 1000 deaths	Hundreds	Quick recovery	> 100 million $	Hundreds
Everyday accident		10 - 100 deaths Thousands injured	10 - 100	No substantial damage	< 10 million $	Less than one hundred
		< 10 deaths	< 10 seriously injured			

*N*ote. A seven-parameter morphological field where scenarios can be generated. The conditions highlighted in blue are a scenario of a dam bursting in Sweden (Ritchey et al., 2004).

tive strategies for different types of scenarios) (Ritchey, 2011).

GMA also enables decision-makers to discover novel solutions by considering multiple connections and outcomes of conditional pairs, especially when addressing complex issues dependent on interconnectivity with other sectors (Garvey, 2017; Swanich, 2014). Another advantage of GMA includes enhancing knowledge translation of scientific information through visual models and in promoting partner and stakeholder engagement through collaborative efforts to determine concepts and assess internal consistency (Ritchey, 2009b). Finally, GMA leaves an audit trail. The conclusions drawn from GMA are documented within the software, thus, increasing the traceability and reproducibility of data (Ritchey, 2009b).

Limitations

While advantages exist, challenges in ap-plying GMA in PHEM have been identified in the literature. GMA is time-consuming, primarily as the quality of results heavily relies on the inputs of SMEs (Johansen, 2018; Ritchey, 2009b; Swanich, 2014). This process may require multiple sessions to work through the problem, thus, participants must be highly committed and adequately knowledgeable to provide quality data. This is especially true at the beginning of the process, considering the likelihood that the model may not yield valuable results. Additionally, dedicated software (e.g., MA/CARMA) is necessary to properly conduct GMA, which requires the commitment of financial resources.

Furthermore, GMA lacks a universal way to assess the effectiveness of the results (i.e., utilizing a specific tool) as it heavily relies on SMEs throughout the entire process. Given the complexity of PHEM, the number of configurations can grow exponentially. This leads to challenges including the inability to analyze

Figure 1.6: Strategic Model

DESCRIPTORS of PHYSICAL DAMAGE		STRATEGIES							
		Risk identification		Risk reduction		Disaster management		Governance and financial protection	
X_{RPh1}	Percentage of destroyed area	RI1	Systematic disaster and loss inventory	RR1	Risk consideration in land use and urban planning	DM1	Organization and coordination of emergency operations	FP1	Inter-institutional, multi-sectoral and decentralizing organization
X_{RPh2}	Dead people	RI2	Hazard monitoring and forecasting	RR2	Hydrographical basin intervention and environmental protection	DM2	Emergency response planning and implementation of warning systems	FP2	Reserve funds for institutional strengthening
X_{RPh3}	Injured people	RI3	Hazard evaluation and mapping	RR3	Implementation of hazard-event control and protection techniques	DM3	Endowment of equipment, tool, and infrastructure	FP3	Budget allocation and mobilization
X_{RPh4}	Homeless	RI4	Vulnerability and risk assessment	RR4	Housing improvement and human settlement relocation from prone-areas	DM4	Simulation, updating, and test of inter-institutional response	FP4	Implementation of social safety nets and funds response
X_{RPh5}	Potential damage in the system of potable water	RI5	Public information and community participation	RR5	Updating and enforcement of safety standards and construction codes	DM5	Community preparedness and training	FP5	Insurance coverage and loss transfer strategies of public assets
X_{RPh6}	Damage for the road system	RI6	Training and education on risk management	RR6	Reinforcement and retrofitting of public and private assets	DM6	Rehabilitation and reconstruction planning	FP6	Housing and private sector insurance and reinsurance coverage

Note. A five-parameter morphological field that analyzes strategies to reduce physical damage in urban areas (Lantada et al., 2020).

all feasible connections and outcomes due to resource constraints. Finally, while GMA is a comprehensive method, the inputs from SMEs may not be exhaustive, as it is inherently challenging for SMEs to identify all possible parameters and conditions during facilitated discussion. Thus, all possible components may not all be identified within the model (Johansen, 2018; Ritchey, 2009b; Swanich, 2014). With that said, artificial intelligence (AI) may help alleviate most of these limitations and how in a time where AI is undergoing significant expansion due to the broad adoption of Large Language Models, there is an opportunity to integrate standard approaches like GMA with new AI powered tools.

4 Key Findings from the Environmental Scan

4.1 Notable contributions and advancements in the use of GMA

GMA is ultimately a flexible generic emergency management tool that supports decision-making processes by organizing complex information in a structured way. GMA's strength lies in gathering various inputs, organizing them systematically, and allowing users to consider all options and possibilities before making decisions. As GMA simply facilitates structured thinking, it can be adapted to other EM sectors beyond natural disaster management, including PHEM. Although most applied examples come from natural disaster management, GMA's role remains the same: to bring structure, clarity, and thoroughness to decision-making by en-

Figure 1.7: Scenario and decision-making tool model

Factors	Hypothesis			
	H1	H2	H3	H4
Comprehensive document of earthquake crisis	Compilation of comprehensive document for earthquake crisis (76%)	Injection of earthquake crisis management principles in all projects (15%)	Failure to formulate a comprehensive earthquake crisis document (5%)	Keeping up with the current trend (4%)
Earthquake alert systems	Design and construction of earthquake alert systems (40%)	Purchase of earthquake warning systems (50%)	Lack of attention to purchasing and designing earthquake warning systems (5%)	Keeping the earthquake alert strategy current (5%)
Strengthening the buildings	Increasing the retrofitting of buildings (63%)	Demolition of unstable buildings (17%)	Lack of attention to retrofitting buildings (10%)	Persistence of the status quo (10%)
Construction in the vicinity of faults	Preventing construction at fault (80%)	Prevention of the construction at seismic zones (14%)	Relocation and integration of earthquake-prone population centres (6%)	Continuation of the existing status of building construction (0%)
Telecommunications	Development of modern telecommunications infrastructure between people and government (60%)	Development of telecommunication infrastructure among the people (16%)	Development of telecommunications infrastructure among government agencies (20%)	Persistence of the status quo (4%)

Note. A portion of a five-parameter morphological field where scenarios were generated and analyzed for earthquake disaster management (Hosseinikhah & Zarrabi, 2021).

suring every relevant factor is considered and all potential strategies are explored. Findings from this research are shown in Table 1 are relevant to PHEM due to their broader applicability to EM. If GMA is effective within other sectors of EM, it can reasonably be inferred that these findings are equally applicable to PHEM. The examples below identified applications of GMA organized into the following categories:

1. Scenario modelling tool for the management of natural disasters

2. Decision-making tool for EM teams

3. Strategy development and prioritization tools (e.g., risk mitigation strategies)

5 Discussion and Implications

5.1 Discussion

This environmental scan is not a critical appraisal; therefore, we will not be assessing the suitability and applicability of GMA as a method compared to current scenario development methods. With that said, this paper identified ten examples of GMA that have PHEM relevance from across seven countries and five organizations. While the findings were targeted at natural hazards, the principles and techniques employed by GMA in other sectors demonstrate its potential for adaptability and effectiveness within other PHEM activities. For example, the processes for scenario building and strategy development are consistent across different types of hazards. GMA can support these activities through its structured yet flexible analytic ap-

proach. Secondly, as a computational tool, GMA has been designed to support EM processes across multiple emergencies, making it applicable across a diverse range of PHEM challenges. Furthermore, the integrative nature of GMA encourages a comprehensive consideration of various factors and SMEs, promoting a holistic approach to EM. These aspects illustrate how GMA findings from natural hazards applications are transferable and valuable to the broader field of PHEM. Despite its underutilization in PHEM to date, GMA's proven effectiveness in other complex fields positions it as a critically adaptable tool for enhancing decision-making processes in PHEM.

The prevalence of scenario modelling as a primary application of GMA in four of the ten reviewed studies highlighted its applicability and relevance in comprehensive EM (Fernandez et al., 2006; Hosseinikhah & Zarrabi, 2021; Navrátil et al., 2019; Schneider et al., 2022). Scenario modelling enabled the users to incorporate several factors concerning natural hazards into the model (e.g., number of fatalities), providing a broader picture of an emergency and an organization's response capacity to address it. These scenarios helped identify gaps in current EM plans, thereby strengthening the most effective approaches across various sectors, including government agencies and private organizations. The use of GMA as a tool provided the basis for decision-makers to prioritize ideal scenarios that support and strategize improvements in current EM plans (Fernandez et al., 2006; Hosseinikhah & Zarrabi, 2021; Navrátil et al., 2019; Schneider et al., 2022).

The identification of strategy development and prioritization in five of the ten articles underscores GMA's role in risk reduction and disaster preparedness (Fernandez et al., 2006; Lantada et al., 2020; Ritchey, 2006; Ritchey et al., 2004; Roy & Garg, 2014). These articles examined risk reduction strategies and compared disaster preparedness and mitigation plans. Through the comparisons of these plans, organizations developed new strategies

aligned with best practices in disaster risk management. This highlights the adaptability of GMA as a tool in evolving EM strategies to meet changing needs and contexts of an emergency (Fernandez et al., 2006; Lantada et al., 2020; Ritchey, 2006; Ritchey et al., 2004; Roy & Garg, 2014).

Finally, six articles utilized GMA to create a decision-making support tool for emergencies (Fernandez et al., 2006; Lantada et al., 2020; Ritchey et al., 2004; Roy & Garg, 2014; Savchenko, 2018; Watson et al., 2015). GMA provided a framework that presents an organization's emergency plans and mitigation strategies. For instance, it was used to develop effective mitigation strategies for natural hazards and assist in mitigation programs and funding (Lantada et al., 2020; Roy & Garg, 2014). These frameworks were used by EM stakeholders to make decisions during an emergency to plan, manage, and react effectively. These of GMA as a decision-making support tool highlights its applicability to support an organization's emergency preparedness and response activities (Fernandez et al., 2006; Lantada et al., 2020; Ritchey et al., 2004; Roy & Garg, 2014; Savchenko, 2018; Watson et al., 2015).

5.2 Identification of gaps or areas requiring further research or development

Table 1 references examples of how GMA was applied to the development of scenarios that may have PH relevance in a Canadian context. Based on these examples, GMA is broadly applicable to scenarios developed specifically for PHEM. However, literature has revealed areas requiring further research and development, for example, examining the integration of GMA and its impact with other methodologies in EM (Ritchey, 2009b). It has been found that GMA can be an initial step that provides input for other modelling methods such as Multi Criteria Decision Analysis (MCDA). Specifically, GMA can complement Analytic Hierarchy Process (AHP), a specific

MCDA method. AHP requires synthesizing internally consistent solutions (e.g., scenarios) through a hierarchy of goals and criteria, which can be facilitated through GMA. GMA can provide a variety of solutions which AHP can then systematically compare to determine the best solutions for complex problems (Ritchey, 2009b). While GMA effectively explores complex problems, MCDA enhances decision-making by allowing the evaluation and prioritization of key criteria such as health impact and feasibility (Zhao et al., 2022). The integration improves the clarity and practical applicability of the model's outputs, making GMA more user-friendly and actionable (Ritchey, 2009b; Zhao et al., 2022).

5.3 Implications of GMA in PHEM for Decision-Makers and Practitioners

In PHEM decision-making, the available data, tools, and priorities often involve a high level of uncertainty (Larsson et al., 2010). Thus, choosing a suitable method to manage this uncertainty is essential (Larsson et al., 2010). GMA supports decision-makers and practitioners within PHEM. As illustrated in Table 1, GMA supports scenario and strategy development, which can serve as a decision-making support tool for PH issues. For instance, the diverse set of scenarios that GMA provides can be used to support EM exercises and training to increase preparedness for emerging threats (Public Safety Canada, 2025). Furthermore, capacity issues have prompted PH systems at multiple levels of government to look for methods that make the best possible use of limited resources (Canadian Institutes of Health Research, 2021; Public Safety Canada, 2025). GMA is one such method that is not too intensive while allowing public health units to handle a diverse risk environment with limited resources. In summary, GMA has demonstrated effectiveness in decision-making by identifying various connections and outcomes for proposed problems, thereby fostering a more holistic, efficient, and

multi-sectoral approach to addressing issues in PHEM.

GMA supports a multidisciplinary group of decision-makers in assessing the importance and significance of numerous conditional pairs and the compatibility of each pair in relation to their impact (Ritchey, 2009a). GMA fosters organizations to uncover innovative solutions by leveraging the diverse insights of SMEs, particularly when navigating complex problems that interconnect with other sectors (Garvey, 2017). In closing, SMEs engagement within GMA mitigates the risk of erroneous decisions by comprehensively filtering out inconsistent relationships within the models, thereby enhancing the reliability of the decision-making process (Garvey, 2017).

Table 1.1: Contributions and Advancements of GMA

Author(s)	Country or Organization(s)	Study Purpose	Contributions and Advancements
Scenario development tool			
Navrátil et al., 2019	Slovakia	Create a scenario model in a participatory manner. Identify new sustainable forest management models incorporating multiple natural, social, or economic uncertainties.	• Increased participation (e.g., forest owners and other stakeholders) and scope in forest management levels. • Created scenarios that may occur within 30 years, allowing stakeholders to set plans for further development and identify patterns of effective strategies. • Model allows for new methodological possibilities in dealing with the increasing demands of environmental health risks like climate change and other extreme weather events on forest management.
Hosseinikhah Zarrabi, 2021	Iran	To create a comprehensive earthquake management plan to reduce human and financial loss.	• Identified earthquake crisis management scenarios to assist in decision-making and effectively implement strategies (e.g., earthquake warning systems). • Preventive scenario model identified the importance of city-level approaches and areas of improvement to help increase resilience in the affected areas.
Schneider et al., 2022	German Aerospace Center	Examine current knowledge to identify emerging risk scenarios within emergency management.	• Model accommodated any novel observations such as damage type and cause, occurring in real-time. • GMA, in combination with the Bayesian Network (BN) model, enabled the estimation of the probability of the overall scenario that enhanced situational awareness in an emergency. • Model provided a broader picture of an emergency through information gathering from various scenario factors.

Author(s)	Country or Organization(s)	Study Purpose	Contributions and Advancements
		Decision-making support tool	
Savchenko, 2018	Ukraine	Generate models for preventing and mitigating social disasters (e.g., floods and typhoons).	• Used for evaluating preparedness (e.g., testing the effectiveness of current measures for disasters), monitoring (e.g., activation of early warning systems), and response towards a disaster (e.g., best practice for mitigation during a crisis). • Aided in control and management during a crisis as a decision-making support tool.
Watson et al., 2015	Foresight Tools for Responding to cascading effects in a crisis – European Commission project	Create a conceptual model to understand the interdependencies of cascading crises (e.g., Japanese Nuclear Power Plant failure due to previous earthquake and tsunami events).	• Used as a decision- support tool to aid crisis managers in planning and reacting to cascading events. • Discovered disparities between vulnerability and resiliency factors using case studies. • Assisted in determining which systems are connected to various crisis and disaster responses and are affected by cascading effects in an emergency.
		Strategy development and prioritization tool	
Ritchey, 2006	Japan	Create a prototype of a multi-hazard disaster risk reduction model.	• Enabled comparison and identification between multiple disaster risk reduction strategies, and mitigation and preparedness measures for hazards (e.g., hurricanes).
		Strategy development/prioritization tool and Scenario development tool	
Fernandez et al., 2006	United Nations Office for Disaster Risk Reduction Earthquake Disaster Mitigation Research Center Swedish National Defence Research Agency	Build a prototype of a Disaster Risk Management (DRM) model for earthquake management.	• Developed realistic strategies and tools for decreasing disaster risk and determining best practices in DRM for various cities. • While the model was focused on earthquake management, the design includes a multi-hazard approach and thus can apply to other natural hazards. • Scenario development included risk reduction strategies, mitigation, preparedness, planning measures, as well as unsafe physical conditions and practices.

Author(s)	Country or Organization(s)	Study Purpose	Contributions and Advancements
Strategy development/prioritization tool and decision support tool			
Ritchey et al., 2004	Sweden	Aid in crisis management for extreme societal events.	• Designed as a strategic decision support tool for municipal, regional, and national government levels. • Enabled ability to identify extreme societal events, management capacities to handle those events, and set crisis management priorities. • Discovered strategies for improvements concerning a national security strategy.
Lantada et al., 2020	Venezuela	Strategy development and prioritization for high seismic regions. • Decision-making tool for public stakeholders at the local level.	• Used as a decision-making tool to implement effective risk mitigation strategies for urban areas dealing with natural hazards. • Determined the need to adjust public administration priority, including a higher focus on risk reduction strategies, specifically for earthquakes, and some focus on financial protection and governance strategies.
Roy Garg, 2014	India	Identify elements of risk and create multiple risk reduction strategies.	• Created a multi-hazard risk reduction model that identified and compared risk reduction strategies and disaster preparedness and mitigation plans. • Identified gaps in disaster reduction methods. • Assisted in decision-making for the allocation of mitigation programs and funding.

*N*ote. This table provides a summary of each study and how GMA has been applied in natural hazard(s) for a country or organization (e.g., scenario development). While this paper primarily focuses on GMA's role in scenario development, its utility extends beyond this application. GMA has demonstrated broader value in strategy development and decision-making, including supporting the prioritization of risk mitigation efforts and guiding decision-making processes during crises. These applications allow stakeholders to make informed decisions and adjust strategies to address threats.

6   Conclusion

6.1   Conclusion

PHEM protects the health systems and population health by managing complex emergencies through various knowledge, techniques, and principles (Rose et al., 2017). GMA can support PHEM through scenario modelling, strategy development and prioritization, and decision-making. Furthermore, GMA, informed by SMEs, can support PH agencies through a comprehensive process to examine complex problems that guide decisions and strengthen PHEM. Given the increased frequency, intensity, and impacts of PH emergencies, there is a need to continually adapt current tools to mitigate the negative impacts of disasters, improve outcomes, and boost national resilience. Thus, the capability of GMA to support PH agencies in enhancing EM planning, fostering collaboration among partners and stakeholders, and incorporating innovative solutions into practice is instrumental in tackling challenges within PHEM.

6.2   Closing remarks and recommendations for future inquiry and practice

Modular scenario development using GMA is compatible with modelling approaches and could serve as a first step in advanced scenario generation. GMA can support PHEM by bolstering the decision-making and planning processes within the intricate landscape. GMA is a modelling method employed by various countries and organizations to analyze and structure complex problems within the realm of EM.

GMA features can be extended beyond scenario modelling to support decision-making and planning in PHEM. In times of crisis when numerous components demand consideration, GMA can provide valuable insights integral to EM. While this is contingent on the GMA model being pre-built as a PHEM tool, the model can be quickly deployed during an emergency to support decision-making. Moreover, GMA can also enhance other methodologies, such as MCDA, thereby reinforcing the evaluation and robustness of various PHEM tools.

Future research and practice can involve applying GMA within a PHEM lens (e.g., health-centric scenarios). Ongoing research, spearheaded by the Public Health Agency of Canada, is focusing on cyclical events such as wildfires, floods, extreme heat events, and extreme weather events through the lens of PHEM within the Canadian context. Other research studies could also look at building scenarios for PH emergencies triggered by infectious and non-infectious agents. Furthermore, future applications will involve the use of artificial intelligence (e.g., GPT-4) to decompose scenarios by producing the morphological field. In conclusion, integrating GMA with other PHEM methodologies can significantly enhance the robustness and effectiveness of EM methodologies, ensuring that GMA is not only interoperable but also a cornerstone in the broader PHEM framework.

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A Gendered Emergency Framework: Integrating Sex, Gender, And Equity Into Emergency Management

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Abstract

As disasters, climate emergencies, public health crises, security threats and conflicts increase in Canada, so do concerns about their inequitable impacts. Canada's 2023 Chief Public Health Officer's Report, Creating the Conditions for Resilient Communities: A Public Health Approach to Emergencies, highlighted the unequal impacts of emergencies in Canada and advocated for an improved public health and health promotion response. This article describes the Gendered Emergency Management Framework (GEM-F), developed as a tool to support emergency personnel, planners, and policy makers in integrating sex, gender, trauma and equity-informed considerations across the emergency management continuum, applicable to climate disasters, pandemics or conflict situations. The GEM-F is built on academic evidence, grey literature, and consultations with Canadian and Australian experts, and suggests the integration of a sex and gender-based analysis plus (SGBA+) lens, and trauma-informed, equity-oriented, and gender transformative approaches into all phases of emergency management. The consistent application of the GEM-F in policy, practice and training could improve preparedness and post-event outcomes, along with overall gender and health equity.

Keywords: emergency management, gender equity, health equity, disaster management, sex and gender.

1 Introduction

The frequency, intensity, and severity of emergencies in Canada is growing, and public health and health promotion initiatives are being called for to build resilience, strengthen

collaboration, and respond to inequitable impacts on physical, mental, and community health (Public Health Agency of Canada, 2023). In the years since the 2023 CPHO report, Canada has experienced heightened awareness of all types of emergencies and disasters, as well as increased security threats, leading to the need for more comprehensive preparedness and protection initiatives. In general, there is a growing call for raising awareness about gender and social vulnerability in federal, provincial, and territorial emergency planning documents (Slick et al., 2022). Gender is a fundamental social determinant that poses differential risks and vulnerabilities for women, men, and gender diverse people (Brabete et al., 2021; Enarson et al., 2018; Erman et al., 2021; Greaves & Poole, 2023; Parkinson et al., 2023; Slick & Hertz, 2024) and intersects with other social, economic, biological, and structural factors to compound risks, exposures, and impacts. Sex-related factors including physiological, anatomical, neurobiological or genetic factors affect female and male bodies' responses to emergencies, pandemics, or disasters differentially. Gender has long been recognized as affecting personal preparedness efforts, risk perception, psychological impacts, roles and expectations during emergencies and in responses (Enarson, 2008), and resilience during conflict and post conflict recovery (Juncos & Bourbeau, 2022). This article responds to these by suggesting the consideration of sex, gender and equity related factors at every stage of emergency response. Further, aspiring to an intersectional gender transformative approach to emergency management that proactively improves gender equity among all groups, along with preparing for and responding to emergencies is essential, and can be taken up by policy makers, emergency management practitioners, educators and researchers in an array of emergent situations. Gender transformative approaches would mean that emergency management not only responds to emergent needs, but also considers its contributions to equity among genders, racial/ethnic, disability, income and age groups.

2 Background

Following the United Nations Landmark resolution on Women, Peace, and Security in 2000 (United Nations Security Council, 2000), in 2008, there was a call for gender mainstreaming in emergency management in Canada. This would have integrated considerations of gender into all aspects of emergency management, as per an implementation framework that identified opportunities for fostering resilience through capacity building, communications, monitoring and evaluation, collaborative leadership, and resource allocation (Enarson, 2008). More recently, Canadian research and advocacy has highlighted the differential effects of COVID-19 on women (Gladu, 2021; Robson & Tedds, 2022), the importance of preventing and anticipating the increased risk of gender-based violence (GBV) during emergencies (Brabete et al., 2021; Slick & Hertz, 2024), recognizing anti-violence services an essential (Canadian Women's Foundation, 2022; Canadian Women's Foundation et al., 2020; Valoroso et al., 2023), and understanding impacts on gender diverse populations (Slick & Hertz, 2024). Efforts have been made to integrate gender and women in planning on peace and security in Canada (Government of Canada, 2024a) and in some global efforts in order to improve conflict resilience by involving and empowering more women.

This article outlines the Gendered Emergency Management Framework (GEM-F), a tool that will help planners, managers and policy makers integrate sex, gender and equity into emergency and disaster management, with a particular emphasis on improving women's health and resilience. In addition to incorporating a gender transformative, equity-oriented, approach, it also suggests a trauma-informed approach to developing a more robust and resilient emergency management system in Canada. Trauma-

informed approaches assume the universality of some form of trauma among those experiencing emergencies, and therefore incorporates principles of safety, collaboration, choice and strengths based responses, wherever possible (Poole et al., 2013).

3 Methods

We conducted a rapid review of evidence on sex, gender, equity and emergencies and a rapid review of reviews of GBV and emergencies. Both of these evidence reviews followed the protocol of Tricco et al, (Tricco et al., 2015).

The first review was based on the overarching research question: "What do we know about sex, gender, ethnicity, age, socioeconomic status and/or disability and impacts of emergencies and emergency interventions?" In our academic search, we utilized definitions of emergencies and disasters based on the 2023 CPHO report, regarding an emergency as a serious event that requires immediate response to mitigate the impacts on health and safety of people and damage to property, whereas a disaster causes significant disruption and exceeds the capacity of the affected area to respond or recover (Public Health Agency of Canada, 2023). The distinction between the two is seen as subjective (Public Health Agency of Canada, 2023). We included emergencies resulting from the following hazard types: geological (e.g., earthquake, landslide, tsunami) , biological (e.g., infectious and communicable diseases, food-, vector-, and water-borne illness, zoonotic diseases), and meteorological and hydrological (e.g., drought, flood, heat, hurricane, wildfire) (Public Health Agency of Canada, 2023). After title and abstract screening of 2,548 articles, 336 full-text studies were assessed for eligibility, and 140 studies were included for data extraction and synthesis. In both title and abstract screening and the full-text screening stages, all researchers involved in the screening initially screened a subset of papers and

then discussed and resolved any discrepancies. Once consensus was established, the remaining papers were screened independently.

The second rapid review of reviews of GBV and emergencies was based on the research question: "What do we know about gender-based violence and impacts of emergencies and emergency interventions?" After title and abstract screening of 140 articles, and consensus reached among screeners based on a subset, 86 full-text studies were assessed for eligibility, and 52 studies were included.

To be thorough, we broadened the search to include a review of grey literature of gender and emergency resources. In searching grey literature, we included key organizational websites, and undertook advanced Google searching, snowballing and citation chaining, enabling us to find items such as checklists, guidance, government reports, resources, policy statements, handbooks, presentations, speeches, books and some additional articles. We continued to iterate the search after partner meetings and expert consultations, ultimately reviewing 135 items.

Hence, the framework drafting was informed by a total of 327 sources including journal articles and pieces of grey literature. We applied a sex and gender based analysis plus (SGBA+) (Centre of Excellence for Women's Health, 2024) to both the academic and grey materials to highlight key evidence and expertise from this wide range of sources. SGBA+ is a method useful for identifying and assessing the sex/gender/equity related content in the materials and analyzing its potential impact. In this way, we identified examples, approaches and indicators, reflecting domestic and international work that could advance research, policy, and practice enhancing gender and equity in emergency management. We created narrative summaries of the articles included in the rapid review and the GBV review of reviews, as well as narrative reports of the grey literature.

After analyzing these data, we drafted key elements of the framework, based on evidence and examples of how sex and gender-

based factors and examples affect emergency management. In collaboration with experts specializing in gender equity, emergency response, and disaster management, including Gender and Disaster Australia, a world leader (www.genderanddisaster.com.au) and our Canadian partners, we iteratively developed the draft framework diagram, and in that process were referred to additional examples, and sources. Using the third draft as a basis we held two consultations with 17 experts and organizations, representing a range of knowledge and experience, from emergency management, education, research, aid agencies, women's health and leadership, and national and provincial organizations. Ultimately, we developed a final version (Figure 1) supported by key examples and considerations for inclusion in the GEM-F materials.

4   Using the GEM-F

The GEM-F diagram illustrates a multi-faceted and multi-step process for assessing planning, policy and evaluation of emergency management. The diagram first draws attention to the overarching impact of biological, social and economic determinants on individual and collective health, including in all kinds of emergency situations.

The diagram is encircled by a sex and gender-based analysis plus (SGBA+) underlining the impact of both sex and gender on the experiences and outcomes of diverse groups in emergencies. In addition to being a research tool, SGBA+ is also a lens that is applied to all health-related initiatives in the federal government when assessing issues, policy and practice in a wide range of topics (Health Canada, 2023). In the GEM-F this ensures that data and information pertaining to emergency management is analyzed for differential impacts on women, men and gender diverse people. This lens is useful in practice, as all data collected to support emergency responses ought to be sex and gender disaggregated, ideally by age, race/ethnicity,

ability, and socioeconomic status, and that these analyses underpin emergency management.

SGBA+ processes when applied to planning, are iterative, incorporating and building upon emerging evidence and practice, and also encouraging prediction of, and speculation about, future impacts of events and responses on men, women, and gender diverse populations (Centre of Excellence for Women's Health, 2024). SGBA+ is a process that can be integrated with workforce training, and that could build improved emergency management and quality improvement with continued usage. Related to this is the requirement of the Canadian Institutes for Health Research (CIHR) to integrate sex and gender into all research (Canadian Institutes of Health Research, 2021) in order to produce more differentiated and accurate evidence. Without building evidence, and collecting and analyzing disaggregated data and information, it is more difficult to carry out SGBA+ and to build better emergency management systems.

The SGBA+ element surrounding the GEM-F suggests that an understanding of both sex and gender-related mechanisms and factors as they affect the outcomes of emergencies is a key requirement in emergency management. This includes acknowledging the impact of sex-related factors, such as hormones, genes, neurobiology, physiology, and anatomy. For example, disparities in mortality from respiratory and cardiovascular outcomes, that can vary by age, disaster type, and context (Abadi et al., 2022; Figgs, 2020; Jia Coco et al., 2017; Lawrence et al., 2019; Salvati et al., 2018). Sex-related factors are also key in biological emergencies such as the COVID-19 pandemic, where research points to sex-related differences in immune responses and morbidity among males and females (Mauvais-Jarvis, 2020). Some studies on maternal exposure and child health show that experiencing disasters during pregnancy can, in some cases, lead to maternal physical and mental health issues, adverse birth out-

Figure 2.1: Figure 1 The Gendered Emergency Management Framework (GEM-F)
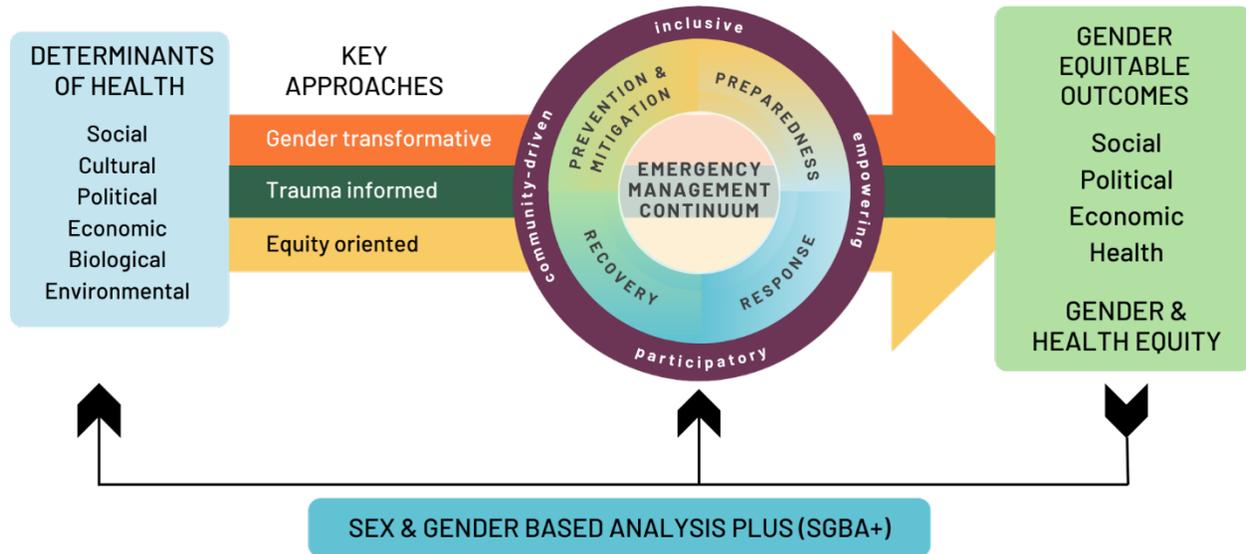
Note. The Gendered Emergency Management Framework (GEM-F) facilitates gender equitable planning and evaluation of emergency management responses.

comes (Afzal et al., 2024; Evans et al., 2022; Huang et al., 2023; Zhang et al., 2024), and sex-specific changes in children's genetic expression, hormones, neurodevelopment, and behavior (Cao-Lei et al., 2021; Laplante et al., 2019; Li et al., 2024; Nomura et al., 2021; Yong Ping et al., 2020). In general, females are more affected by disaster-related trauma, although some studies report exceptions or comparable effects in males (Lai et al., 2021; Le Roux & Cobham, 2022; Meltzer et al., 2021; Orengo-Aguayo et al., 2019; Rezayat et al., 2020; Rossi et al., 2022; Shepard et al., 2017; Turan et al., 2022; Witt et al., 2024).

Gender-related factors, such as roles, relations, identities and institutional practices, also affect people's experiences in emergencies. For example, traditional gender roles are often reinforced during disasters (Cocina Diaz et al., 2024), resulting in increased caregiving responsibilities and losses in employment or education (Ayittey et al., 2020; Christie et al., 2022; Flor et al., 2022; Green et al., 2021; Trentin et al., 2023) that affect women disproportionately (Ayittey et al., 2020; Connor et al., 2020). Traditional ideas of mas-

culinity and men as 'heroes and protectors' are often reinforced, defining roles and expectations in emergency response and recovery (Slick & Hertz, 2024), and creating barriers to accessing emotional and mental health support (Gender and Disaster Australia, 2023b). There is also usually a rise in GBV during emergencies (Agrawal et al., 2023; Bell & Folkerth, 2016; Logie et al., 2024; Murphy et al., 2023), including intimate partner violence (IPV) and coercive control (Bhuptani et al., 2023; Brabete et al., 2021; Kim & Royle, 2024; Medzhitova et al., 2023; Trentin et al., 2023).

Sex and gender interact to produce real life experiences in emergencies and conflicts, but major research gaps remain in understanding how they influence differential mortality and physical and mental health outcomes, either separately or together, and what exact tailored responses are needed. For example, disruptions in accessing sexual and reproductive care, such as antenatal and postnatal care, contraception, and safe abortion (Afzal et al., 2024; Hine et al., 2024; Jeffers et al., 2022; Mukherjee et al., 2021; Ratnayake Mudiyanselage et al., 2022; Tolu et

al., 2021; Welton et al., 2020) often occur in emergencies, reflecting sex-related factors and gendered attitudes and decisions. However, sex/gender sensitive community integration (Bell & Folkerth, 2016; Jeffers et al., 2022), innovative healthcare delivery (Tolu et al., 2021), and gender-informed policies and interventions (Medzhitova et al., 2023) can address these challenges during recovery. Despite remaining evidence gaps, applying a solid and iterative SGBA+ to available evidence and data, is essential to identifying what causes or is associated with differential impacts and continuing to learn what each sector can do in response.

5 Improving the Management of Emergencies

The horizontal arrow in the GEM-F embeds three important approaches to be applied continuously throughout the emergency management continuum and in all types of emergencies/disasters. Gender transformative approaches combine the dual goals of improving emergency management while simultaneously improving gender equity (Greaves et al., 2014). This ensures that emergency responses do not diminish existing gender equity, and indeed, actively work to generate improved equity. For example, gender stereotypes, such as 'men are strong' and 'women are nurturing', can be actively countered (Gender and Disaster Australia, 2023c), and skill, interest and aspiration used to determine roles in emergencies, shifting gendered assumptions that may result in women automatically making food and men automatically clearing debris, to more balanced assignments. Gendered structural determinants such as poverty can be actively improved by creating environments and focused programs that protect and improve women's food, housing and job security during recovery, and improve women's agency, thereby embedding gender equity in emergency management and post emergency

outcomes (Simons et al., 2022).

Most emergencies, disasters and conflicts have short- and long-term impacts on mental and physical health, socioeconomic status, and community stability. Hence, it is recommended that all responses also be trauma-informed (Bloom & Farragher, 2013; Wathen & Varcoe, 2023). This approach assumes that trauma has occurred and impacted all and embeds a universal approach accordingly. A trauma-informed approach does not rest on disclosures, narratives, behaviours or diagnoses, but rather applies to all individuals, groups and communities using the principles of choice and collaboration, connection, safety and trustworthiness, and strengths based and skill building (Centre of Excellence for Women's Health, 2017; Poole et al., 2013). Taking a trauma informed approach would ensure that emergency management is grounded in trauma-informed principles, underpinning all procedures, planning, policies and actions. For example, all evacuees would ideally have some element of choice in accommodations or visiting disaster sites, and remediation planning would ensure connection and building upon community strengths as a starting point.

Finally, utilizing an equity-oriented approach prioritizes those most affected by a disaster, actively ensuring that disparities are acknowledged and factored into emergency management, through constructing tailored programs or policies. Further, emergency resources are allocated proportionately, reflecting the needs of those most affected and the size of the population of those in most need. Ensuring such responsive resource allocation requires conscious planning. For example, equitable approaches to evacuation would provide separate emergency evacuation processes for residents of women's shelters who have experienced intimate partner violence to ensure that they do not encounter their perpetrators as they relocate. Re-housing evacuees or survivors would involve prioritizing those with fewest resources and those who are most physically, mentally, or intellectually

challenged. The development of these processes and responses requires the advice and active engagement of those with lived experience and knowledge and the organizations serving them.

6 Applying these approaches to the Emergency Management Continuum

Applying an ongoing SGBA+ and integrating all three approaches—gender transformative, trauma informed, and equity informed—can enhance standard emergency management phases such as preparedness, response, recovery and prevention and mitigation efforts (See Figure 2). Each of these phases includes activities ranging from awareness and networking, planning, implementation to monitoring activities.

Figure 2.2: The Emergency Management Continuum
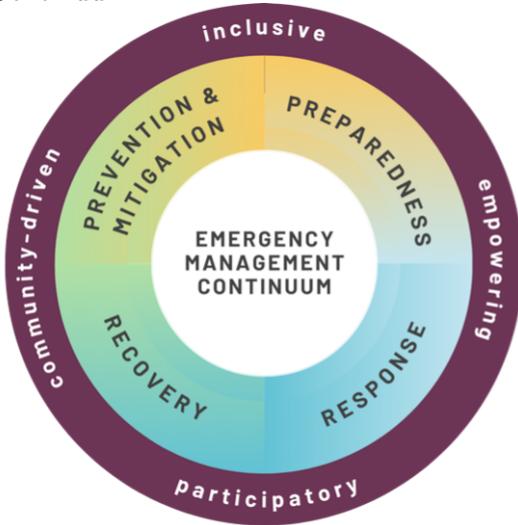
*N*ote. The engagement circle is added to this depiction of the emergency management continuum adapted from the Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2023: Creating the Conditions for Resilient Communities: A Public Health Approach to Emergencies (2023).

Figure 2 depicts the central circle of the GEM-F, illustrating the phases of emergency

management as overlapping and iterative, and surrounded by a circle articulating engagement processes. Community engagement in emergency management is key to accurate, timely, and appropriate emergency responses that are well-received and have positive impacts. Meaningful collaboration with individuals, communities, groups, and services is important. It ensures that lessons are learned from each emergency, people are empowered via participation, adjustments and tailored responses are made, and stronger foundations are created for community-driven initiatives. Diverse, experience-based viewpoints, including locally and community-based perspectives, are essential in producing effective and sensitive equity, trauma and gender informed responses. Without clear engagement, it is easy for responses to be misinformed or inappropriate, or even increase risks for some, as the actions of emergency managers may not align with local and group-specific needs.

6.1 Preparedness

Preparedness includes activities such as hazard, risk and vulnerability assessments and development of preparedness and response plans, as well as the resourcing and testing of these plans. Filtering and checking preparedness planning by using the GEM-F will immediately surface issues in preparedness related to social vulnerability and inequity.

The Canadian Centre for Safer Communities and the Canadian Women's Foundation developed a toolkit for applying GBA+ to Hazard, Risk and Vulnerability Analyses (HRVAs). The toolkit provides guidance, templates, and actionable steps for assessing risk, identifying vulnerability, and strengthening community resilience through an intersectional gender lens. Applying this lens to HRVAs can bring greater understanding to how gender and factors such as race, age, income, and ability impact risks, vulnerability, and resilience in disasters (Canadian Women's Foundation, 2024).

Preparedness also includes assessing gen-

der and risk reduction activities for specific groups, such as the approximately 15% of the population with disabilities. Employing a disability inclusive disaster risk reduction approach (Crawford, 2023) to reduce disproportionate impacts on those with disabilities is both possible and essential. According to the United Nations Office for Disaster Risk Reduction's 2023 Global Survey Report on Persons with Disabilities and Disaster, 84% of people with disabilities reported that they did not have a disaster preparedness plan, a reduction from the 2013 report, and only 8% reported that local disaster risk reduction plans addressed the specific needs of people with disabilities (United Nations Office for Disaster Risk Reduction, 2023). Recommendations include using technology, peer and social support, and taking a strengths-based, capabilities approach (Crawford, 2023) to reduce these risks.

Integrating a SGBA+ into such a disability framework could create even more meaningful preparedness actions tailored to men and women, girls and boys, and exual and gender minorities with disabilities that preserve social care connections, offer participatory planning opportunities and consider specific physical and environmental accommodations. Research suggests that this is needed, as women with disabilities are less likely to engage in preparedness due to a set of intersecting factors including poverty, stigma, lack of political power, caregiving, and marginalization (Gartrell et al., 2020) and sheltering plans for people with disabilities during active conflicts are often overlooked.

Such complex vulnerabilities may be addressed using disaggregated data. The Inclusive Resilience project undertaken by the Canadian Red Cross conducted a risk assessment to understand where disproportionate vulnerability exists in order to target disaster risk reduction activities and strengthen flood resilience among specific communities at increased risk. To do this, they combined socio-economic vulnerability data with flood exposure risk analyses to map areas of con-

vergence and create an index. In analyzing vulnerability, detailed social, cultural, demographic and economic factors such as family structure, proportion of single mothers and mode of transportation were combined with data on infrastructure and the built environment. While it is necessary to be mindful of privacy concerns in small or remote communities, the tool supports tailored and targeted disaster risk reduction outreach to vulnerable communities by mapping socio-economic risk and vulnerability to floods, (Partners for Action, 2024). These are all examples of integrating an intersectional SGBA+ into preparedness.

6.2 Response

Emergency response activities include all actions taken during (or immediately before or after) an emergency or disaster such as implementing emergency response plans, conducting emergency communications, coordinating resources, and working to minimize suffering and loss (Public Health Agency of Canada, 2023). All of these activities can easily incorporate a SGBA+ lens, resulting in effective tailored communications that eliminate gender stereotyping and acknowledge the importance of sex/gender and equity considerations. For example, Australia's National Gender and Emergency Management (GEM) Guidelines identify the creation of gender sensitive communication and messages as one of three key areas of focus in disaster management (Gender and Disaster Australia, 2023c). Harmful gender stereotypes are avoided or actively challenged, ensuring that men are not portrayed solely as risk-takers or heroes, nor women only as caregivers.

Similarly, information on the specific sex/gender impacts of disasters, along with information on anti-violence services, maternal, sexual, and reproductive healthcare, mental health support, and gender-specific substance use services need to be made readily available. During the Fort McMurray wildfires, Safely Fed Canada worked with a local

government to offer a separate space within evacuation facilities for parents and children, called the Baby and Child Unit, which offered supports related to feeding, play, sleep, and hygiene, as well as emotional support for caregivers. This illustrates how evacuation facilities can ameliorate the disproportionate burden on women as caregivers and reduce maternal stress during disasters, thereby improving maternal, fetal, and child health (Gribble et al., 2023). Importantly, during the response phase, anti-violence organizations must be supported as essential services (National Academies of Sciences Engineering and Medicine, 2024), and outreach workers who work with people experiencing houselessness are supported to continue to provide assistance (Sundareswaran et al., 2015).

The GEM-F helps us understand how to better respond in emergencies. When gender issues are ignored, inequities and harm can result. For example, emergency housing aid based on head-of-household registries in the USA forced some women fleeing violence to cohabit with an abusive partner (Medzhitova et al., 2023). Similarly, in Canada and other countries, during the COVID-19 lockdowns, women faced disproportionate job losses due to overrepresentation in part-time and informal work and caregiving responsibilities at home (Ayittey et al., 2020; Christie et al., 2022; Connor et al., 2020; Flor et al., 2022; Gladu, 2021; Green et al., 2021; Mũrage et al., 2024; Robson & Tedds, 2022; Trentin et al., 2023). Using the GEM-F can directly ameliorate some of these results.

6.3 Recovery

The 2023 CPHO report notes that recovery "is seen as a time to return to, or improve upon, the way things were before an emergency" (Public Health Agency of Canada, 2023, p. 69). Recovery includes a wide range of activities from infrastructure, roads and housing reconstruction, support for continuity of health and education services, and restoration of water and sanitation services.

According to the Asian Development Bank, "Best practice planning for restoration and reconstruction of lifeline community infrastructures takes into account the specific needs of both women and men. Restoring infrastructure supports women's economic empowerment through increased access to income generating activities, strengthened mobility, and access to a variety of services" (Asian Development Bank, 2014, p. 7). A strong SGBA+ is essential to all of these, often long-term efforts, and can also directly address sex and gender specific needs and underlying causes of and contributing factors to gender inequality and overall inequity.

Disaggregated data collection is essential as a basis for shaping recovery plans that consider a wide range of sex, gender and equity factors and identify gender transformative recovery priorities. Recovery means looking ahead to create information and communication that highlights the gendered impact of the emergency and actively plans for gender sensitive recovery initiatives that improve gender equity. Collaboration across sectors can be fostered to achieve progress on policy goals and the building of resilience in this phase, where women are key members of developing networks. Ongoing recovery can utilize the community networks that pre-existed or spring up post disaster, to help prepare officials to make necessary adjustments.

Equitable recovery is when policies, practices, communications, and distribution of resources are impartial, fair, just, and proportionately responsive to the needs of all impacted community members. Local officials, community leaders, and partners can achieve equitable recovery by addressing systematic recovery barriers and ensuring that all groups in the community can meaningfully participate in and benefit from recovery planning processes, projects, and decision-making (Federal Emergency Management Agency, 2023, p. 1).

A gender transformative approach to recovery directly and explicitly considers im-

proving gender equity in the course of recovery decision-making. For example, services such as childcare can be prioritized as essential and critical to restore, freeing up mothers to participate fully in recovery action. A report examining principles of the Women, Peace, and Security framework (WPS) in disaster response notes that re-entry to communities is often focused on infrastructure and safety – not on access to essential services – which causes gaps in critical services (Fleming et al., 2024). Ensuring future responses are improving gender equity along with ameliorating emergencies depends on the quality and depth of recovery planning, such as economic recovery programs that recognize women's unpaid, caregiving and informal care work and account for disaster-related job loss or precarious employment (Scott, 2023; Sultana & Ravanera, 2020). The distribution of relief and recovery programs and services should also ensure that women and girls are directly reached and the long-term impacts of disasters on them are monitored.

Achieving gender transformative resilience and recovery is a challenge. There is much scope for resilience building and recovery efforts to become gender transformative, where initiatives upend 'business as usual', question gender roles, or the systemic nature of gendered power especially in conflict situations (Juncos & Bourbeau, 2022).

6.4 Prevention and Mitigation

Strategies and activities to prevent a disaster or emergency, or reduce its impact, are important for long-term resilience building and community protection. In this phase, actions aimed at the drivers and root causes of inequity and direct action on the determinants of health are important. It is a chance to align emergency management activities with broader community, population, and national-level strategies to reduce health inequities.

The Gender Action Plan to Support Implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030 is a stellar example of such an approach. It aims to increase gender-responsive approaches to disaster risk reduction, noting "women's organizations and other gender equality and inclusion stakeholders play a pivotal role in disaster resilience, advocating for gender equality and localizing efforts" (United Nations Office for Disaster Risk Reduction et al., 2024, p. 1). This clear and compelling international guidance offers several key objectives for integrating a gender lens, and key actions for integrating gender into policy and practice. Again, of foremost importance is collecting sex/gender/equity/age/ability/race/income disaggregated data in systems and carefully using such data for risk assessment and risk reduction, without violating the privacy of small sub-groups. This includes engagement, indicator development, and gendered budgeting in accordance with risk, as well as ensuring access to sexual and reproductive health care and violence services (United Nations Office for Disaster Risk Reduction et al., 2024).

Prevention can be aimed at specific issues, such as gender-based violence. The Canadian Women's Foundation convened women's and GBV sectors to identify priorities to "Shockproof" communities against GBV during emergencies. Eight priority areas were identified that include strengthening food and housing and income security, enhancing system navigation and infrastructure, and integrating GBA+ in emergency management planning. Addressing these basic social determinants of health, in the context of GBV establishes important groundwork for improving overall gender equity (Canadian Women's Foundation, 2022).

The prevention and mitigation phase offers an opportunity to strengthen and innovate. Prevention efforts can minimize impacts of disasters and reduce their impact. For example, the Build Change initiative develops disaster resistant housing to equalize resilience by developing housing based on micro financing and cultivating investors. The Build

Change initiative was founded by a woman in the USA who is a skilled brick, block, and stone mason to initiate building resilient housing with specific emphasis on the disproportionate impact of disasters on women. This initiative involves women directly and engages with skill development to offer gender transformative solutions in disaster preparedness and resilience.

Training and education for public health and emergency management professionals is a critical component of prevention and mitigation. This is an opportunity to highlight differential impacts of emergencies reflecting sex, gender, and equity factors that affect exposure and harm. It is also an opportunity to bring different sectors together, in a non-emergency setting, to plan and exchange knowledge and wisdom. Standards can be developed together, and progress measured against other major priorities. In Canada, for example, the 10-year National Action Plan to End Gender-Based Violence and Calls for Justice from the National Inquiry into Missing and Murdered Indigenous Women and Girls are examples of overarching strategies on which to draw.

7   Discussion

Sex and gender related factors interact in shaping the impacts of emergencies, disasters, and conflicts, and intersect with factors such as age, disability, race, income, and housing status. Integrating these factors in planning and policy will improve all phases of emergency management and contribute to more equitable impacts and improved resilience. While acting on these issues in practical and emergent situations is a challenge, the GEM-F raises awareness of the need to shift thinking and introduce more sensitive approaches to all phases of emergency responses.

Some practical tools have been developed to further these approaches over the last decade by Gender and Disaster Australia (GADAus), a global leader in bringing aware-

ness to how gender and intersecting factors contribute to inequitable impacts of emergencies. GADAus has developed national guidelines for gender and emergency management (Gender and Disaster Australia, 2023c) with an actionable checklist (Gender and Disaster Australia, 2023a) and have trained national emergency management personnel on the integration of gender and equity into their work (Gender and Disaster Australia, 2025). They have conducted evidence reviews on women, men and masculinities, GBV in the context of disasters, long-term resilience building, Indigenous approaches, and women's leadership. Such coordinated initiatives by a permanent organization have drawn sectors together and sparked a national model for change that could be emulated in Canada.

On a global level, various aid organizations have integrated gender into peace building and security initiatives, conflict preparedness and protection and continue to view resilience through a gender lens. The WPS framework has been utilized in developing cross-border disaster response scenarios in Canada (earthquakes in BC) and Mexico (hurricane at the USA-Mexico border) with a view to integrating WPS principles into emergency response systems. The principles outlined in Canada's framework for WPS (Government of Canada, 2024b) can be easily combined with official emergency planning documents, policies and standards.

Applying the GEM-F in Canada while deriving plans, evaluating outcomes, or undertaking preparedness and mitigation can similarly focus thinking on ameliorating gender and health inequities in a wide range of situations. While research gaps persist in understanding the full scope of these impacts, initial moves have been made to consider these differential impacts by groups and exposure levels, and the direct implications for emergency preparedness, response, and recovery strategies. Expanding this perspective in Canada is both overdue and pressing and will directly contribute to responding to the 2023 CPHO report on emergencies, inequities and

resilience.

The GEM-F can assist with filtering plans and policies for these issues, as well as identifying issues of risk. For example, disaster-related IPV risk factors such as housing displacement, loss of services and weakened social networks, can be repaired by sensitive disaster responder training, and improved planning and housing policies (Medzhitova et al., 2023). Efforts to employ women and sexual and gender minority individuals and increase the overall diversity of staff and leadership at the organizational level are also important, as reducing the 'masculinization' of emergency management is critical (Gender and Disaster Australia, 2023b; Melgar, 2020). The GEM-F can help to surface all related issues, risks and potential ameliorations, and is relevant in emergencies, disasters, and conflict situations. Underscored by an ongoing SGBA+ that invites consideration of, and speculation about, differential impacts, the GEM-F can also spur new ideas and solutions in response to such inequities.

8   Conclusion

The GEM-F is a tool for assessing and ameliorating the sex/gender/equity related impacts of emergencies and emergency management in Canada. It embeds three key approaches to not only enhance emergency management but also improve post emergency experiences. It can support emergency management personnel working on the ground in analyzing existing plans and policies and designing improved emergency management approaches. It can also be used by policy makers, educators, trainers, and researchers to address the underlying gender inequities related to emergencies and conflict situations, and to focus on shifting larger systemic and societal forces to ameliorate their impact. It can be used to pinpoint data disaggregation needs, create standards and tailored indicators, improve training programs, and generate new research questions.

However, the full engagement of those who are most vulnerable and experiencing the most inequities is key, and best accomplished through participatory engagement processes that increase individual and collective agency and transform gender systems. Working in coalitions with equity serving organizations and groups will pave the way for reducing many of the gendered, social and economic inequities currently associated with disasters and improving emergency management.

Acknowledgments

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Learning From COVID Equity Measures To Increase Community Resilience: Case Study Of A Rural Local Public Health Unit

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Abstract

During the COVID-19 pandemic, certain populations were more likely to be infected, become ill, and suffer worse outcomes than others. Additionally, the response measures put in place to prevent viral spread had disproportionately negative impacts on certain groups of people compared to others. Local public health has a role in not only mitigating the infectious disease impacts but also those related to equity. This paper describes multi-sectoral initiatives led by a local public health agency in the district of Timiskaming, Ontario, Canada to address inequities tied to the pandemic. The authors reflect on this experience to identify opportunities for rural community actors, including local public health, to build community resilience and reduce the impact of future emergencies.

Keywords: rural, health, equity, emergency, public health, resilience

1 Introduction

In rural communities, we often talk of resilience in the face of emergencies. Community resilience is "the social processes...that occur within places and that are put into action by local people to collectively learn and transform toward enhancing community wellbeing and addressing the negative risks and impacts they perceive and experience as common problems" (Imperiale & Vanclay, 2021, p. 895). Enhancing community resilience requires addressing the systemic inequities (understood as unjust and avoidable socially produced inequalities that shape health) that existed before COVID-19 such as income disparity, educational

attainment, and access to broadband internet. Although COVID-19 outbreaks continue to require response, we have also moved into the recovery phase of this emergency and authors compel us to resist attempting to return to pre-pandemic conditions and to instead prioritize transformation into more equitable societies (Mulligan, 2022; Van Assche et al., 2020). In rural communities, the competencies of local public health are well-suited to identifying and understanding issues of equity and catalyzing community-appropriate and collaborative responses (Public Health Agency of Canada, 2007). In this paper, we explore the experiences of a small public health agency working to address equity-related impacts of COVID-19, emphasizing the use of multiple types of learning to identify opportunities for both system transformation and community resilience.

Timiskaming Health Unit (THU) serves a population of approximately 32,000 in Northeastern Ontario, Canada, covering 15,125 km^2(Statistics Canada, 2023). Its largest centre has just under 10,000 people, and a third of the population is over 60 years of age (Statistics Canada, 2023). The area faces high material deprivation and housing instability (Matheson et al., 2023), with a 1.5 times higher early mortality rate in the lowest socioeconomic group compared to those in the highest socioeconomic group (Ministry of Health and Long-Term Care, 2018). Like many rural areas, three-quarters of the population report having a strong or very strong sense of community (Statistics Canada, n.d). Despite being Ontario's smallest health unit, THU is often able to use size as a strength, to nimbly change course, innovate, and evaluate new interventions.

Equity played a significant role in the COVID-19 pandemic. Various political and persistent health and social factors created disparities in people's experiences: from exposure to the virus, to treatment, to health outcomes (Public Health Agency of Canada, 2020). As framed by Bambra et al. (2021), "the pandemic has killed unequally, has been

experienced unequally and will impoverish unequally" (p. XIV). The pandemic was more than a viral outbreak; it was two epidemics occurring synergistically, compounding emergencies of infectious disease and inequalities (Horton, 2020).

Across Canada the pandemic impacted substance use, mental health, food security, gender-based violence, and financial security (Public Health Agency of Canada, 2021). However, these impacts were not uniform, often exacerbated in rural communities, and often compounded by unequal access to services, including broadband internet (Agyepong et al., 2020; Allen, 2020; Kevany & O'Donnell, 2020; Mental Health Commission of Canada, 2021; Weeden, 2020).

2 Responding to the COVID-19 Pandemic

Various public health measures were implemented to curb the virus' spread, including travel restrictions, healthcare access changes, school and business closures, physical distancing, and limited social interactions (Canadian Institute for Health Information, 2022). Masks or other face coverings were at times mandatory, and isolation was required or recommended based on exposure or symptoms (Canadian Institute for Health Information, 2022). Compliance with public health measures can be burdensome, resulting in lost income, social isolation, or an inability to obtain necessities (Harris & Holm, 1995; Holland, 2010). In exchange for an individual's willingness to assume the burdens associated with public health measures aimed at protecting society, the principle of reciprocity places an ethical obligation on society to provide supports and resources to facilitate the individual's adherence to these measures (Holland, 2010; Upshur, 2002). In this sense, there is give and take between the individual and society (Keeling & Bellefleur, 2014). However, the burdens resulting from public health measures are not experienced equally across pop-

ulations, resulting in some requiring more assistance than others to fulfill their obligations (Harris & Holm, 1995; Keeling & Bellefleur, 2014).

In Ontario, financial aid (e.g., sickness benefits, wage subsidies, grants, and loans) was offered by the federal and provincial governments. THU complemented these measures by tailoring initiatives to meet local needs and strengths. These initiatives included policy advocacy, evidence briefs, developing and distributing resources and tools, supports to local health and social services systems, and community engagement. In March 2020, THU convened a group of community agencies to identify populations at risk of being disproportionately affected by the pandemic and to determine and develop responses. The group met regularly, sharing client needs, community resources, and funding opportunities, and becoming a catalyst for initiatives. They established a dedicated webpage for pandemic-related support, took part in a rapid review of public health measures' impact on low-income individuals, and provided free cloth masks.

To address testing barriers, they coordinated mobile swabbing teams, sought funding for and supplied plexiglass retrofits to taxis and non-profit transportation, such as city buses and vehicles operated by social service organizations, and disseminated evidence-informed public facing information about infection prevention and control specific to drivers and passengers. To address concern about transmission outdoors and on playground equipment, THU provided municipalities with evidence-based guidance, outdoor signage, and resources for creating safe public spaces. With increasing summer temperatures and access to indoor public spaces still limited, rapid evidence briefs and public communications were created for property owners and municipalities to support them in providing indoor cooling spaces while reducing the risk of viral transmission. With rising opioid incidents, THU advocated to local opioid agonist treatment clinics to better support

clients who were isolating and potentially using alone.

Recognizing digital disparities, THU partnered with a local business and with social service providers to offer free technology access and advocate for improved broadband connectivity. THU launched the Connexions Timiskaming Connections (CTC) volunteer line, matching community needs with volunteers. As community spread of the virus increased, the CTC line became a mechanism through which they could provide more services.

THU staff used an informal equity screen during case management, promoting the CTC line. For people needing to isolate due to a COVID-19 exposure or positive test but experiencing barriers to do so, THU resourced and provided shelter, food, clothing, links to pharmacies, tobacco, and harm reduction. Staff worked with other housing and shelter providers to support transition out of isolation. When vaccines arrived, they used local data to plan mass clinics and, through partnership, offered free rides to and from clinics for those in need.

In addition to tailoring some of the above initiatives to local Indigenous communities, THU staff and leadership collaborated with Indigenous community leaders to co-plan, promote and deliver vaccine clinics. They also provided tools and human resources to support Indigenous community-determined approaches to screening, case and contact management, and implementation of control measures.

After five waves of the pandemic, volunteer requests declined, leading to a pause in the CTC line in April 2022. Over two years, THU staff connected 77 volunteers with 162 direct service requests. Staff distributed 2350 cloth masks at twelve mask depots, retrofitted seventeen vehicles, supplied seventy-five public signs, and provided digital devices or Internet service to 401 people. A strength of this menu of supports is that they were locally tailored; other communities may have required different interventions. Table

1 outlines THU's initiatives during the pandemic and the equity-related dimensions of exposure, treatment, and/or impact (Public Health Agency of Canada, 2021) that each initiative addressed.

3 Identifying Root Causes

The above needs for support came from deeply rooted issues like social isolation, insufficient social support networks, lack of broadband access, inadequate income, insufficient sick leave policies, and poor access to transportation. Despite Canada being a leader in knowledge on the social determinants of health, inequities in wealth and income are growing (Burkinshaw et al., 2022), which negatively impacts all of society (Wilkinson, 2011). Solutions to these types of issues involve provincial and federal policies that equalize access to education, income, safe environments, and a culture that is willing and ready to make these policies a reality.

Connections among people, termed "social capital", have societal value (Putnam, 2001) and were an important contributor to the initiatives described above. We believe that social capital enabled the creative, often after-hours collaboration among health unit staff, the desire of people to support their fellow community members, and the linkages among organizations that led to such collaborative projects. There are many types of capital in a community, each contributing to social well-being, as seen in Figure 1 (Emery & Flora, 2006). However, we have experienced a societal shift that prioritizes material wealth above other types of capital (Van der Leeuw, 2018). Our pandemic experience suggests that investing specifically in social and human capital is crucial to achieving resilient communities.

Effectively investing in social and human capital, however, requires community learning, which can be understood on three levels: single-loop (e.g., continuous quality improvement), double-loop (questioning our ap-

Figure 3.1: Community capitals framework—adapted from the original as depicted in Emery & Flora, 2006
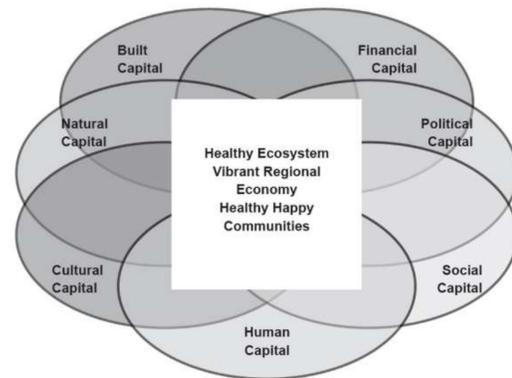
proaches), and triple-loop (open to transformative change) (Lauzon, 2017). All three levels are essential for enhancing processes, reevaluating assumptions, and transforming the systems guiding our work (Lauzon, 2017; Pahl-Wostl, 2009). Encouraging this type of learning enables us to make changes that reduce vulnerability to future disruption.

The initiatives discussed above emerged from a community-driven desire to assist one another, quickly evolving through cross-sector collaboration, even with the private sector, to mobilize support during the pandemic. Focusing on social capital and multi-level learning will build on this success to enhance both readiness for significant policy changes and the capacity to address existing disparities.

4 Future Directions

As the COVID-19 pandemic shifts to endemicity (again, while continuing to respond and mitigate), addressing inequities is vital. This involves self-reflection as an institution, nurturing social capital, building healthy public policy, and revisiting the emergency management cycle to incorporate equity-focused approaches into disruptive events and community-based recovery efforts.

Table 3.1: Equity interventions implemented during the COVID-19 pandemic, March 2020-April 2022

Interventions	Equity Dimensions Addressed		
	Exposure to virus	Treatment | Susceptibility	Impact of Measures
Provincial and Federal Policy Advocacy			
Paid sick days	•		
Food insecurity			•
Broadband internet access	•		•
Local Evidence Briefs			
Safer access to outdoor public places	•		•
Safer public transportation	•	•	•
Lower risk use of cooling rooms	•		•
Resources and Tools			
Mask depots	•		
Digital divide projects	•		•
Isolation supports	•		•
Free transportation for vaccinations		•	
Testing outreach program		•	
Physical dividers in public transportation	•		
Local Health and Social Services Collaboration			
Community Health Equity Collaborative Table	•	•	•
Advocacy for local harm reduction support			•
Screening tool to identify intimate partner violence			•
Community Engagement			
Connexions Timiskaming Connections Line	•	•	•

Reflect on our role as an institution

A community-serving institution should be aware of its influence and how it supports individuals (Russel, 2022). The initiatives described above pushed THU staff to think creatively, enhance existing partnerships, develop new ones, manage risks, try to communicate effectively, and provide support while respecting people's dignity. This approach fostered team unity and community pride among staff and embedded the organization in the community in new ways. THU staff learned the importance of incorporating equity and well-being into infection prevention and control decisions, which they are actively integrating into recovery efforts.

Public health units in rural areas have a unique ability to listen and respond, serving their communities' distinct health and wellness needs, considering local social and cultural factors. Health and well-being are primarily cultivated locally, and rural communities excel in fostering connections, flexibility, and continuous learning. Indeed, in her 2021 report, Canada's Chief Public Health Officer reinforced the importance of community involvement to achieve health equity and strengthen locally relevant public health (Public Health Agency of Canada, 2021).

While THU's response could have been strengthened by amplifying the voices of and supporting activities led by those facing these pandemic challenges, public health measures and institutional factors created barriers to such engagement. Also, the approach to evidence reviews inadvertently reinforced existing power structures by using a knowledge base to which not all people have equal opportunity to contribute and whose framing often fails to consider the influence of power (Gaventa & Cornwall, 2015). This emphasizes the need for leadership and organizational practices that prioritize diverse community voices.

Work across sectors to foster social capital

It is crucial to acknowledge that we all play a role in shaping health. This begins with reflection and dialogue, wherein we can uncover our assumptions, values, and beliefs, and collaboratively find ways to make positive change (Lauzon, 2017). For instance, local public health can foster cross-sector collaboration: local governments shape policy, urban planning, and service provision, while local organizations and private sector actors also impact health through prevention efforts. Individuals, too, contribute by supporting one another.

Aim for higher level policy shifts

Because inequalities can harm overall well-being and affect even the most well-off, reducing inequities benefits the entire community (Wilkinson, 2011). At the local level, we can influence various health determinants, but access to these determinants often depends on provincial and federal level policies. Efforts to prevent and address vulnerability involve advocating for policies that enhance access to education and income, as well as promoting healthy environments to ensure optimal living conditions for everyone. Local public health's optimal role in this multi-level governance context, however, is unclear. They are well positioned to articulate local needs and identify locally appropriate solutions to policy-makers, yet are rarely able to gauge the efficacy of such advocacy work.

Revisit the emergency management cycle

The emergency management cycle consisting of prevention, mitigation, preparedness, response, and recovery phases, provides a framework to achieve these goals (Government of Canada, 2022). These phases are interconnected but often isolated within and between actors. In Ontario, municipal emergency responses are governed by provin-

cial legislation (Emergency Management and Civil Protection Act, 1990) that leads them to focus on large-scale, short-term hazards while ignoring social dimensions of risk, undermining a community's ability to foster resilience (Imperiale & Vanclay, 2021). Learning from SARS and COVID-19, we appreciate the need to combine outbreak response with health promotion, community development, and policy efforts that address environmental and socioeconomic determinants of health (Haworth-Brockman & Betker, 2020). The recovery phase of the cycle offers an opportunity to lay the groundwork for future mitigation and prevention efforts.

An equity-focused approach to emergency management is not novel (Spence et al., 2019) and there are tools available to help (e.g., Sendai Framework (UNDRR, 2015)), which emphasize understanding risk in multiple dimensions, strengthening governance, and investing in resilience. New frameworks and indicators specific to public health emergency preparedness and response, including equity indicators, have emerged in recent years, and can now be applied in practice (Haworth-Brockman & Betker, 2020; Public Health Ontario, 2020). THU embedded an Equity Lead within its Incident Management System to link initiatives identified in this paper with other local pandemic-related decision-making. However, literature calls to question the appropriateness of this style of command-and-control structure for complex emergencies and emphasizing their negative impact on equity (Imperiale & Vanclay, 2021), suggesting a need to consider alternatives.

THU's work with First Nation communities aimed to adhere to principles such as relationships, listening with humility, trust, respect, self-determination, and commitment. Consistent with findings from local research (Talking Together to Improve Health Research Team, 2018, 2020), we believe these principles should also be considered in future initiatives, to promote community wellbeing and to minimize the impact of future disruption.

During the pandemic, various recovery frameworks like the Just Recovery Principles (Just Recovery, 2022), 2020 Declaration on Resilience in Canadian Cities (Keesmat, 2020), Green New Deal (MacArthur et al., 2020), as well as recommendations from the Canadian Rural Revitalization Foundation (Canadian Rural Revitalization Foundation, 2021), and the public health sector (Mulligan, 2022; Public Health Agency of Canada, 2020, 2021; Public Health Ontario, 2022), have emphasized transformation, sustainability, reconciliation, intersectionality and equity. Integrating these principles into both emergency management and ongoing operations can help public agencies to support community resilience.

THU continued to collaborate with the Community Collaborative, maintaining a community-centred approach to pandemic recovery. They completed an evaluation report on the CTC line to inform its potential upkeep by someone other than local public health and other potential equity related interventions. Additionally, they are supporting a research project exploring the experience of rural communities in Northern Ontario to identify ways in which they can better navigate future disruptions, be they from infectious disease, climate change or economic instability.

Local public health units are mandated to work with others on emergency management, health equity, public policy, the built environment, climate change, chronic disease prevention, injury prevention, and wellbeing (Government of Ontario, 2021). This mandate enables them to collaborate with local governments and organizations across all phases of the emergency management cycle. These insights underscore the importance of using comprehensive health promotion strategies to address social vulnerabilities that exacerbate the impact of emergencies.

5   Conclusion

We propose that reflection and connection are key to fostering resilient communities and achieved by each of us actively reflecting on our experiences, strengthening ties, and supporting those around us. Whether related to extreme weather, infectious disease, or economic fluctuations, change is something communities will always need to navigate and the more that is done now to prevent disparities that are unjust and harmful to individuals, families, organizations, communities, and society, the better off we will be.

Thoughtful reflection following a drawn-out emergency response can foster change that contributes to this resiliency. This local public health unit's equity-related experiences during the COVID-19 pandemic leads them to reflect on the role of their institution, how they might strengthen and build new connections at the local level, to explore their role within the complex policy landscape, and to consider assumptions behind the emergency management cycle. As a public institution, local public health agencies are driven to impactfully serve the public to the best of their ability. We invite others to share their perspectives and experiences, some collective reflection to help us be impactful stewards for the public good.

Acknowledgments

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Enhancing Health Equity In Emergencies: Implementing An Equity Officer In Public Health Emergency Responses

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Abstract

Emergencies, particularly those with public health impacts, disproportionately affect priority populations, thereby exacerbating existing health disparities. To address these challenges, emergency management practitioners across various sectors must explore actionable ways to enhance health equity throughout the emergency management cycle. Following the COVID-19 pandemic, Ottawa Public Health conducted an environmental scan and literature review that revealed limited research or resources on how to fully incorporate equity into an emergency response structure. This paper examines local initiatives in Ottawa, Ontario during emergency responses, and the need for a formal role to support those most negatively impacted. These findings led to the development of an Equity Officer position, along with a role-specific checklist. The authors recommend the implementation of this unique role, thus ensuring a core member of the incident command team is dedicated to providing support to priority populations and recommend tailored response actions during an emergency.

Keywords: Equity, Health Equity, Equity Officer, public health, emergency management, emergency response

1   Introduction

Emergencies with public health impacts, such as pandemics and extreme weather, pose significant challenges to communities worldwide. These events disproportionately affect priority populations. Priority populations, as defined by the Ontario Public Health Standards, refer to "those that are experiencing and/or at increased risk of poor health outcomes

due to the burden of disease and/or factors for disease; the determinants of health, including the social determinants of health; and/or the intersection between them" (Ministry of Health, 2021, p. 20). Given these inequities, the integration of health equity into emergency management has become crucial. As emphasized in the Chief Public Health Officer of Canada's Report on the State of Public Health in Canada 2023, "to what degree an emergency impacts individuals and communities is influenced by how likely they are to be exposed to a hazard, the intersecting inequities, or vulnerabilities they experience, and their access to resources to respond and recover" (Public Health Agency of Canada, 2023,p. 16). The disparities observed in public health practice led us to explore how consolidating health equity within a designated role in an emergency response structure could help address inequities and improve population outcomes.

When responding to emergencies, public health units (PHUs) in Ontario, and many organizations across Canada, commonly use the Incident Command System (ICS) or the Incident Management System (IMS). Ottawa Public Health (OPH) previously used IMS but transitioned to ICS in 2024. Both emergency response systems are scalable and designed to enable effective and efficient incident management by deploying staff to operate within a set organizational structure. However, in both IMS and ICS, there is no mandate to include health equity to guide decisions (Goralnick et al., 2021). This can pose challenges in providing equitable care to priority populations. Moyal-Smith et al. (2024) report that, in times of cognitive stress, individual shave greater implicit bias as well as an added reliance on stereotypes. Public health emergencies are constantly evolving and, at times, strain available resources, which may cause responders to overlook community partners and those most affected (Myint et al., 2022). Under these pressures, adding a de-

fined equity role ensures that the needs of priority populations are considered, and potential gaps are addressed in all emergency response actions.

2 Emergency Response: A Call for Health Equity

During the COVID-19 pandemic, OPH activated an IMS emergency response structure. The Liaison, Communications, and Safety Officers were deployed as members of the Command Team, reporting directly to the Incident Manager. They, along with the General Staff (comprising Planning, Operations, Logistics, and Finance and Administration Chiefs), met routinely throughout the response with collective efforts aimed at implementing incident action plans.

Through initial epidemiological data collection and analysis of sociodemographic indicators, OPH identified that between February to August 2020, COVID-19 infections disproportionately impacted racialized communities, particularly Black communities in Ottawa (Ottawa Public Health, 2020). Higher infection rates were attributed to factors such as high-density housing, which made physical distancing difficult, and employment in essential work that is often precarious (e.g., low-wage, temporary, unstable, and without pensions and benefits)(Ottawa Public Health, 2020). These findings align with public health's understanding that structural determinants, such as systemic racism, economic inequality, housing, and other social determinants of health, shape inequitable distributions of infections (Public Health Agency of Canada, 2022).

Throughout the COVID-19 pandemic, OPH also utilized pre-existing data from the Ottawa Neighbourhood Study, which categorized neighbourhoods into five quintiles based on various neighbourhood-level social and economic indicators,as well as other health determinants from the Canadian Census, with Q5 indicating neighbourhoods having the low-

est socioeconomic advantage (Ottawa Neighbourhood Study, 2022). During the first year of the pandemic, COVID-19 hospitalization and death rates were nearly three times higher in Q5 neighbourhoods compared to Q1 neighbourhoods(Ottawa Public Health, 2023). OPH's report on the State of Ottawa's health also noted that Q1 neighbourhoods generally experienced higher levels of COVID-19 vaccination compared to Q5 neighbourhoods, particularly among younger populations (Ottawa Public Health, 2023).

During the response and recovery phases of the COVID-19 pandemic, the need for enhanced local public health and equity-driven initiatives became evident. However, determining strategies to best serve priority populations was challenging,as most interventions were geared towards the general public. These challenges prompted OPH to develop solutions focused on those most negatively impacted. Some examples of these initiatives include:

- Expanding OPH's human resources during the pandemic resulted in a more diverse workforce, fostering stronger outreach and improved service delivery. This led to the establishment of a Community Engagement Team (CET) that continues to work closely with residents and organizations, particularly those facing the greatest barriers, to gather valuable community insights. Serving as a conduit between local public health programs and services, the CET played a pivotal role.

- Prioritizing trust-building and partnerships with communities and groups who had not been effectively engaged in the past. This ensured that community voices were heard and meaningfully informed OPH response strategies.

- Collaborating with community leaders and organizations to deliver services at Neighbourhood Health & Wellness Hubs in Q5 neighbourhoods, such as

vaccination and the dissemination of rapid antigen testing kits.

- Providing key public health resources through various communication channels and translating them into multiple languages. This was important for delivering evidence-based community messaging on respiratory illness prevention and management. Additionally, a public dashboard for COVID-19 and respiratory infections was created to share real-time local infection rates.

- Advocating for and providing in-home COVID-19 immunizations to homebound residents. The health unit acknowledged the essential role of caregivers in supporting homebound clients as well as the potential negative impacts if they tested positive for COVID-19. It also advocated to policy developers for changes to guidance to also immunize caregivers.

- Collaborating with local Indigenous healthcare organizations to support COVID-19 vaccine clinics for First Nations, Inuit, and Métis community members. These partnerships also helped identify and respond to specific needs, such as the development of a respiratory illness infographic in Inuktitut.

- Participating in a taskforce made up of City of Ottawa departments and key community partners to coordinate information, identify the needs of priority populations, and respond to emerging issues and barriers.

Findings from post-incident debriefings with OPH staff and community partners,as well as in the COVID-19 After-Action Report,identified the direct benefits of implementing health equity initiatives and their success in mitigating the impacts of COVID-19. These results prompted further exploration of ways to formally address disparities within an emergency response structure.

The roles under initial consideration included adding either a designated officer or a unit lead. An environmental scan revealed that, to our knowledge, most PHUs, Emergency Operations Centres (EOC),and Emergency Coordination Centres (ECC)in Ontario and across Canada did not have such a designated position within their response structures. This identified gap led us to initiate a literature review. Our aim was to gain insights into the use of a defined equity role within an ICS or IMS structure by identifying existing resources and practices from other organizations and jurisdictions. This article shares findings and recommends an approach to enhancing health equity in responses.

3 Literature Review

In the summer of 2022, a literature review was conducted to gain insights into the use of an Equity Officer in an IMS or ICS structure during emergencies. The literature search was carried out in collaboration with a regional public health librarian. The search was conducted across several health-related databases and used the "snowball" method, in which the citations within the utmost relevant papers were included for review. The search concept map included the terms'(in)equity officer' (portfolio, position, staff, response), combined with IMS/ICS and emergencies. There were no date restrictions for the search for articles in both English and French. The query yielded a total of 13 grey literature and 26 published articles for in-depth review.

Results identified were predominantly from the United States and focused only on general strategies for incorporating equity principles throughout the emergency response. However, some U.S. jurisdictions recognized the need for a defined health equity role within formal response structures. One key report from San Francisco highlighted that embedding an Equity Officer into their COVID-19 EOC led to improved identification of and action on, urgent community needs, especially for disproportionately impacted groups (The Bay Area Regional Health Inequities Initiative & The Public Health Alliance of Southern California, 2020). Goralnick et al. (2021) noted that institutional racism and the absence of equity disproportionately impacted morbidity and mortality in marginalized communities during the COVID-19 pandemic. These researchers recommended a structural change to include an Equity Officer role as a core member of their Hospital Incident Command System (HICS), with the authority to obtain the resources needed to ensure equitable response actions going forward for priority populations (Goralnick et al., 2021).

After reviewing findings from the literature search and considering how equity-driven initiatives were implemented during the COVID-19 response within our local context, the decision was made to pilot the Equity Officer role into our response structure. The process was driven by several factors. Firstly, the role needed to be distinct; it was important to avoid overloading the Liaison, Communications, or Safety Officer with responsibilities that solely focused on health equity. Secondly, the Equity Officer,as a member of our Command staff, required a direct line of sight on issues related to priority populations. Lastly, the officer would need to have the knowledge and credibility to influence decision-making.

4 Creating an Equity Officer Role in Emergency Responses

4.1 Reflecting on Prior Public Health Responses

To begin the process of implementing an Equity Officer role, reviewing prior after-action reports to evaluate performance and identify areas for improvement was crucial. In the wake of the COVID-19 pandemic, rigorous analysis provided strong insights and

concrete recommendations. Subsequently, the opportunity to strengthen our response structure by integrating health equity became evident. We then proceeded to identify staff within the organization to be trained and deployed as Equity Officers. The selection criteria for this role were stringent, including personnel who could be deployed from their regular duties for longer than 72 hours, had knowledge of equity issues and practices, and had previous emergency response experience. The identified staff underwent comprehensive training, including the IMS100-Introduction to Incident Management System course and an OPH-internal orientation.

4.2 Revisiting the Response Structure

A strong structure is a cornerstone of an effective and efficient emergency response. As such, much time and effort go into reviewing every response. Experiences during the COVID-19 pandemic reinforced the need to revisit our structure. Shortcomings were identified in the way priority populations were assessed and engaged, as well as in how response actions corresponded to their needs from an inclusivity and accessibility perspective. This provided the underpinnings for the creation of an Equity Officer role within our structure.

To strengthen clarity amongst all responders, role-specific checklists were also created. These included an Equity Officer checklist (Appendix A) which outlined responsibilities that was further supported by internal training materials and resources intended for use in preparedness exercises, as well as responses. **Figure 1** provides a visual representation of the typical ICS structure used at OPH, including the integration of an Equity Officer

4.3 Pilot Testing

The pilot process involved deploying an Equity Officer for the first time as part of OPH's monitoring-level ICS structure related to a measles outbreak in Québec and Ontario in

Figure 4.1: OPH ICS Structure including an Equity Officer
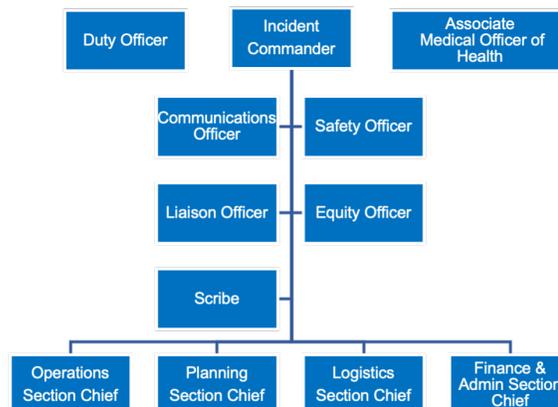
spring 2024, as well as during an enhanced-level ICS related to extreme heat in June 2024. While there were no confirmed cases of measles in Ottawa during the ICS response, the Equity Officer was instrumental in identifying priority populations and existing community supports, distributing key resources in multiple languages and addressing potential barriers to care and vaccination. In collaboration with the Epidemiology Unit Lead within the Planning Section, the Equity Officer identified that areas with the highest rates of unvaccinated individuals for measles were in Q5 neighbourhoods. This prompted OPH Public Health Nurses at the Neighbourhood Health & Wellness Hubs to engage with community members about potential barriers related to measles vaccinations, address concerns and misinformation, and provide onsite immunization. The Equity Officer also raised the issue of vaccine hesitancy at family shelters and places of worship. This led to a collaboration between the Incident Command and General Staff and CET, who were deployed within the Operations Section, to provide outreach to local organizations and attend public events in high priority communities to discuss routine childhood immunizations and promote nearby OPH vaccine clinics.

During an extreme heat event, the Eq-

uity Officer supported the response by helping to identify priority buildings in Q5 neighbourhoods (e.g. high-rise buildings without air conditioning, subsidized housing, and areas with a high concentration of older adults living alone) and promoting nearby accessible cooling locations. Their role focused on guiding community engagement, proactively raising awareness, and supporting the Communications Officer to ensure effective public information distribution. This included reviewing heat preparedness materials for culturally inclusive and accessible language and incorporating feedback received previously from priority populations, sending letters and resources to school boards for families concerned about hot school environments. The Equity Officer also prioritized newcomers, Indigenous communities, and older adults by supporting the dissemination of targeted information through both informal and formal communication networks. Efforts included advocating for multilingual and multicultural resources as well as providing paper resources to address challenges with accessing electronic materials and online cooling location maps. Collaborating with the Liaison Officer, they conducted routine check-ins with community partners during the heatwave and provided updates to the incident command and general staff to help address emerging issues and gaps.

The successful actions of this role were clearly reflected in the response debriefings and after-action reporting. OPH employees deployed to the response highlighted the Officer's effectiveness in advocating for priority populations, identifying and addressing barriers, and contributing to inclusive multilingual communications. The presence of an Equity Officer brought a diversity perspective to the table. Their purview,based on their distinct knowledge and experience ensured response actions were more comprehensive, effective,and tailored to priority populations.

Areas of improvement included maintaining role clarity between the Equity and Liaison Officers, particularly in articulating re-

sponsibilities when collaborating with external partners. Community organizations were supportive of the new initiative; however, additional information was needed on the Equity Officer's scope, as well as who would be OPH's primary contact if partners had specific equity-related concerns. Additional coaching support was also provided to those deployed within the ICS structure to adapt to collaborating with this new role for the first time. This helped all members utilize the Equity Officer's unique perspective and skill set to inform decision-making. Finally, as this was the initial stage of implementation, the limited pool of trained Equity Officers would have posed a challenge in deploying them during 7-day operations and/or an anticipated prolonged emergency response. To prepare for future deployments, recommendations included training additional staff for this role, planning future emergency exercises with OPH and external partners, and establishing clear evaluation metrics for continuous quality improvement.

5 Conclusions

Emergencies disproportionately impact priority populations, underscoring the need for practitioners to embed health equity into all phases of emergency management. While these findings make it clear that integrating health equity into the response and recovery phases is imperative, they also highlight the need to proactively integrate equity considerations into all other phases of emergency management. By embedding equity principles throughout the entire emergency management cycle, the needs of priority population scan be better anticipated and addressed, ensuring a more comprehensive and inclusive approach to public health emergencies. Lessons from the COVID-19 pandemic, the literature review, and OPH's pilot process demonstrate that equity-driven interventions lead to more positive outcomes. The work accomplished alongside community members and partners

amplified the voices of communities more negatively impacted. Establishing an Equity Officer within a response structure ensured that the needs of priority populations were at the core of interventions. The addition of an equity role in IMS or ICS is not only a recommendation for other public health organizations, but a call to action for all emergency management practitioners to make health equity foundational to emergency management.

Acknowledgments

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Appendix A: Ottawa Public Health Equity Officer Checklist

Core Responsibilities

☐ Provide internal consultation to ensure ICS decisions are based on health equity, diversity, and inclusion to ensure the needs of impacted communities and individuals are considered in response and recovery efforts.

☐ Identify populations and groups at-risk and outline specific risks.

☐ Support the Liaison Officer in engaging community collaborators, and the Communications Officer in ensuring all communications are culturally and linguistically appropriate.

Upon Activation

☐ Receive appointment from Incident Commander (IC).

☐ Arrange work station(if applicable), review position responsibilities,and acquire any necessary work materials.

☐ Review position checklist and ICS organization chart.

☐ Initiate activity log (ICS 214.Record date/time of your activation as Equity Officer and document activities during shifts.

☐ Obtain briefing from IC(and outgoing Equity Officer, if applicable).

☐ Inform your direct supervisor about your deployment and discuss activation of program specific Continuity of Operations Plan to cover your responsibilities within your home program.

☐ Attend initial ICS meeting.

☐ Provide input into the development of the Incident Action Plan (IAP).

☐ Identify specific community groups at-risk of inequitable access to information or resources, including linguistic and cultural needs.

☐ Advise on potential initial strategies.

☐ Assist the Liaison Officer to identify community support contact information:

    (a) Contact person(s)

    (b) Email/Phone numbers

    (c) Address

Intermediate Actions

☐ Attend ICS meetings (with Command and General Staff) and provide briefings on equity strengths and concerns of the response,including emerging issues.

☐ Support Planning and Operations to identify barriers to the well-being of priority populations and recommend actions.

☐ Support Incident Command in implementing evidence-based and community-engaged interventions to address issues that may affect timely and appropriate responses for the impacted communities.

☐ Inform the Liaison Officer's work in consultation with organizations and leaders representing diverse groups to determine needs.

☐ Collaborate with Planning Chief to identify available client-facing resources.

☐ Meet with Planning Chief to determine deployed staff information or time sensitive training needs based on the populations affected.

☐ Support Epi in reviewing the inclusive collection of sociodemographic data.

☐ Maintain ongoing assessments to identify emerging issues and patterns impacting various communities, including both unintended positive and negative impacts.

☐ Ensure ongoing communication with the Health Equity, Diversity & Inclusion program.

☐ Ensure that a deputy has been identified to fill the Equity Officer role for the next shift (if applicable).

☐ When shift assignment is complete, or when handover is required in the event of extended deployment, brief the incoming Equity Officer using your activity log (ICS 214), and any incident reports that have been generated.

Extended Actions

☐ Work with Planning Section Chief, Communication and Liaison Officers to determine strategies and interventions to address issues raised by the community.

☐ Propose equity-based recovery and mitigation solutions or interventions.

Documentation

☐ Ensure all forms are dated and saved using the YYYY/MM/DD format.

☐ Use clear text and ICS terminology in all communications

☐ Document all actions and decision points using an Activity Log (ICS 214).

☐ By the end of each shift:

　☐ Complete the required forms and reports and send them to the Documentation Unit.

　☐ Confirm that documentation with personal information or personal health information is secured in clinical program files.

☐ Provide a detailed handover briefing to your relief officer. Ensure that all in-progress activities, outstanding issues, and follow-up requirements are identified and documented.

Demobilization Actions

☐ Respond to demobilization orders.

☐ Ensure that all in-progress activities and outstanding issues requiring follow-up are either completed or delegated to a core unit for completion.

☐ Ensure all documentation is completed and submitted to Documentation Unit Lead as appropriate.

☐ If deactivating email accounts or telephones, set required notifications (e.g., automatic reply e-mail or voicemail notification).

☐ Debrief with IC and provide input for the after-action report and participate in the OPH cold debrief and/or evaluation survey.

☐ Participate in the City of Ottawa ECC hot and cold debrief as appropriate.

Leaning Forward: Joint Task Force North, Civil-Military Relations, And Domestic Disaster Response In The North

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Abstract

Communities in Canada's North face unique challenges in disaster response due to extreme environmental conditions, geographic remoteness, and limited infrastructure and territorial emergency management capacity. These factors often necessitate federal support, including assistance from the Canadian Armed Forces (CAF). This article examines the role of the CAF, specifically Canadian Forces Northern Area (CFNA) and its successor, Joint Task Force North (JTFN), in strengthening the intergovernmental and interorganizational collaboration required for disaster response in the region. Although we identify limitations and areas for improvement in these efforts, we argue that JTFN has consistently "leaned forward" to build and sustain the collaboration required for whole-of-government disaster response operations, while making broader contributions to the practice of emergency management in the North. Although this article focuses on the Canadian North, it adds to the wider body of research on civil–military cooperation during domestic disasters–a critical area of study given the prominent role militaries often play in disaster response.

Keywords: Canadian Armed Forces, Joint Task Force North; territorial North; disaster response; intergovernmental and interorganizational collaboration; Arctic Security Working Group; exercises; liaison officers.

1 Introduction

Communities in Canada's North are exposed to a wide array of hazards, ranging from wildfires, floods, earthquakes, severe weather, melting permafrost, and landslides to prolonged

power outages, cyber threats, and major transportation accidents –many of which are exacerbated by the effects of climate change. The risk this exposure creates is amplified by the austere nature of the region's environment, the remoteness and inaccessibility of many northern communities, their distance from external sources of assistance, their small pools of human power from which to generate a disaster workforce, their limited local and territorial emergency management capacity, and their aged, weakened, and inadequate critical infrastructure (Cox, 2014; Funston, 2009; Kikkert & Lackenbauer, 2021; Lauta et al., 2018; Munk-GordonArctic Security Program, 2014). These factors often allow hazard events to cascade into more profound situations and create logistical and operational challenges that increase the difficulty of executing timely and effective responses. As one Nunavummiut emergency responder pointed out,

> Responding can be tough, absolutely. You got 25 small communities spread over more than two million [square] kilometres. Many of them have very limited resources and you can only get to them by air most of the year, if the weather lets you. Help is always a long way away... And there really isn't very much help in the territory. (Comment made during Kitikmeot Roundtable on Search and Rescue, Yellowknife, November 20–22, 2022).

Given the unique challenges in Canada's North, the territories often require federal assistance, including the services of the Canadian Armed Forces (CAF), to respond to certain disasters. "We do a lot on our own. But we also know that the military can help with a lot of the problems we face," explained one territorial emergency management official. "And these are issues that a lot of our southern partners don't have to deal with, not in the same way" (Territorial emergency

management official, comment made during Mass Rescue Tabletop Exercise at the Kitikmeot Roundtable on Search and Rescue, Yellowknife, November 20–22, 2022). The capabilities that make the CAF effective during disaster response operations are particularly relevant in the North: strategic airlift assets, planning and logistical resources, and the ability to quickly put hundreds of self-sustaining boots on the ground.[1] The Army in particular offers a source of human power that is physically fit, does not get paid overtime, can work for extended periods, and can be put in harm's way (Botha, 2022). "I actually think [the territories] have done a pretty good job of not relying on [the CAF] too much for help," noted the territorial official. "But it's important for us to know that we do have some back-up if we need it and that it's ready to go" (Territorial emergency management official, comment made during Mass Rescue Tabletop Exercise at the Kitikmeot Roundtable on Search and Rescue, Yellowknife, November 20–22, 2022).

The CAF has long recognized the need to prepare to support disaster response activities in the North within a broader whole-of-government approach involving close collaboration between all levels of government and across different agencies and departments. In 1999, Canadian Forces Northern Area (CFNA) worked with its civilian partners to create the Arctic Security Working Group (ASWG), a biannual forum that continues to bring together participants from federal departments and agencies, as well as territorial governments and other northern stakeholders, to discuss a wide array of safety and security issues. [2] From its first meeting, participants

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[1]Many of the individuals interviewed for this project highlighted that, although CAF personnel do draw on the resources of the areas in which they are deployed, they are still highly self-sustaining–particularly compared to other federal, territorial, and volunteer resources.

[2]Established in 1999, the ASWG was initially known as the "Symposium on Arctic Security Issues." In May 2000, the name of the group changed to the Arctic Security Interdepartmental Working Group,

have emphasized the need to strengthen the civil-military relations that facilitate rapid responses to disasters. When CFNA transitioned into Joint Task Force North (JTFN) in 2006, the regional headquarters took seriously its directive from Canada Command to increase its readiness and capability to respond to all types of domestic emergencies in the region. JTFN established stronger working relations with territorial emergency management officials, particularly through its liaison officers, and developed standing procedures and contingency plans to respond to civilian requests for assistance (Bell, 2006; Russell, 2009). Colonel Norm Couturier, the task force's first commander, pledged that his staff would help "develop plans to ensure that authorities are able to respond to a civil emergency within 24 hours." The defence team, Colonel Couturier explained, would test plans "in exercises conducted with various agencies, to make sure they work"–which JTFN has done almost every year since, through the emergency response components of major military exercises in the North (Exercise NARWHAL and then Operation NANOOK) (Bell, 2006). In October 2023, JTFN's current commander, Brigadier-General Dan Rivière, echoed his predecessor, highlighting the importance of exercises that validate "our shared emergency processes" and concluding that, in the North, "[o]ur strength is the level of collaboration" between all levels of government (as cited in Government of Yukon, 2023a). In short, CAF leadership has consistently emphasized the need to adopt a proactive and anticipatory "lean forward approach" to generate the experience, skills, and networks required to engage in potential disaster and emergency response roles in the North (Russell, 2009, pp. 77, 87).[3]

Using ASWG meeting materials, after-action reports, media stories, and practitioner interviews, this article explores how CFNA/JTFN has worked with its civilian counterparts to build a "whole of government" approach to prepare for disaster response activities in the North. CFNA and subsequently JTFN have primarily done so in three ways: by chairing or co-chairing the Arctic Security Working Group, by strengthening relationships with territorial and local officials through its liaison officers and the Canadian Rangers, and by organizing and facilitating annual large-scale response exercises.[4] Although we identify limitations and areas for improvement in these initiatives, we also argue that JTFN has consistently "leaned forward" to build and sustain the intergovernmental and interorganizational collaboration required for whole-of-government disaster response operations, while making broader contributions to the practice of emergency management in the North. It has done so even though these contributions fall outside the CAF's primary mandate and seem to conflict with its intended role as a "force of last resort" in disaster response. We then assess the results of these efforts by examining JTFN's involvement in several large-scale responses: the crash of First Air Flight 6560 in 2011, the COVID-19 pandemic, the 2021 flooding in the Northwest Territories (NWT) and the Yukon, and the Iqaluit Water Crisis. The latter two cases represent the first occasions on which Operation LENTUS, the military's standing operation to provide assistance and respond to disasters within Canada, deployed to the territorial North. Although this article fo-

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and seven years later, the group became known simply as the Arctic Security Working Group. Rights holders and stakeholders invited to participate have included Indigenous governments and associations, non-governmental organizations, private sector, and academics.

[3]The idea of "leaning forward" was raised fre-

quently by participants in the Arctic Security Working Group and by military personnel interviewed for this project.

[4]We are primarily covering the work that Joint Task Force North has spearheaded. Other military exercises with emergency management components have been completed under the leadership of other military organizations. For instance, Joint Rescue Coordination Centres and their federal and territorial partners have spearheaded major air and major marine disaster exercises.

cuses on the Canadian North, it contributes to the wider body of research on civil–military cooperation during domestic disasters–a critical area of study given the prominent role militaries often play in response operations.

1   Civil-Military Relations and Disaster Response: Requirements for Success and Key Challenges

The role of the Canadian Armed Forces in disaster response has grown significantly over the last two decades. In Canada, when an emergency situation escalates beyond the capabilities and/or capacity of a province or territory, provincial/territorial governments submit a formal request for assistance (RFA) to the federal government that outlines the additional resources that the jurisdiction requires for an effective response (Public Safety Canada, 2024). Between 1990 and 2010, provincial RFAs resulted in the CAF's participation in six humanitarian assistance and disaster relief missions. Since that time, the CAF's involvement in disaster response "has broadly doubled every five years." The CAF completed seven Operation LENTUS deployments in 2021, seven in 2022, and eight in 2023 (Department of National Defence [DND], n.d.; Standing Committee on National Defence, 2024). The military's unique capabilities, the limited provincial/territorial investment in emergency management, and the lack of other options across the country have transformed the military from a force of last resort in disaster response into a force of first –or only –resort (Kikkert, 2021; Standing Committee on National Defence, 2024).

The effectiveness of these disaster response activities depends on close domestic military cooperation with local and regional authorities and first responders in an integrated whole-of-government approach that cuts across traditional institutional silos to achieve a shared goal. Although there is ex-

tensive research on interorganizational cooperation during disasters and on civil-military cooperation in expeditionary (conflict) settings, few studies look in detail at civil-military cooperation in domestic disasters and how distinct organizational cultures, structures, and operational approaches complicate collaborative efforts between military and civilian actors (Bollen & Kalkman, 2022, p.80). Work that has been completed on the subject emphasizes the importance of a shared civil-military belief in the value of cooperation, strong interpersonal relationships, formal and informal networks, the effective exchange of information, clarity on command and control, and a mutual understanding of roles, responsibilities, capabilities, and processes (Ahmedet al., 2023; Bollen & Kalkman, 2022; Dahlberget al., 2020; Kalkman, 2019; Tatham & Rietjens, 2016). Using a framework that cuts across the literature on emergency management, civil-military relations, and public administration, Botha (2022) identifies several critical components for the effective use of the military in disaster response: information sharing, non-manipulative influence, flexibility, support, collective conflict resolution, coordination, integration, satisfaction, trust, and processes to deal with conceptual differences (see also Fremis, 2021; Hudson, 2021; MacGregor, 2012; Rock, 2021; Saul, 2019; Shadwick, 2018; Thomas, 2014).

Botha's book-length study on the CAF's role in disaster response–the first such study produced in the Canadian context–focused on case studies of disaster response operations in southern Canada, highlighting generally successful civil-military collaboration that is marked by effective information sharing, high levels of trust, and a strong coordination of effort. CAF personnel, particularly liaison officers and local Reservists, generally maintain strong links with key emergency management partners even in non-disaster times, which has facilitated the creation of shared situational awareness and speedy and effective responses. These formal and informal networks have allowed the CAF to "lean for-

ward" during past disaster events, preparing responses before the federal government has received formal provincial requests for assistance (Botha, 2022, pp. 101–102). Nevertheless, Botha identified several possible friction points and areas for improvement. "Benign incapacity"– defined as situations in which "limited technical, fiscal, institutional, equipment, or labour capacity" inhibit an organization's willingness to collaborate– has acted as a barrier to civilian emergency management organizations working effectively with their military counterparts (2022, pp. 119–120). Civil-military interoperability during planning processes and front-line disaster deployments has also been limited– although that non-interoperability has not seemed to reduce the effectiveness of on-the-ground responses (Botha, 2022, p.148).

The largest challenges in Canadian civil-military relations during disaster response operations stem from "conceptual differences" in defining the actions required to reach a clear end state –which, from the military's perspective, is a return to civilian services as quickly as possible –and issues around the RFA process. Regarding the end state of operations, civilian emergency management officials tend to see response and recovery efforts flowing into one another without rigid boundaries, while, from the beginning of its deployments, the CAF is eager to set a clearly defined line at which a response moves into recovery and the military's role ends. The RFA process has caused even more confusion and disagreement. An appropriately worded RFA asks for an effect rather than linking tasks to specific military capabilities, providing the federal government with maximum flexibility in determining a response. Too often, however, RFAs ask for specific military capabilities and exact numbers of personnel, providing little room for the CAF to manoeuvre. As Botha (2022) notes:

> Once the RFA passed from a province's solicitor general (or equivalent) to the (federal) minis-

ter of public safety, and from there to the minister of national defence for sign off, the parameters for CAF action– their 'left and right of arc' in military-speak –were set in stone. (p. 72)

As a result, during disasters, jurisdictions often requested services that the CAF could have provided, but, as they were beyond the scope set by the RFA, it was unable to do so (Botha, 2022).

Botha's findings on the RFA process mirror broader international trends. Bollen and Kalkman (2022) argue that creating increasingly rigid parameters for engaging military assistance represents a common approach to reducing the complexity of civil-military disaster response operations. These efforts aim to create

> an illusion of control: ever more detailed and stricter guidelines, definitions, and directives to achieve domain and goal consensus. In the meantime, the discretionary space for operators in the field is reducing and spontaneous civil-military cooperative efforts in response to urgent needs are viewed with skepticism or reversed. (p. 86)

In the Canadian context, Botha concludes that, while CAF commanders often view the RFA as critical to democratic oversight and to avoid civilian dependence on the CAF, the process represents an "institutional constraint to [the] CAF's ability to freely aid disaster response partners in any way its commanders saw fit" and "to civilian influence over CAF response actions" (2022, pp. 70, 73, 126).Despite JTFN's proactive approach to working with its territorial partners, these conceptual differences have also emerged in past northern exercises and disaster response operations.

2 Working at the "Speed Of Trust": JTFN, Team North, and Preparing For Disaster

Military responsibility for the Canadian North (defined as the area north of 60º North latitude) falls under Canadian Joint Operations Command (CJOC), with the three northern territories being the responsibility of Joint Task Force North (DND, 2018).

JTFN's complement includes over 300 military and civilian personnel, the majority of whom are stationed in Yellowknife, with small detachments in Iqaluit and Whitehorse. The joint task force also hosts and supports three lodger units:440 Transport Squadron (part of 8 Wing Trenton); C Company (part of the Loyal Edmonton Regiment); and 1st Canadian Ranger Patrol Group or 1CRPG (part of 3rd Canadian Division).

JTFN, like the five other Regional Joint Task Forces (RJTFs) across Canada, maintains continuous situational awareness, liaises with civilian authorities, and coordinates, supports, and conducts operations in its area of responsibility. "During domestic operations," Alexander Fremis (2021) notes, "RJTF commanders will form task-tailored forces and direct their employment in assisting civil authorities... RJTFs form the brain and backbone from which CAF domestic deployments are directed" (p. 67). Generally, responses to RFAs submitted in a specific region involve the deployment of task-tailored forces located within that region. It is possible, however, for RJTFs to share units depending on available resources, the tasks to be completed, and the scale of a disaster event (Hartwick, 2020–2021, pp. 36–37; Hudson, 2021). Given its limited human-power resources, JTFN often must deploy soldiers from other RJTFs to execute most of its operations, including disaster response. In responding to territorial RFAs, JTFN can draw upon the approximately 1,600 Canadian Rangers of 1CRPG, located in 65 communi-

ties across the North;southern-based Immediate Response Units (IRUs), which can be temporarily assigned, deploy in between 8 and 24 hours, and are "scalable to the situation" Arctic Response Company Groups, composed of southern-based Primary Reserve members used to augment IRUs; and other CAF resources, including aerial assets, as required (Hartwick, 2020–2021). These resources are important, but their effective use in disaster response depends upon the mechanisms that CFNA/JTFN has put in place to enable civil-military cooperation in the North.

3 The Arctic Security Working Group

Through a collaborative "Team North" approach, the ASWG is intended to serve as a boundary-spanning institution that brings a wide range of government and non-government actors together to discuss security and safety issues, strengthen relationships, share information, and coordinate activities, programs, and resources. As the working group's terms of reference explain, "with limited assets, departments and agencies operating in the region understood that by working together through the ASWG, their collective strength would be greater than individual efforts" (Arctic Security Working Group [ASWG], 2012). The ASWG holds biannual two-day meetings, usually in May and November. Originally chaired solely by the commanding officer of CFNA and then JTFN, Public Safety Canada's Northern Regional Manager for Emergency Management assumed the co-chair position in May 2008. In 2017, however, the territorial governments assumed the role of co-chairs from Public Safety, serving on a yearly rotating basis. As a result, the constant in the ASWG's leadership and direction has been CFNA/JTFN.

Early in its existence, emergency management practitioners on the ASWG's interoperability subcommittee noted that the working group could improve the "horizontality and

harmonization" required to respond to "disaster/crisis level" events in the unique Arctic operating environment ("Team Interoperability," 2003). Specifically, these practitioners highlighted how the working group's "face-to-face" meetings could be used to build key relationships, share the information required to develop a "clear and full understanding of roles, responsibilities, and capabilities" (including which organizations should be in the lead during various situations), and facilitate efficient communications and coordination ("Team Interoperability," 2002; "Team Interoperability," 2003).

The face-to-face meetings facilitated by the ASWG have helped to develop the relationships required to conduct whole-of-government responses. Since 1999, the working group's regular membership has grown from 21 to well over 100, with strong representation from a wide array of the organizations and agencies involved in northern disaster response operations.[5] During a presentation in November 2016, a Public Safety Canada representative insisted that a group like the ASWG is uniquely suited to build the connections and social ties required during crisis situations so that "we can move at the 'speed of trust'" ("Fort McMurray," 2016). Emergency management practitioners involved in the working group have consistently noted the interpersonal linkages, interorganizational trust, and resultant belief in the value of cooperation that have been fostered through the ASWG. In May 2009, for instance, a representative from Nunavut Emergency Management (NEM) noted that the ASWG "continues to be a forum of importance to Nunavut. Contact with and assistance from other agencies developed at these meetings has greatly as-

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[5]Examples include territorial emergency management organizations and departments of health, Indigenous governments and associations, the Royal Canadian Mounted Police, Public Safety Canada, the National Search and Rescue Secretariat, the Canadian Armed Forces, the Canadian Coast Guard, Transport Canada, Natural Resources Canada, Environment Canada, the Public Health Agency of Canada, Parks Canada, and Global Affairs Canada.

sisted us in meeting the ever-growing challenges we face" (Nunavut Emergency Management, 2009). Over a decade later, another member of NEM also cited the working group's relationship-building role and how it helps to bridge one of the realities of northern governance: the high turnover of federal and territorial staff. "I see the value of the meetings because there's always new people in all these offices," he observed. "The military changes a lot ... so you are always trying to work with new people and you have to get used to it. It would be nice if this wasn't the case, but at least [the] ASWG lets you meet them face to face. I know that makes it easier to call" (Territorial emergency management official, personal communication, November 20–22,2022). The relationships fostered over coffee and shared meals at the ASWG build trust and improve communication and coordination,representing the working group's greatest contribution to disaster response in the North (see also Russell, 2009).

Still, the ASWG does not include every entity involved in disaster response operations in the region. After a tabletop exercise in 2004, for instance, one territorial emergency management director questioned whether the ASWG was the right platform for such exercises given that it "was not a response group" and that all the "right people" were not at the table" ("Minutes", 2004). In his 2009 assessment of the ASWG's role in enhancing disaster and emergency management in the territorial North, Ivan Russell (a member of JTFN who had served on the working group) highlighted the strong interpersonal connections that the working group created. However, he also noted that it had to do a better job of including Indigenous governments, the private sector, and international partners in the network it was creating. While involvement in the ASWG has continued to grow since 2009, including broader participation from Indigenous governments and organizations, many of the actors that might be involved in disaster response in the North are still underrepresented or absent, including private sector,

non-governmental, and municipal-level entities.

Beyond building relationships, ASWG meetings have also served as an important platform for improving shared situational awareness and for the exchange of information regarding emergency response roles, responsibilities, and capabilities. Federal and territorial departmental updates often include information on emergency response capacities and issues, while territorial emergency management organizations frequently explain their plans and structures. Many of the meeting themes, which dictate presentation and discussion topics, are directly relevant to emergency management practitioners, such as multi-domain awareness and information sharing (November 2019), multi-agency collaboration (November 2017), critical infrastructure (November 2016), energy security (May 2016), cyber security (May 2015), oil spill response (May 2014), and northern community resilience (May 2013). Various presentations and discussions have also attempted to educate ASWG members on how to obtain and employ federal assistance, including briefings from Public Safety Canada on how to craft an effective RFA (2013, 2018, and 2021), which should have allowed members to bypass some of the conceptual differences that Botha has identified in civil-military disaster response operations (Role of Public Safety Canada ,2018).

While these presentations create a better shared understanding of emergency management issues between practitioners working in and with the three territories, it is fair to question the impact they have on preparing JTFN and its civilian partners for collaborative, whole-of-government disaster response operations. The vast majority of presentations, one federal member of the ASWG noted, follow a "'this is what we've done rather than this is how we do it' format" –a trend that has grown over the years (Federal member of the ASWG, personal communication, September 3, 2021). Another long-standing ASWG participant noted that "it's been a long time

since [the] ASWG actually spoke about how emergency management works and the associated processes, decision nodes, mandates and responsibilities" (Federal member of the ASWG, personal communication, September 3, 2021). In 2022 and 2024, territorial members echoed these sentiments, suggesting that the ASWG "does a good job of bringing people together" but generally consists of "long presentations" focused on "policy and high-level stuff," with little space for learning how to "work together" during incidents (Territorial emergency management official, personal communication, November20–22,2022; Territorial emergency management officials, personal communication, August 8, 2024). Further, although relatively detailed reviews of past incidents (e.g., First Air Flight 6560, the Iqaluit Water Crisis) at the ASWG have exposed pressing response issues, there has been little effort to compare after-action reviews and identify common areas for improvement. There is also no process in place to support the translation of lessons observed into lessons learned, measured as new approaches and changed behaviour during operations.

Past tabletop exercises (TTXs) have exposed some of the limitations of the ASWG's impact on preparations for disaster response operations. In November 2003, CFNA personnel prepared a TTX focused on a cruise ship evacuating its passengers onto Herschel Island. The exercise exposed a lack of clarity on roles and responsibilities, particularly on which agencies should assume the lead and when, as well as communication and coordination issues (Exercise SWORDFISH IV,tabletop exercise conducted at the Arctic Security Interdepartmental Working Group meeting, November2003). Another TTX in November 2019, which focused on three cruise ship–related scenarios (a missing passenger, a health outbreak, and a grounding incident), identified similar issues, particularly participants struggling to know who to contact and when (Tabletop exercise conducted at the ASWG meeting, November 2019). One participant observed that emergency management capac-

ities "ebb and flow" in the North and "we need to do a better job keeping track of what's available." Another individual noted that we "can't do away with silos because of mandates, but we can be more aware of the silos around us and make them as transparent as possible" (Author's notes from hotwash for tabletop exercise conducted at the ASWG meeting, November 2019).

Through its support for and direction of the ASWG, JTFN has created the conditions necessary for the development of several core ingredients required for successful civil-military collaboration during disaster response operations, including strong interpersonal relationships, a belief in the value of cooperation, and the growth of formal and informal networks. While it has also provided a platform for the exchange of information regarding emergency management, it has not often disseminated the knowledge or strengthened the skills required to conduct domestic disaster response operations, including clarity on command and control and mutual understanding of roles, responsibilities, capabilities, and processes.

4 Exercising: NARWHALAND NANOOK

While the ASWG has not always built the practitioner competencies required to execute whole-of-government response operations, as Rob Huebert pointed out in his 2005–2006 assessment of the group, the relationship building and enhanced coordination it has fostered has served as a catalyst for joint exercises to work through how to conduct these responses (Huebert, 2005–2006). Between 2004 and 2007, CFNA and JTFN inserted components into Exercise NARWHAL (a training series that ran from 2002 to 2007) that were designed to test emergency management capabilities, including the simulation of major air disasters and a public health emergency (Canada Command, 2007). As a previous commander of JTFN, Brigadier-General Christine Whitecross, explained, "the genesis of Operation Narwhal came from [the] ASWG. It gave ... the opportunity to figure out how we co-operate together, who we call when something happens, where we are duplicating efforts, and where are the gaps in our capabilities" (as cited in Rochette, 2008, p. 30).

Over the last two decades, these exercises have grown in size and complexity, as well as in their involvement of civilian partners –a rarity in the Canadian context. "While there was some civilian inclusion in some of [the] CAF's exercises leading up to events studied here," Botha concluded in his study, "civilian and military participation in each other's exercises is not institutionalized and is viewed as something 'nice to do' rather than something that is fundamentally necessary" (2022, p. 156). In the north, JTFN has encouraged other federal departments, municipal, territorial, and Indigenous governments, and non-governmental organizations to participate in its emergency response exercises. After NARWHAL2007, Brigadier General Whitecross suggested that this kind of collaborative exercise was a core requirement in the North, demonstrating the CAF's "ability to operate in a complex setting in a joint and integrated manner" (DND, 2007). As one JTFN member asserted, no other RJTF can match the number of civilian members consistently engaged in these northern exercises, the complexity of the scenarios, the frequency of these activities, and the high level of CAF involvement (Comment made during discussions at ASWG in Iqaluit, June 6–7, 2023).

In 2007, JTFN planned and executed the first iteration of Operation NANOOK (see Lackenbauer & Lajeunesse, 2017). Between 2007 and 2018, this annual operation included an integrated whole-of-government emergency response component designed to establish a comfortable working relationship between key partners. Rebranded in 2018 as a year-round initiative, Operation NANOOK now encompasses various deployments, including

NANOOK-TATIGIIT (meaning "together" in Inuktitut), which continues to practice whole-of-government responses to scenarios chosen by territorial governments (see Table 5.1).[6] The overarching objective of the NANOOK exercises is to improve intergovernmental, interorganizational, and civil-military cooperation and coordination. From JTFN's perspective, the exercises allow it to plan and practice with its partners, improve interoperability, identify the issues that could act as a barrier to the CAF's deployment on disaster response operations, and determine how military assets could bridge OGDs' capability gaps. At the same time, JTFN and its federal partners use these exercises to highlight to the territories how other agencies could respond to certain events, "as opposed to automatic CAF engagement." Along these lines, achieving "stakeholder common understanding of the RFA process and procedures" has become a key objective (Brinkema, 2024). Territorial and municipal organizations generally use the exercises to develop a "common understanding of emergency operating procedures," validate emergency plans, improve on emergency operations centre functions, and practice specific response tasks, from urban search and rescue to the establishment of reception centres. These actors can also refine emergency management policies, processes, and procedures based on the lessons observed (Joint Task Force North[JTFN], 2012; Municipal and Community Affairs, 2018).

Given the scope of the exercises, their multi-faceted objectives, and the limited logistical support available in most northern communities, JTFN's planning process for them has always been complex. As Lackenbauer and Lajeunesse (2017) observed, during early iterations of NANOOK, OGDs often felt like

military personnel did not adequately include them in planning processes, which, in turn, meant they had peripheral roles during the actual exercises. Although some improvements were made, OGD officials continued to point out that "the CAF still conducted the orchestra and the OGD, who would have to lead a response to real-world events, often remained spectators or supporting players."After-action reports have indicated that, while JTFN has personnel dedicated to planning and executing training exercises, many OGDs lack the requisite budget and human resources and must participate in the training "off the side of their desks," representing a significant barrier to full participation (JTFN, 2012; JTFN, 2015; Lackenbauer & Lajeunesse, 2017).

In recent years, JTFN has sought to foster a "joint planning process" that is "integrated" and "inclusive," engaging with civilian partners earlier in the process and listening to their needs and concerns from the start(Comment made during discussions at the ASWG in Iqaluit, June 6–7, 2023).Planning for NANOOK-TATIGIIT begins more than a year in advance of the actual exercise. To facilitate the process, the exercise is generally held in whichever territory has assumed the co-chair of the ASWG, to create synergies between the two lines of effort (ASWG Planning Committee, 2017). While broad exercise ideas and concepts are discussed during ASWG meetings, the real work begins with regional outreach by JTFN andthe stand-up of a joint operational planning group. In the year leading up to the exercise, military planners and their civilian counterparts work through multiple planning conferences and participate in detailed scenario writing board activities, which generally stretch over two to three days and are, at times,facilitated by private contractors (Calian Defence Solutions, n.d.).

Despite improvements to the planning process, issues remain. Public Safety Canada, for instance, is involved in planning and outreach efforts on an inconsistent basis. The department's overall involvement in the exer-

[6]The other deployments are NUNALIVUT (a land component in the High Arctic), NUNAKPUT (focused on increasing presence and surveillance along the Northwest Passage), and TUUGAALIK (a maritime component to demonstrate presence and conduct surveillance in the North,in concert with partners and allies).

cises has also fluctuated widely over the years. Further, territorial officials involved in recent exercise planning and preparation have asserted that it "doesn't always feel like a team effort," with some planners coming in with ideas and objectives that "don't necessarily match ours and don't necessarily reflect territorial realities." Greater effort is required to ensure an "integrated planning process from the very beginning," so that territorial participants do not feel "tacked on." Concern also exists about how lessons from past exercises and events are used to shape future activities. As one official asked, "What are we building off and building towards? ... What about the lessons from past exercises, even the ones held in [our territory]? Why aren't these used to shape the next exercises?" In the end, the two agreed that planning and executing the exercise "is a ton of work and time for all involved, and it needs to be more than a performance box to check off, which is sometimes how it feels" (Territorial emergency management officials, personal communication, August 8, 2024).

For its part, the Yukon government recently emphasized "[c]onsidering how to maximize the long-term benefits of each Operation NANOOK-TATIGIIT scenario should be a component of planning from the outset" (Government of Yukon, Executive Council Office, Intergovernmental Relations, 2023, p. 8).

Although there continues to be room for improvement in the planning and execution of NANOOK-TATIGIIT, these issues should not overshadow the benefits. The exercises have enhanced the ability of JTFN and the CAF to provide support to its civilian partners during domestic disaster response operations. In 2021, JTFN's commander, Brigadier-General Pascal Godbout (2021), emphasized the value the exercises have "brought to our work with our partners. Really developing that network, those connections, knowing who to talk to, understanding our respective capabilities, and knowing how to execute a contingency operation". Civilian partners have also acknowledged the role the exercises have played

in preparing them to work with the military and other key actors during disaster events. In a note of thanks to the CAF after NANOOK-TATIGIIT 2023,the minister of community services for the Yukon, Richard Mostyn, stated,"I saw firsthand that this exercise had built relationships that will improve co-ordination and planning with our partner agencies and governments well ahead of an actual emergency. I heard candour and honest talk about gaps that emerged and how we are going to close them across all agencies" (Government of Yukon, 2023b).

NANOOK exercises have strengthened local and territorial emergency management capacities more broadly. NANOOK2015, for example, provided incident command system training to interested territorial and federal agencies, as well as spill response training to community members in Ulukhaktok, which was "very well received and appreciated." Meanwhile, the CAF personnel that deployed to participate in wildfire response and evacuation activities in Fort Smith brought new solutions to the community's evacuation plan, including how best to communicate with residents during door-to-door checks and how information can be passed to and from municipal emergency management organizations (JTFN, 2015).In 2014, the director of NEM noted that the previous year's operation allowed the department to "test its specialized communications equipment for emergency response" and "find our gaps ... [and] look around and see what we might need." It was the kind of exercise that the Government of Nunavut did not have the resources to conduct–while NEM spent approximately $40,000 on the exercise,the CAF spent $10 million (Varga, 2014). Similarly, the Government of Northwest Territories (GNWT) used Operation NANOOK-TATIGIIT 2018 to test and revise a new territorial emergency plan, which it released a month after the exercise finished (Government of Northwest Territories [GNWT], 2020).

Table 5.1: Emergency and disaster response exercise components of Operation NANOOK and NANOOK-TATIGIIT, 2007-2024.

Year	Scenario	Location
2007	Oil spill response exercise.	South Baffin, Nunavut
2008	Health emergency on a cruise ship, fuel spill, and mass rescue operation.	South Baffin, Nunavut
2009	Terrorist attack on storage tank containing jet fuel and compromised pipeline delivery manifold system, resulting in 300,000 litres of P50 diesel being released into Iqaluit inlet and Frobisher Bay.	Iqaluit, Nunavut
2010	Remediation of a community-level petrochemical leak.	Resolute Bay, Nunavut
2011	Major air disaster outside Resolute Bay.	Resolute Bay, Nunavut
2012	Request for assistance TTX, functional exercise working through notification and activation of emergency plans, and a full-scale exercise involving an accident between a barge and ferry on the Mackenzie River.	Various communities, NWT
2013	Response to a wildfire threatening Whitehorse and search and rescue of a sick child and his father on Resolution Island near Iqaluit.	Whitehorse, Yukon,and Resolution Island, Nunavut
2014	Search and rescue of a fishing boat in distress in Davis Strait and response to a 50-passenger cruise ship that experienced mechanical difficulties and ran aground in York Sound, requiring the CAF to deploy its major air disaster kit.	South Baffin, Nunavut
2015	Containment and remediation of a maritime fuel spill in Amundsen Gulf and response to a wildfire threatening Fort Smith and requiring community evacuation.	Ulukhaktok and Fort Smith, NWT
2016	Major response to an earthquake that severely impacted Haines Junction and moderately damaged Whitehorse. An aftershock occurred during the response efforts that isolated Haines Junction and surrounding communities.	Whitehorse and Haines Junction, Yukon, and adjacent areas
2017	Involved a response to a wide array of community emergencies, including a resupply disruption, HAZMAT/health hazard, mass casualty event,and industrial accident.	Rankin Inlet, Nunavut
2018	Wildfire response and community major air disaster (Exercise READY SOTERIA;JTFN was not the lead on this activity).	Yellowknife and Behchokǫ̀, NWT
2019	Wildfire response and evacuation, activation of the Canada-United States Civil Assistance Plan.	Whitehorse, Yukon
2020	Major maritime disaster but actual exercise cancelled due to COVID-19.	Iqaluit, Nunavut
2021	Major maritime disaster and mass rescue TTX.	Davis Strait, Nunavut
2022	TTX working through various territorial and community-level whole-of-government responses.	Yellowknife, NWT
2023	Command post exercise focusing on an ice storm causing extensive power infrastructure damage/outages/disruption during extreme cold temperatures. Scenario injects included unsafe roads,missing persons, the evacuation of Carmacks, and the unavailability of fuel,food, and potable water.	Whitehorse and Carmacks, Yukon
2024	Major power plant failure, water-pumphouse freeze up, targeted cyber-attack.	Chesterfield Inlet, Nunavut

These military-led, whole-of-government exercises have become critical components of territorial emergency preparedness. An after-action review into the spring flooding that occurred in the NWT in 2021 called for the territorial emergency management organization (EMO) to plan and support "increased participation from all levels of government in territorial, regional and community mock and tabletop exercise events." In its response, the GNWT referenced the EMO's participation in NANOOK-TATIGIIT every three years and its plans "to continue to expand GNWT and community participation in this activity"(GNWT, 2 0 2 3, pp. ii, 14, 33, 35). Meanwhile, the Yukon government has identified NANOOK-TATIGIITas "our most fruitful and visible security cooperation," indicating that its "opportunities for training and other positive legacy impacts" have provided "practical experience and raise[d]the knowledge and domain awareness of the Yukon"(Government of Yukon, Executive Council Office, Intergovernmental Relations, 2023, p. 8). Past exercises have served as "critical learning tools" and exposed problems in the Yukon's plans, protocols, and "cross-agency coordination" that the actors involved have gone on to address (Government of Yukon, 2023b).

5 Liaison Officers and Canadian Rangers

JTFN's liaison officers play an essential role in facilitating the plans and preparations for Operation NANOOK-TATIGIIT– and are critical to the conduct of actual disaster response operations. As one member of JTFN explained, while the ASWG and its exercises help to build the civil-military connections and some of he capabilities required for effective responses, "for operations, you need the liaison officers. They are the ones who can make things happen... Without them, things don't happen smoothly" (Federal member of the ASWG, personal communication,

September 3, 2021).The literature on civil-military relations during domestic disaster response operations highlights the essential role these officers play as boundary spanners –"critical networkers" who "establish and maintain contacts, information conduits who facilitate data exchange, as well as organizational and domain experts with much relevant crisis management knowledge" (Kalkman, 2020, 234). The networks and relationships sustained by the work of liaison officers can also help create a sense of common purpose and dissolve an us-versus-them mentality (Botha, 2022, p. 141).

When JTFN was stood up in 2006, its commander, Colonel Norm Couturier, emphasized that the capacity of the detachments in the Yukon and Iqaluit would be improved to assist with their liaison duties, particularly their "work with territorial and federal officials to develop better emergency response plans" (Bell, 2006). At the November 2007 ASWG meeting, officials from the Yukon emergency management organization highlighted the results of these efforts, noting the importance of the "strong relationship" they enjoyed with JTFN personnel based in the territory (Yukon Emergency Measures Organization, 2007). Between 2008 and 2010, JTFN commander Brigadier-General David Millar placed tremendous emphasis on the liaison role and the development of strong personal connections (Lackenbauer & Lajeunesse, 2017). This period even saw JTFN entering into discussions with GNWT officials about the establishment of an "executive liaison group," or"a standing forum for executive engagement to consider emergency planning or response issues which require the attention of this senior level." These plans, however, did not materialize (GNWT, 2008).

Today, liaison officers sustain ongoing relationships with the core federal and territorial actors involved in emergency management and sit on the emergency coordinating bodies in all three territories. During emergency events, they keep JTFN updatedon territorial emergency response capabili-

ties and requirements, while providing territorial EMOs with an understanding of possible CAF assistance during events (Federal member of the ASWG, personal communication, September 3, 2021; see also Carroll, 2021a). Generally, JTFN's liaison officers enjoy positive relationships with their civilian counterparts and maintain strong lines of communication through which to exchange information, create shared situational awareness, and facilitate responses (Federal member of the ASWG, personal communication, September 3, 2021).

Nevertheless, several issues have undermined the effectiveness of such liaison officers in the past. First, the emphasis placed on the liaison role has ebbed and flowed over the years, largely resulting from the approach and perspective of the JTFN commander. Commanders change every two to three years and can bring with them very different opinions on the importance of liaison officers (Federal member of the ASWG, personal communication, September 3, 2021). Second, the frequent turnover of military personnel at JTFN and the concomitant need to constantly rebuild liaison relationships can be challenging (Federal member of the ASWG, personal communication, September 3, 2021). Third, given the small size of JTFN's detachments, there are few alternatives if interpersonal issues arise and officers and their civilian partners clash or do not work well together (Territorial emergency management officials, personal communication, August 8, 2024). Fourth, issues have arisen in the past when liaison officers "have not stayed in their wheelhouse" and "have really overstepped" in their actions, such as attempting to bypass their civilian emergency management partners (Territorial emergency management officials, personal communication, August 8, 2024). Finally, while liaison officers maintain good relationships at the territorial level, they often have fewer connections with regional, Indigenous, and municipal governance bodies, which can limit their effectiveness during response operations (Federal member of the ASWG,

personal communication, September 3, 2021).

While liaison officers can struggle to extend their networks to the local level, the Canadian Rangers often serve to fill this gap for JTFN. Canadian Ranger patrols consist of part-time Reservist swho are part of relationships, groups, and networks that span the social breadth of their communities. As a patrol member from Kugluktuk explained,

> Rangers wear a lot of hats. We are in local government, hunter and trappers' organizations, Coast Guard Auxiliary units, housing associations. We are coaches. We volunteer at community events. We have coffee with Elders. We go to church. We run bingo. We work with a lot of different people. (Member of the Kugluktuk Ranger Patrol, personal communication, October 20, 2019)

The intersection of multiple social networks in a patrol ensures that Rangers know most or all community members, including the key local players involved in emergency response. When outside agencies, including the CAF, respond to local emergencies and disasters, Ranger patrols provide a ready entry point into communities and offer immediate access to extensive local networks, all of which facilitates response activities (Kikkert & Lackenbauer, 2021).

6   The Impact of JTFN'S Efforts on Domestic Disaster Response Operations in the North

The first major test of JTFN's efforts to prepare for disaster response operations came in August 2011 with the crash of First Air Flight 6560, a Boeing 737-200 that crashed on landing at Resolute Bay, Nunavut, killing 12 of the 15 people on board and severely injuring the three survivors. Fortuitously, elements of

JTFN, hundreds of CAF personnel, and civilian partners were already deployed in Resolute prior to the crash as part of the Operation NANOOK2011 whole-of-government exercise simulating a major air disaster outside the community. Consequently, military personnel were able to respond to the crash almost immediately, working closely with their civilian counterparts. An after-action report applauded the "good collaborative planning process for Op Nanook Phase 4 which enabled a good coordinated response for the First Air [Flight] 6560 incident" ("Lessons Learned,"n.d.).

Despite the time and energy that JTFN expended working with its civilian partners to prepare for a major air disaster exercise, serious civil-military issues still arose during the response. Many JTFN and CAF personnel were unaware of the contingency plans, operating processes, and procedures of territorial and federal partners and vice versa, making it difficult to function in an "integrated operations environment" (Canada Command, 2012).The military also encountered complications exchanging secure information with its partners, with communication issues inhibiting shared situational awareness. Both military and civilian agencies had to do a better job "anticipat[ing] requirements during a crisis response. Improved interoperability should begin with standardized terminology that would enhance the functioning of a fused emergency response centre, whereby immediate clarifications could be achieved in any instances of inadvertent confusion" (JTFN, 2011).Alack of awareness about the processes needed to request the CAF's assistance, including the need to rapidly transition verbal requests into written form, caused confusion. Finally, JTFN found it difficult to quickly identify local emergency response resources and capacity in the community, highlighting the limits of the networks that its liaison officers had formed (Canada Command, 2012; JTFN, 2011).

Subsequent ASWG meetings and NANOOK exercises offered ample opportunities to work through the civil-military issues that had arisen during the First Air crash. During the long response to the COVID-19 pandemic, JTFN liaison officers were embedded in the Yukon's emergency coordination committee (ECC) and the NWT's territorial emergency management organization from the onset of Operation LASER (the CAF's pandemic response) in April 2020. JTFN activated Ranger patrols to provide assistance at the community level, provided planning support for vaccine distribution, and worked with the Royal Canadian Air Force to deliver five medical-grade low-temperature freezers (-35°C) to the Yukon and Nunavut as part of Operation VECTOR (DND, 2024a; DND, 2024b; Government of Yukon, 2020). A review of these efforts at the November 2020 meeting of the ASWG noted how "pre-existing working relationships" had culminated in generally effective communication and coordination between key actors (ASWG, 2020). Nonetheless, civil-military challenges arose in sustaining consistent communications and shared situational awareness throughout the duration of the pandemic. A second issue revolved around limited local and territorial understanding of the possible roles, capabilities, and limitations of the Canadian Rangers, which generated confusion and highlighted the need for continued education regarding the activities that Rangers could and could not perform (Federal member of the ASWG, personal communication, September 3, 2021).

During the response to COVID-19, three major incidents (one in each territory) required assistance from JTFN and the CAF, with two culminating in the first deployment of Operation LENTUS in the territorial North. The first incident occurred in the NWT in May 2021, when the territory experienced its worst flood season on record, with flooding in multiple communities and the evacuation of hundreds of residents (GNWT, 2023). On Friday, 14 May, Fort Simpson's senior administrative officials asked the GNWT to secure the support of approximately 30 mil-

itary personnel –either Rangers or a combination of Rangers and other CAF members –to support the community and provide the human power required to start the recovery process (Whitehouse, 2021). That day, the GNWT submitted a request for assistance for an unspecified number of Rangers to support the remaining high-risk communities experiencing river breakup conditions, while noting that, due to COVID-19 concerns, it did not want the deployment of southern-based assets into the territory (Whitehouse, 2021). The request for Ranger assistance"was approved on May 15 to provide for a six-week period until June 25, with a reassessment to take place after the initial period to determine the continued need" (Sibley, 2021a). In Fort Simpson, the actual physical response amounted to two Canadian Rangers from the community's own patrol employed from 15 to 18 May. The small number of Rangers and the length of time they were deployed led to critiques from local leadership about the military's willingness and capacity to respond (Desmarais, 2021; Sibley, 2021a).

While the territorial after-action review on the flood response ignored civil-military dynamics, media reports and government statements exposed critical issues during the incident. The GNWT's Municipal and Community Affairs (MACA) department alluded to some of these problems in the immediate aftermath of the floods, noting that the Fort Simpson situation had "made it aware that there were gaps in the formal communication on the status of Rangers during the flood response" (Sibley, 2021a). Throughout the situation, local and territorial officials expressed confusion over the roles and capabilities of the Canadian Rangers. They did not understand that the Rangers were not self-sustaining and could not be deployed away from their communities, and they expected that the military could provide long-term assistance during the recovery process facing the communities. The fact that any self-sustaining troops available to JTFN would have to come from the South also seemed to surprise MACA. Meanwhile,

territorial officials passed on little information to the communities about the military's capabilities and limitations (see Carroll, 2021b; Desmarais, 2021; Sibley, 2021a, 2021b). Further, rather than set specific tasks for the Rangers, territorial emergency management officials largely left that to local governments, which had significantly less experience working with the military. This left individual Rangers in a position of explaining to local officials why they could not undertake a specific task. According to the mayor of Fort Simpson, "there was confusion among all parties involved regarding 'what the military's role or capacity would be during an emergency'" (Sibley, 2021a).

Some of these gaps indicate that JTFN did not use its liaison role to "lean forward" during the crisis to anticipate the GNWT's need for CAF assistance and educate territorial officials on what services it could provide. Issues also resulted from JTFN's limited liaison networks at the regional and local levels. Each of the five regions of the NWT has an emergency operations centre that is responsible for managing emergencies and coordinating with communities. While JTFN had a liaison officer working at the territorial level, it did not have officers at the regional level. "One significant lesson learned is the need for a JTFN Liaison Officer at the Regional EMO level," one federal member of the ASWG reflected, "which has been acted upon." This improved civil-military coordination assisted in linking JTFN to the regional and local levels and "made things much easier to ensure the tasks Rangers get are the ones they can actually execute" (Federal member of the ASWG, personal communication, September 3, 2021).

Operation LENTUS in the Yukon in 2021 offers a more positive case study. Through the spring and summer, the Government of Yukon mounted the largest emergency response in its history to manage the impacts of flooding in the Southern Lakes region. As the situation intensified throughout June, the territorial government maintained frequent contact with Public Safety Canada and other fed-

eral partners, including JTFN. The Yukon expended all of its emergency response resources and tapped into the private sector to support its efforts. When the situation escalated in early July, the Government of Yukon requested federal assistance on 3 July, and, three days later, over 100 CAF personnel deployed to the territory. From 5 July to 2 August, they filled and moved sandbags, assisted persons affected by the floods, conducted wellness checks, protected critical infrastructure and transportation routes, and assisted with evacuations (Desmarais, 2021).

By all accounts, civil-military relations were excellent throughout the incident, marked by early coordination, a well-crafted RFA, and efficient integration of the CAF's resources into territorial response efforts. The Yukon government explained that "[o]ur relationships with the JTFN, local CAF staff in Yukon, and Public Safety Canada led to well-coordinated and timely briefings, meetings, and interventions that saved critical infrastructure and private property from significant damage" (Government of Yukon, Executive Council Office, Intergovernmental Relations, 2023, p. 12). Once the CAF unit arrived, "the territorial EMO in the Yukon coordinated all task requests that the CAF undertook exactly as it should" (Federal member of the ASWG, personal communication, September 3, 2021). While deployed, the military worked under the direction of the Yukon's incident management team in the Southern Lakes, while each military unit had a civilian supervisor who was either a territorial wildfire fighter or a member of the Alberta Disaster Response Team (Canada Task Force 2), who provided daily objectives and guidance (Lennips, 2021). Damien Burns, Assistant Deputy Minister of Protective Services in the Yukon, explained the benefits of working with the CAF during this deployment: it was able to "take this whole problem away from us from a logistics, operations and management sense," because "they're there for us, they're trained in the way we need them to[be], to come and integrate into our system, and they are plugging

those holes that we can't" (Burns,2022).

While JTFN facilitated Operation LENTUS in the Yukon, it continued to work with its civilian partners on Operation NANOOK-TATIGIIT 2021, which focused on a cruise ship incident in Nunavut. The day before the exercise was scheduled to take place, however, the Iqaluit Water Crisis escalated into a critical situation. In October 2021, testing identified the presence of hydrocarbons in Iqaluit's water supply, which were eventually traced to the city's water treatment plant. For nearly two months, city residents went without clean tap water, with the city placed on a do-not-consume order. Residents gathered water from the Sylvia Grinnell River, while between October and December 2021, more than 1.5 million litres of bottled water were procured and shipped to Iqaluit on 39 chartered flights (DPRA Canada, 2023). Given that most of the "main players were already working through the [NANOOK] exercise[,]they easily switched to real discussions with partners" about federal assistance, including the support that JTFN/the CAF and other federal agencies could provide (Discussion at the ASWG, November 25, 2021). This involved a clear assessment of what the military's Reverse Osmosis Water Purification Units (ROWPUs) could accomplish. These discussions shaped the territorial RFA submitted by Nunavut's Community and Government Services (CGS) department on 20 October 2021,which asked the federal government"to deploy water treatment assets and personnel to Iqaluit to support access to potable water in the community" (Discussion on the Iqaluit Water Crisis at the ASWG, June 6, 2023).

On 21 October, JTFN and the CAF were tasked to supply two ROWPUs and the required operators (over 20 military personnel). A day later, JTFN personnel, with assistance from CGS, set about identifying potential sites for the deployment of its ROWPUs. It was difficult to find facilities to work in, "but the [JTFN] detachment in Iqaluit was a key enabler ... we were able to plug

into those relationships." On-the-ground relations between JTFN/CAF personnel and their civilian CGS partners were very good as they attempted to locate a suitable site, find solutions to the austere environmental conditions they faced, and navigate the logistical issues involved with transporting the water produced by the ROWPUs (Territorial emergency management official, personal communication, November 20–22, 2022). Eventually, the military and CGS settled on a site at the Sylvia Grinnell River. Throughout the deployment, JTFN had frequent meetings with Public Safety Canada, Nunavut Emergency Management,and other Community Government Services officials, ensuring effective collaboration between those partners (Discussion on the Iqaluit Water Crisis at the ASWG, June 6, 2023).

Three weeks passed from the receipt of the RFA to running ROWPU water. During this deployment, JTFN was caught up in a disagreement between CGS and the City of Iqaluit, which did not believe that the level of risk required the military's assistance and felt that the territorial government had overstepped and was being overly prescriptive. City officials perceived "Operation LENTUS as an unnecessary distraction from remediation efforts at the Iqaluit WTP [water treatment plant]. The City preferred, instead, to continue filling its water trucks at the Sylvia Grinnell River. "They were also skeptical that the ROWPUs could provide adequate drinking water, disagreed with the military and CGA on where to situate the units, and worried about "the concentration of chemicals in, and means of disposing of, the waste water produced by the ROWPU[s]. "Throughout the crisis, disjointed communication and coordination between the two civilian entities slowed the military's process (DPRA Canada, 2023, pp. 21, 26). Without the City's support, progress stalled, and, although JTFN attempted to alleviate concerns with a formal letter, the City only permitted the military to commence operations at the Sylvia Grinnell

River site on 31 October.[7] Between 7 November, when the ROWPUs became operational, and 10 December, when the do-not-consume order was lifted, Operation LENTUS produced and distributed a total of 371,650 litres of treated water for Iqaluit residents through the City's water trucks. Unfortunately, the coordination and communication issues between the City of Iqaluit and the Government of Nunavut departments "may have contributed to some Iqaluit residents' hesitation to consume treated water produced by Operation LENTUS" (DPRA Canada, 2023, pp. 25, 33). While JTFN was caught in a turf war between CGS and the City of Iqaluit, personnel involved still identified several critical lessons that would have improved civil-military relations during the crisis. JTFN needed to better understand the roles and responsibilities of the civilian actors involved in the incident, including with which entities they would have to partner closely. With a better understanding of who was responsible for what, JTFN personnel could have done a better job developing and maintaining clear horizontal and vertical lines of communication with key stakeholders. This approach may have allowed them to more quickly alleviate concerns about the ROWPU process and work through logistical and operational disagreements (Discussion on the Iqaluit Water Crisis at the ASWG, June 6, 2023). The Iqaluit Water Crisis again seemed to indicate that the liaison network established between JTFN and its civilian counterparts did not extend adequately to the local level.

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[7]On 1 November, JTFN started setting up its ROWPUs at the Sylvia Grinnell River. On 7 November, Operation LENTUS distributed 27,000 litres of treated water through the City's water trucks. Operation LENTUS would continue to produce treated water until 23 November, when a winter storm damaged some equipment and forced JTFN to suspend operations for a second time. Consequently, JTFN shut down its ROWPUs and moved its operations to a forward operating facility at the Iqaluit airport. Rather than risking further equipment damage and additional interruptions, JTFN opted to operate the ROWPUs from inside this facility.

Despite JTFN's efforts through the ASWG, response exercises, and liaison networks to build the conditions necessary for effective cooperation across the complex jurisdictional landscape of the territorial North, common civil-military issues emerged during its responses to the crash of First Air Flight 6560, the COVID-19 pandemic, the 2021 NWT floods, and the Iqaluit Water Crisis. These include conceptual differences around the RFA and the end state of military assistance, difficulties with the exchange of information, interoperability, and command and control, as well as a limited mutual understanding of roles, responsibilities, capabilities, and processes. While we recognize the territorial-municipal dynamics at play during the water crisis, the City of Iqaluit's response also seemed to indicate a limited belief in the value of civil-military cooperation and a low degree of trust. Conversely, civil-military collaboration during the 2021 Yukon flood response appears to have been seamless.

7 Conclusion

This article has argued that the CAF–specifically Canadian Forces Northern Area and its successor, Joint Task Force North–has strengthened its whole-of-government disaster response operations in the North. Still, we have identified significant areas for improvement in each of the military's primary efforts to improve intergovernmental and interorganizational collaboration in the region, namely the Arctic Security Working Group, liaison officers,the Canadian Rangers, and its annual large-scale response exercises.

JTFN is already working on some of these issues. In reviewing the CAF's response to the 2021 incidents in the North, JTFN's commander, Brigadier-General Godbout, reflected that "JTFN and its partners operating in the North must work on the contingency operation planning process itself beyond NANOOK to better prepare for events in which communities and territorial govern-

ment[s] have very short periods of time to assess the situation and request the military's assistance to ensure support arrives in time" (Godbout, 2021). To operate at the speed of trust, Team North requires more joint planning and practice. JTFN has attempted to strengthen its liaison efforts, while the ASWG has taken steps to act on some of the lessons identified during the 2021 incidents. In its November meeting that year, for instance, it adopted the theme "Community Safety: Preparedness, Resilience and Recovery," which included detailed discussions of the RFA process, how private sector resources can be used in disaster response and recovery, and best practices in community evacuation.

To assist in improving civil-military collaboration in northern disaster response, additional research is required into the lessons observed from each NANOOK-TATIGIIT exercise, to determine how effectively they have been translated into lessons learned, and to identify outstanding areas for improvement. Further research is also needed into how the ASWG can play a more substantive role in building the competencies required for on-the-ground civil-military coordination. Furthermore, work remains to identify how JTFN can move from a whole-of-government approach to a more inclusive whole-of-society approach that would allow the CAF to improve its connections and navigate the increased complexity that these additional entities bring.

A broader question should be considered: is JTFN the right organization to be leading federal-territorial emergency response exercises and engagement in the North (Federal member of the ASWG, personal communication, September 3, 2021)? The military has taken on this important role for over two decades, providing a capability where none existed and taking on a responsibility no other federal agency wanted. Moving forward, serious thought should be given to whether Public Safety and Emergency Preparedness Canada should be leading federal lines of effort or, at least, playing more of an equal partner role in planning for NANOOK-TATIGIIT.

Regardless of the specific role that JTFN plays in the years ahead, improved civil-military cooperation is essential as the hazards facing the territorial North continue to increase in size and frequency. Canada's April 2024 defence policy update reaffirmed the CAF's commitment to "establishing greater presence, reach, mobility, and responsiveness in the Arctic and North to deal with disasters, threats, and challenges to our sovereignty" (DND, 2024c, p. 4). This recommendation supports the priorities of the Government of Canada's Arctic and Northern Policy Framework (September 2019), which highlights the importance of relationship building and engagement between the CAF and northern communities and, more generally,emphasizes strengthening the region's whole-of-society emergency management capabilities (Crown-Indigenous Relations and Northern Affairs Canada,2019). The unique operating challenges in the region, compounded by the limited local and territorial resources, mean that the CAF will continue to be called upon –as it was during the evacuation of Yellowknife in 2023 due to forest fires. It must be ready.

Acknowledgments

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A Resilience Space Focusing On Municipal Critical Infrastructures' Electricity Dependence

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Abstract

This article addresses the growing vulnerability of municipal critical infrastructures to their dependence on electricity, a situation exacerbated by complex interdependencies. Major power outages, considered systemic risks, are difficult to anticipate and control. Moreover, within a given territory, such outages affect a wide range of infrastructures simultaneously. Consequently, consequence management requires collaborative and adaptive governance among all relevant stakeholders to mitigate impacts on populations. In this context, the concept of a resilience space is introduced. It is defined as a structured framework bringing together municipal actors and the power grid operator to strengthen both individual and collective resilience through enhanced cooperation. The central tool is the Common Situational Picture, which maps infrastructures' response capacities and vulnerabilities, thereby supporting shared understanding and the development of adapted strategies. The implementation of the resilience space in the Montréal region has demonstrated significant benefits: improved identification of vulnerable sectors, adaptation of municipal emergency plans, and strengthened relationships among all involved stakeholders. The sustainability of this approach relies on clear governance, secure information sharing, and neutral leadership. It is becoming increasingly critical in the face of emerging challenges related to the energy transition and climate change.

Keywords: municipal critical infrastructure (MCIs), electicity dependence, collaborative governance, vulnerability assessment, energy, emergency management, adaptation strategies, climate change.

1 Introduction

Electricity is essential to the functioning of societies today, but it is becoming increasingly complicated to manage, given the existence of highly interrelated issues, which may be regulatory, political, climatic or consumption-related. This complexity is a source of vulnerability and may result in major, long-term service interruptions that can affect several municipalities. In urbanized territories, such interruptions can be particularly damaging for critical infrastructures (CIs), defined as "processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government" (Public Safety Canada, 2022). Some CIs provide services directly to the population, such as drinking water, wastewater treatment, safety and public transit; these are referred to as municipal critical infrastructures (MCIs). If their own services are interrupted, the consequences for public health and safety are immediate. Consequently, MCIs' dependence on electricity, which is amplified by little-known interdependencies, represents a systemic risk that is difficult to analyze without a global approach focusing on their resilience. It is therefore important to implement joint risk management strategies, based on close collaboration between MCIs and the manager of the electricity system. This requires the creation of a resilience space designed to structure such collaboration and ensure collaborative, adaptive management of electricity outages.

In this article, we first present the findings that led us to consider collaboration as essential for the management of a major electricity outage. We then develop the concept of resilience space and discuss the results of the implementation of such a space within a group of Quebec municipalities. Finally, the challenges related to the long-term maintenance of the resilience space are discussed, and avenues to ensure its long-term effectiveness are suggested.

2 Risk Management and Resilience

National and international risk management practices to handle the technical risks associated with electrical systems remain consistent with the principles and guidelines of ISO 31000:2018 on risk management (International Organization for Standardization [ISO], 2018). In general, this standard requires the application of three phases.

The first phase consists in establishing the context of the study. This involves defining the study's objectives and scope and clearly characterizing the system to be studied. A multidisciplinary analysis team with the appropriate skills to handle the complexity of the system under study should be set up. The risk analysis and acceptability criteria must be defined and approved, which is a crucial step for the rest of the process.

The next phase, which is more technical, involves risk assessment. The hazards that may affect the system under study are identified and characterized, along with how they might materialize (scenarios). In this article, risk situations based on long-lasting service interruptions in large urban areas are addressed. Consequently, major hazards must be considered, such as earthquakes, windstorms, and freezing rain that may affect generating stations, transmission lines, distribution substations, etc. It is crucial to identify existing protective measures designed to prevent the impacts of these hazards or lessen their consequences. These scenarios are then analyzed in terms of their impacts on facilities and the consequences of service interruptions, as well as their probability of occurring. The impacts are determined based on duration, sequences of events, equipment affected, etc. Frequencies of occurrence are also established using relevant historical data, analytical techniques, digital simulations and expert opinions.

The impact analysis takes account of the protective measures in place and the vulnera-

bility of the relevant equipment. Both immediate and long-term consequences are considered. For the electrical system, consequences are generally assessed in terms of generation losses and unsupplied power,and repair and recovery costs, as a function of the duration of the interruption, its geographic extent and the duration of recovery. For major interruptions, some studies have also quantified the direct and societal costs, which are referred to as Value of Lost Load (VoLL) (Morissette et al., 2024). This indicator, which is generally expressed in $/kWh or $/MWh, reflects the economic impact and inconvenience experienced by users if the power supply is lost, giving an economic value to the quantity of power that is not supplied (Morissette et al., 2024). In addition to economic values, the consequences in a territory are related to domino and snowball effects. Domino effects correspond to cascading impacts on several CIs (an electricity outage leads to a drinking water outage, etc.). Snowball effects correspond to direct impacts without domino effects. They mainly concern MCIs and consequently affect populations directly. The analysis of these impacts is the topic of this article, as we will see below.

Risks are then calculated, assessed and ranked, applying the risk analysis and acceptability criteria defined and approved when the context was established at the outset of the project.

The final phase, risk processing and control, completes the process. The goal is to implement protective measures so that identified risks do not remain in the class of risks deemed unacceptable. In the scenarios used to assess the risks of major service interruptions, other strategic risk control measures may be envisaged over the long term, such as reinforcing equipment, adding new equipment, changing maintenance policies, reviewing design standards, etc. In addition, recovery strategies are established to allow for the fastest possible restoration of service. The residual risk that remains after all the preventive and protective measures are put in place is then documented.

In major service interruption scenarios, with the acceptance that failures are inevitable, the concept of system resilience becomes significant. The resilience of these systems is defined as their ability to limit the scope, severity and duration of the degradation of elements following an extreme event, in order to ensure acceptable functioning. It is achieved by applying a set of protective measures before, during and after extreme events (Abdul-Nour et al., 2021; Komljenovic, 2021; Logan et al., 2022; Moreno Vieyra et al., 2020; Panteli et al., 2017). Rapid recovery and adaptation, rather than merely resistance to the initial disruption, are considered, adhering to the control strategies for these risks. In this context, Hydro-Québec published its Action Plan 2035 to guarantee a reliable electricity supply throughout Quebec, despite increasing demand, more frequent climatic hazards and aging infrastructures. The plan highlights the importance of improved collaboration with all players in a territory (Indigenous communities, municipalities, area experts, unions, environmentalists and consumers) to increase resilience (Hydro-Québec, 2024).

However, ensuring resilience requires that populations and organizations in a territory that depend on electricity, including MCIs, must also be resilient. They need to accept that service interruptions are inevitable and, most importantly, establish protective and recovery strategies that are compatible with electrical systems' resilience strategies; this process demands sustained collaboration among all the organizations involved.

In addition, electricity dependence is characterized as a so-called emerging risk because it applies in contexts that are new and unusual for managers (Florin et al., 2018). Electricity dependence is also considered to be a systemic risk (UNDRR, 2019) since numerous interconnected players depend on this resource. Moreover, the characteristics of systemic risks make it impossible to define a single acceptability criterion, in view of the many organizations involved. Thus, whether a risk

is acceptable can no longer be the decision of just one organization; rather, it must be the subject of discussion and consensus building by all stakeholders (Florin & Parker, 2020).

In conclusion, the stakeholders, and especially MCIs, in a territory must accept that major electrical outages can occur and must adopt collaborative, adaptive management of such disruptions. They need to collaborate to develop and adapt coherent protective and recovery strategies to deal with such events in their territory, given that their consequences and scope cannot be known or anticipated.

3   A Resilience Space

Charmont (2025) defines a system's resilience as its ability to support collaborative, adaptive management of disruptions. This resilience is based on three pillars: acceptance, planning and adaption. Since the system studied here is an urban area, we propose integrating a resilience space that can incorporate all MCIs in order to develop collaborative, adaptive management of major electricity outages. A resilience space corresponds to a structured framework that unites major players (from a territory or an organization) to work on their individual and collective resilience. It can structure and support communication, coordination and cooperation among all stakeholders.

The development of a resilience space is based on a common situational picture (CSP), a tool to bring the stakeholders together around the problem of an electricity outage (Charmont, 2025). This tool is based mainly on Endsley's (1995) work on situational awareness. The CSP, which was first used in the military and aviation fields, allows for quick, informed decision-making on the basis of the perception and interpretation of the information held by several players, allowing for effective anticipation and decision-making. The CSPis adapted to a resilience space that is developed over time; it is similar to a dashboard presenting one or more representations of shared vulnerabilities (Charmont, 2025). In the context of electricity outages, the CSP provides a representation that incorporates MCIs' vulnerability and the consequences for the services with which they supply the population. Thus, it allows stakeholders to identify critical issues and collectively reflect on solutions. The CSP depends on the use of a certain amount of room to manoeuvre, defined as the tolerance interval available before the disruption significantly affects an MCI's functioning (Charmont, 2025). This room to manoeuvre is the result of the MCI managers' professional judgments,which incorporate knowledge of vulnerabilities, existing protective measures and the processes for implementing those measures.

Because it uses this room to manoeuvre, the CSP is able to strengthen each of the three pillars of the territory's and the MCIs' resilience. This tolerance depends on an understanding of vulnerabilities (acceptance pillar) and includes planning measures (planning pillar). Thus, the CSP enables stakeholders to consider the issues that have been raised and define joint solutions (adaptation pillar). As a result, it fosters collaboration, allowing the various players present in the territory to heighten their resilience in the face of certain disruptions. Even before the resilience pillars are strengthened, the creation of a CSP allows MCIs to develop and consolidate their communication mechanisms and their connections and clarify their roles and responsibilities, which are necessary for effective mobilization when a disruption occurs.

A resilience space has been set up in the territory of the Communauté Métropolitaine de Montréal,a community of several large and small cities, including Montreal, Longueuil, Laval and Terrebonne (Morissette et al., 2024). The implementation process started with the creation of a CSP for all the MCIs concerned. To do this, the managers of each MCI identified the key electricity-dependent elements their networks needed to function. For each one, they established the available room to manoeuvre, which involves

defining the impacts on the functioning of the key elements, as shown in Table 1. The evaluation of functional status corresponds to the evaluation of each key element's vulnerability.

Table 6.1: Description of the status of a key element.

Colour		Status of key element
Light green		Normal operation
Dark green		Normal operation with redeployment of activitiesto a backup site
Yellow		Degraded operation with standby equipment
Orange		Degraded operation with standby equipment that needs recharging or refuelling
Light blue		Non-functional but security is maintained by standby equipment
Dark blue		Non-functional but security is maintained by standby equipment that needs recharging or refuelling
Red		Non-functional
Grey		Unkown

Source: Morissette et al. (2024)

A colour code was also created to allow for the visualization of the various entities' room to manoeuvre in the CSP. Figure 1 presents a CSP for part of the territory. It was integrated into mapping tools that make it possible to consider the geographic areas that are most critical from the public's point of view, as well as the most vulnerable populations.

The CSP revealed was confirmed to have played a direct role in increasing the collective and individual resilience of the MCIs involved in the resilience space. This finding is based on the three pillars of resilience. The managers gained a better understanding of their vulnerabilities and mobilized to deal with their joint vulnerabilities (acceptance).

The municipal managers took actions to reduce some of the vulnerabilities, and individual action plans related to major electricity outages were updated (planning). Finally, discussions were rapidly initiated between the electricity system and certain MCIs to adapt their joint recovery strategies in order to enhance public safety (adaptation).

To set up resilience spaces in the territories covered by this study, the MCIs were contacted through their emergency measures and operational continuity departments, which directly piloted the dependence analyses within the municipal departments. Data confidentiality agreements were established, including with the managers of the electricity system. One player was made responsible for the interface between the MCIs and the electricity system. This person worked directly with the municipalities to collate the dependence of the MCIs' key elements on electricity and then map the results, which were then transmitted to the electricity system's geomatics department. Inside the municipalities, the resilience spaces enabled all municipal departments to understand their vulnerability in the face of electricity. The most vulnerable areas were highlighted and individual action plans could be adapted. Protective measures could also be planned, together with the electricity system's managers. For each municipality, the work the head of each municipal department had to do was minimal, but the pooling of their results led to shared awareness of their vulnerability and adaptation of the protective measures for all the key elements under consideration. These results clearly showed how effective the CSP was in the collaboration process, since it stimulated numerous discussions among all the stakeholders.

4 Conclusion and Discussion

Overall, this work has shown the importance of collaboration within a territory and the value of a resilience space for the MCIs in that territory. The study carried out in Mon-

Figure 6.1: Figure 1: Example of a CSP related to electricity dependence in the Montreal area.
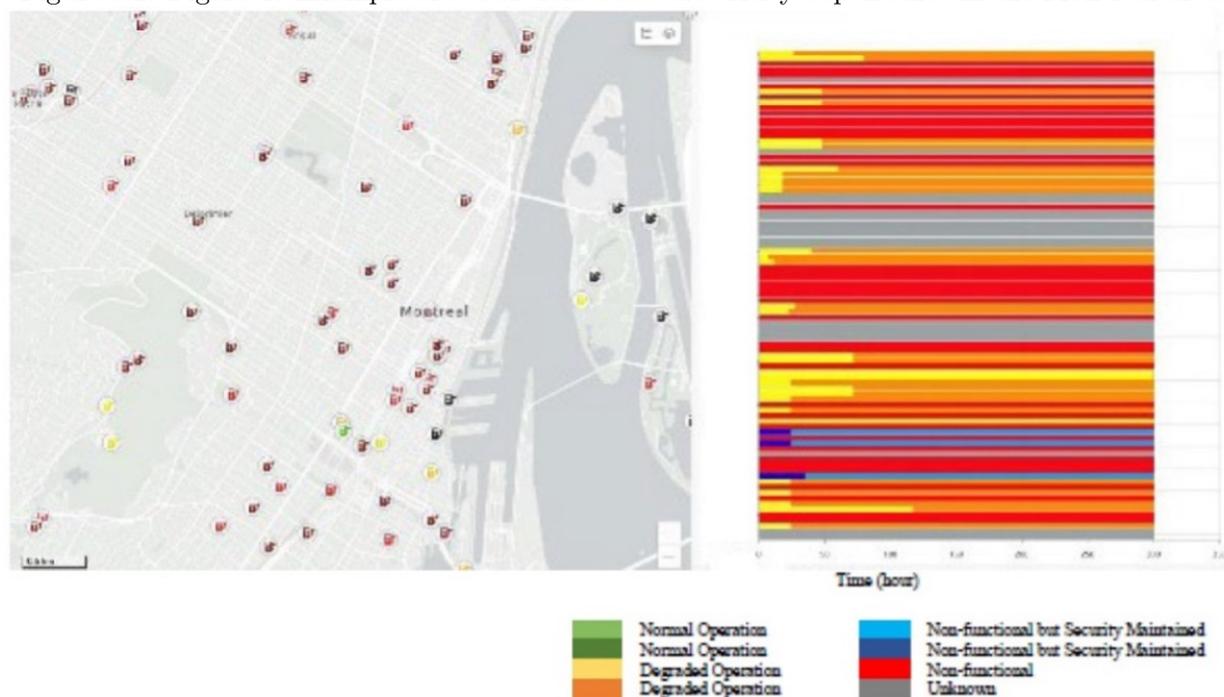
*S*ource: Morissette et al. (2024)

treal clarified the MCIs' vulnerabilities, raised their awareness and opened the door to expanded collaboration in order to enhance the entire territory's resilience. Today, the major issue is ensuring that this space is maintained, which will depend on the continued commitment of the managers involved, each of which has its own operating constraints. A clear governance structure needs to be installed and sustained in order to:

- Define common objectives and manage information sharing, bearing in mind confidentiality, transparency and the MCIs' roles.

- Ensure that the actions resulting from the analysis of the CSP are followed through on, in accordance with the municipalities' policies and operational realities. Preparatory exercises can be done to support these actions.

- Manage documentation, to track changes in vulnerabilities and allow all

players to access the CSP.

- Maintain managers' commitment through regular communications about the actions taken and periodic updating of the CSP

These actions must be supported by a leader (Morabito & Robert, 2023). In addition to building and maintaining ties between the members of the resilience space, the leader's role is to create real consistency throughout the territory and effective coordination of all the players, including the electricity system's managers, since short-and medium-term changes in municipal departments' electricity dependence must always be in phase with the issues facing the electricity system and its generation and distribution strategies. The leader must be neutral so they can ensure transparent coordination without any conflicts of interest. However, the manager of the electricity system must ensure the long-term survival of the resilience space so it can continuously update its protective measures and

plans, particularly its priority restoration list, and adapt it to the realities on the ground. This is especially true in the current context of the fight against greenhouse gas emissions and adaptation to climate change. In fact, the energy transition undertaken by the vast majority of players in the territory is making it more complicated to manage sources of energy and the system as a whole, and thereby significantly changing vulnerabilities throughout the territory. This situation makes collaboration among all the players involved more necessary than ever before.

Acknowledgments

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