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Emergent Patterns: From Observed Crisis Behaviour to Agent-Based Simulations

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ABSTRACT

Understanding human behaviour is essential for designing realistic AI agent-based models (ABM) for crisis preparedness. However, a primary challenge for simulating crisis behaviour is obtaining behavioural data on acute events, and existing research often relies solely on one specific methodology, like retrospective accounts. To complement existing crisis behaviour research and simulations, we want to discuss opportunities to apply an iterative, mixed-method research approach to derive implications for AI-based ABM. This aims to simulate human responses to acute crises for training and preparedness purposes more realistically. To achieve this, our goal is to integrate an iterative research concept by using these complementary methodological approaches:

- **Qualitative interviews** with emergency professionals to capture observations on behavioural patterns.
- **Surveys** to quantify intended as well as retrospective behaviour in different crisis situations, as well as socio-demographic differences.
- **Experiments** to systematically observe high-stress and psychophysiological reactions and mobility patterns in a reproducible environment (such as through virtual reality or field evacuation studies)

As a first step, qualitative expert interviews (N=9) were conducted with experts from emergency medical services, fire departments, and crisis response. These experts reported on diverse events, including earthquakes, floods, and violent conflicts. Data was analysed using inductive content analysis to identify behavioural patterns, emotional states, and influencing factors. Our preliminary findings highlight the immense variability and context-dependency of human reactions:

- **Acute Reactions:** In acute crisis situations, people exhibit highly situational and temporal behaviours. Experts often described instances of panic and attributed them to instinctive actions, characterised by heightened sympathetic nervous system activation and prefrontal cortex inhibition.
- **Social Behaviour:** In general, experts reported solidarity among those affected and instances of neighbourly assistance. At the same time, they expressed conflicting views regarding solidarity and the willingness to help in very acute and threatening situations.
- **Influencing Factors:** Experts indicate that behaviour in crisis situations is influenced by several socio-demographic factors, most often mentioning cultural backgrounds and prior experience with crises.

These preliminary findings already indicate that constructing a unified and realistic crisis simulation using AI-ABM requires careful consideration of both behavioural diversity and contextual sensitivity. Human responses vary across individual agent types, crisis dynamics, and context-related, spatial-temporal patterns, all of which should be taken into account when building the agents' decision-making systems. We thus distilled the following three opportunities for advancing AI-ABM of crisis behaviour:

- **Creating individual agent types:** Agent populations should be heterogeneous and characterised by dispositional factors like prior experience, or demographic attributes.
- **Modelling spatial-temporal patterns:** Each agent should be equipped with parameterised physiological and psychological subsystems that incorporate profile consistent, time-dependent indicators.

- **Including social parameters:** Furthermore, multi-agent models must account for interpersonal relationships and interactions.

This project aims to provide an empirical basis for replacing abstract assumptions with realistic parameters to iteratively refine a simulation tool to better prepare responders for the complexity of human behaviour in crises.

KEYWORDS

Crisis Behaviour, Mixed-Method, AI Agent-based Modelling, Iterative Research

« GESICA: An AI-Based Decision Support System for Anticipating and Managing Exceptional Health Crises »

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ABSTRACT

Healthcare systems are increasingly exposed to exceptional health crisis situations, including pandemics, heatwaves, industrial accidents, cyber incidents, and other disruptive events that may overwhelm emergency and care capacities. These situations are characterized by uncertainty, rapid escalation, strong territorial interdependencies, and the need to maintain routine care while responding to crisis-related demand. In cross-border regions such as the France–Switzerland Interreg area, these challenges are amplified by heterogeneous data sources, coordination constraints, and differences in operational practices. The GESICA project (GEstion de SItuations de Crises sAnitaires) addresses this challenge by developing an intelligent decision-support system for the anticipation, management, and optimization of healthcare resources during exceptional health situations.

The purpose of the project is twofold. First, GESICA aims to detect and characterize weak signals announcing an emerging health crisis before it fully materializes. Second, it aims to generate decision-support scenarios for crisis management, including the sizing and optimization of healthcare resources, patient flows, emergency means, and territorial coordination mechanisms. The project is designed for a transboundary setting and seeks to improve preparedness, resilience, and operational efficiency across partner institutions.

Methodologically, GESICA relies on a multi-model AI framework structured around the integrated perspective “Patient–Resources–Territory”. It combines endogenous healthcare data (e.g., emergency activity, hospital capacities, care pathways, medical dispatch information) with exogenous variables such as meteorological, demographic, environmental, and societal data. The initial demonstrator focuses on the COVID-19 pandemic as a reference case because it provides a well-documented, multi-wave crisis with rich retrospective data for training,

simulation, and comparative analysis. The system is organized around four complementary temporal scales: real-time crisis response, short-term prediction, planning, and simulation. This structure supports both immediate operational guidance and broader strategic preparation. GESICA also builds on prior collaborative experience from the SIA-REMU project on emergency medical regulation and transport optimization.

The poster presents the conceptual architecture of GESICA, its data integration strategy, and its expected operational contributions. Anticipated outcomes include earlier detection of critical signals, more robust crisis-response scenarios, improved allocation of beds, staff, and transport resources, and better coordination across hospitals and territories. More broadly, GESICA aims to strengthen cross-border cooperation, support public-health decision-making, and provide a transferable AI-based framework for future exceptional health crises beyond the COVID-19 case.

KEYWORDS

Crisis Management, Health Emergency, Artificial Intelligence, Decision Support, Cross-Border Healthcare

Mental Health Outcomes of Trained Volunteers

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ABSTRACT

Background: Understanding how disaster response affects volunteers' mental health is critical for sustaining volunteer-based emergency systems. While prior research has examined disaster-related mental health in professionals, limited attention has been given to trained volunteers embedded in formal response systems, particularly in prolonged crises. In contexts such as Iceland, where volunteers often respond within their own communities, repeated exposure may lead to cumulative psychological strain and resource depletion. Furthermore, some volunteers may themselves be members of the affected community. **Objective:** This poster presents preliminary results from an ongoing PhD project that examines mental health among Icelandic Search and Rescue (ICE-SAR) volunteers deployed during the Grindavík volcanic eruptions (since 2023). Guided by Conservation of Resources (COR) theory, a conceptual multilevel framework is used to distinguish between individual (resilience), social (social support), and organisational (feeling heard) resources in relation to anxiety, depression, PTSD, and burnout. **Methods:** A mixed-methods, multiphase design is employed: (1) a systematic review synthesising global evidence on mental health outcomes and resource processes among disaster volunteers; (2) two quantitative studies using repeated cross-sectional surveys (2024 and 2025), assessing symptoms using validated measures (PCL-5, PHQ-9, GAD-7, BAT), analysed using regression and structural equation modelling, and (3) a qualitative approach using semi-structured interviews with volunteers and professional firefighters, analysed using reflexive thematic analysis. Preliminary quantitative results are based on T1 (N=574; mean age=44.9, SD=13.9) and T2 (N=349; mean age=45.2, SD=15.2), with 69% male participants at both timepoints. Participation in the Grindavík response was reported by 44.1% (T1) and 48.8% (T2) of respondents. Exploratory analyses indicated minimal between-team variance in organisational support (feeling heard), suggesting that these measures primarily reflect individual-level perceptions. **Results:** Mental health symptom levels were low to moderate across both timepoints and showed slightly lower average scores at T2 (anxiety 0.48 → 0.43; depression 0.50 → 0.47; PTSD 0.45 → 0.40; burnout 1.59 → 1.52). Moderation analyses indicated that at T1, resources conceptualised as organisational and social played a more prominent buffering role than resilience scores. Feeling heard within the organisation significantly moderated the relationship between disaster participation and symptoms of anxiety, depression, and PTSD. Social support showed weaker and less consistent effects, reaching significance for anxiety and depression but not PTSD. In contrast, resilience scores did not significantly moderate outcomes at T1. At T2, this pattern differed, with resilience scores emerging as a consistent and significant moderator across anxiety, depression, PTSD, and burnout. Social and organisational resources were no longer significant moderators at T2. **Conclusion:** Overall, the findings might indicate differences in the pattern of associations between timepoints in the types of resources most strongly linked to mental health protection, with social and organisational resources more prominent at T1 and individual resilience scores at T2. However, these differences reflect cross-sectional comparisons rather than within-person change. These results highlight the importance of both organisational practices, such as clear support protocols, and individual coping resources in supporting volunteer well-being and sustaining resilient disaster response systems.

KEYWORDS

Disaster mental health; Volunteer responders; Conservation of Resources (COR) theory; Crisis informatics; Multilevel resource processes

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AI Logistic Awareness System (AILAS): Weather adaptive Routing for Humanitarian Logistics

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ABSTRACT

Reliable logistical processes are the backbone of humanitarian aid, ensuring the delivery of critical goods to vulnerable populations in various crisis contexts. However, logistic operations in remote areas or regions with underdeveloped infrastructure often rely on unpaved road networks that commonly constitute the 'last mile' of vital logistic routes. In contrast to paved roads, these surfaces are significantly more sensitive to weather conditions; for example, rainfall or associated flooding can lead to softening of the road surface, gully erosion, and rutting, decreasing the roads passability or rendering them completely impassable. Currently, a significant information gap exists as established routing services like Google Maps or TomTom lack reliable data for these poorly mapped regions, while manual in-field reconnaissance, using tools such as drones, is often too costly, slow, or complex for time-critical missions. This lack of data leads to delays and planning uncertainties that directly impact the cost and effectiveness of aid delivery. Crucially, the absence of reliable data for the unpaved 'last mile' can lead to a complete failure in reaching remote, vulnerable communities.

The AI Logistic Awareness System (AILAS) addresses this deficit by implementing a weather-adaptive, AI-supported routing system. The system utilizes a multi-stage pipeline: first, the passability of unpaved road segments is classified from Street-Level Imagery (SLI) (georeferenced ground-level photos) using a Deep Learning model. These classifications are then spatially and temporally coupled with dynamic and static secondary data, such as precipitation records, weather forecasts, terrain parameters, and satellite imagery. Based on this integration, a probabilistic model is developed to predict the current and forecasted accessibility of the entire unpaved road network, including sections for which no direct imagery is available. These passability estimates are integrated daily into a capable routing engine (openrouteservice), where impassable or restricted sections are automatically devalued or excluded using penalties to ensure a functional routing graph. The long-term vision is that, by leveraging secondary data and extensive training on SLI, the system will effectively assess and forecast the passability of specific unpaved road segments. Ultimately, this will enable the model to approximate the condition of segments not represented in the imagery, providing reliable assessments even in data-scarce environments.

Currently piloted in Madagascar in collaboration with the Croix-Rouge Malagasy (CRM), the project leverages SLI data collected by CRM teams during their daily operations, alongside additional SLI sources such as the Mapillary platform. For humanitarian actors, AILAS can serve as a critical decision-making tool, enabling

logisticians to generate routes that account for dynamic weather impacts. By integrating these insights into practitioner-friendly dashboards such as the United Nations Logistics Cluster's LogIE platform, the system has the potential to significantly enhance the reliability and efficiency of aid delivery during hydrometeorological disasters such as tropical cyclones or floods.

KEYWORDS

Logistics, Street Level Imagery, Computer Vision, Humanitarian Aid

Control Without Command: Communicative Self-Organization Among Spontaneous Volunteers in Search and Rescue

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ABSTRACT

When a disaster occurs, professional emergency services rapidly mobilize. The same pattern can be observed among spontaneous volunteers. Spontaneous volunteers may represent significant operational potential; however, their lack of formal affiliation and established roles create challenges for coordination and participation. Their interaction with professional emergency services is often unstructured and characterized by skepticism and uncertainty related to responsibility, risk, and competence.

In the Norwegian context, the police typically lead rescue operations as the incident commander and are responsible for health, safety, and environmental (HSE) standards for all participants, including spontaneous volunteers. This responsibility often leads to institutional hesitation toward the inclusion of spontaneous volunteers, as doing so entails risk and accountability. The need for greater understanding is reinforced by increasing complexity and limited capacity within professional emergency services and the police. Previous research has primarily focused on structure, leadership, and information systems, while less attention has been given to how organizing is actually constituted through communication, and which relational mechanisms enable or constrain this process.

Against this background, the study examines how public rescue services can benefit from spontaneous volunteers without directly incorporating them into existing formal structures during a search and rescue (SAR) operation. Specifically, it investigates how swift trust influences the emergence and dynamics of communicative flows in a SAR context. Drawing on the Communicative Constitution of Organizations (CCO) perspective and its four communicative flows, the study analyzes how organizing emerges through interaction.

A high degree of organizational quality may result in reduced friction, fewer misunderstandings, more effective utilization of volunteers, improved safety, and greater endurance over time, thus enhancing overall robustness. Conversely, low organizational quality may manifest as frustration, distrust, parallel initiatives, and increased safety risks. This, in turn, affects task performance, operational quality, and potential consequences for the local community. The degree of organizational quality therefore plays a significant role in shaping coordination, quality, and the maintenance of trust.

Although CCO provides an analytical framework for understanding how organizing emerges through communication, it offers less insight into why communicative flows accelerate, stabilize, or break down during different phases of an operation. The study therefore incorporates swift trust theory to address this gap, as it focuses on how temporary trust is established among actors without prior relational history.

The study examines how the police and professional emergency services, through simple communicative actions, can foster swift trust among spontaneous volunteers, and how this influences the emergence of organizing communication in situations involving large numbers of volunteers. When spontaneous volunteers

develop a higher degree of organizationality, the police may need to allocate fewer resources to direct supervision and control.

The study has a descriptive and analytical purpose and examines how swift trust affects the emergence and stability of communicative flows. It is based on non-probabilistic data collection from a large-scale search operation in Lindesnes, Norway, where approximately 1,200–1,500 spontaneous volunteers participated. Seventeen individuals were selected for qualitative interviews, in addition to several incident commanders from the professional emergency services. The analysis was conducted in two stages. First, interview data were coded according to the four communicative flows to identify how organizing emerged. Second, elements of swift trust were used as analytical concepts to examine how communicative flows were accelerated, stabilized, or disrupted.

Findings indicate that swift trust not only affects relationships but also structures communicative flows. In temporary systems, membership negotiation appears to occur primarily through category-based expectations. The suspension of distrust is necessary to prevent parallel initiatives when activity coordination is weak. Fragile or absent swift trust manifests as rapid declines in “flow strength,” for example when volunteers are left waiting for extended periods, face criticism, or encounter unclear responsibility structures.

The study contributes theoretically by combining CCO and swift trust, demonstrating how trust operates as a communicative enabler that shapes the tempo and stability of organizing among spontaneous volunteers in a search and rescue operation. It advances understanding of spontaneous volunteer engagement and illustrates how incident commanders in situations involving large numbers of spontaneous volunteers may, through simple communicative actions, support the emergence of swift trust across actor groups, thereby strengthening otherwise fragile CCO flows.

KEYWORDS

Spontaneous Volunteers, Swift Trust, Communicative Constitution of Organizations, Search and Rescue, Disaster Management

Beyond Three Tiers: Subtype-Aware Stochastic Optimization and Resource Misallocation Measurement for Earthquake Emergency Medical Response

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ABSTRACT

Optimizing emergency medical operations after major earthquakes requires coordinating temporary facility deployment, patient routing, and staff allocation under deep uncertainty within the first 72 hours. Standard triage based optimization models assign all casualties to three broad tiers (Immediate, Delayed, Minimal), ignoring clinically meaningful variation in treatment needs. This coarseness directly translates into misallocated resources: a T1 cardiac arrest patient and a T1 crush injury patient receive identical time allocations despite requiring fundamentally different treatment durations and specialist resources.

We present three independently applicable contributions for any triage-aware stochastic optimization model. First, we disaggregate three triage tiers into eight clinical subtypes (T1a–T1c, T2a–T2c, T3a–T3b) with subtype-specific treatment times and Markov survival dynamics calibrated from earthquake injury epidemiology. Second, we replace deterministic linear scenario scaling with Monte Carlo generation from a log-normal distribution calibrated to Istanbul earthquake loss estimates, capturing the heavy-tailed nature of casualty distributions. Third, we introduce the Resource Misallocation Index (RMI)—a model-agnostic, practitioner-ready metric that converts classification coarseness into wasted doctor-hours, computable from field data before any optimization model is formulated.

We embed these contributions within a two-stage multi-period stochastic mixed-integer program that jointly optimizes temporary medical center location, casualty-to-facility assignment, and doctor/nurse deployment across a 72-hour planning horizon. The framework is validated on Istanbul’s Kartal district (470,000 residents, 20 sub districts, 11 hospitals, 74 candidate temporary medical center sites) using published seismological and infrastructure data.

Key results: (1) the three-tier baseline misallocates 22.1% of all doctor-minutes (131 doctor-hours per event), with T2 fracture patients most under-served; (2) 696,550-variable instances solve in 69 seconds on standard hardware using the open-source HiGHS solver; (3) the enhanced model reduces weighted transport distance by 87–88% relative to three-tier solutions; (4) under capacity-stressed scenarios ($3\times$ – $5\times$ base casualty volume), 6–10 additional lives are saved; and (5) results are robust to $\pm 40\%$ subtype proportion perturbation and 30% triage misclassification. The poster will present the RMI framework, key computational results, and practical implications for pre-positioning medical resources and investing in triage training programs. Ongoing work targets clinical validation against the 2023 Turkey–Syria earthquake trauma registry and prototype integration with geospatial coordination dashboards for field deployment. By bridging operations research with crisis informatics, this work contributes to building stronger futures through evidence-based preparedness tools that municipalities can adopt for seismic risk planning.

KEYWORDS

Humanitarian Logistics; Triage; Stochastic Optimization; Monte Carlo Simulation; Earthquake Emergency Response

Design Principles to Mitigate stress Related Performance Decline

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ABSTRACT

The EU-funded project CHIMERA is developing a “Comprehensive Hazard Identification and Monitoring system for uRban Areas”, for CBRN incident response. Heterogeneous sensor nodes and data fusion are combined into a Situation Awareness (SA) application. The goal is to increase first responders’ decision quality by presenting complex information through a user-friendly Human-Machine Interface (HMI). This HMI will display essential incident response tools; a dispersion cloud prediction of the leaked substance; and a Threat Map that visualizes the effects of the predicted dispersion cloud over time.

For the application development process, Keystone is used: a User-Centered Design process based on ISO9241-210 User-Centered Design and Development principles. It started with an analysis of the operational domain of CBRN incident response processes, roles, and responsibilities. Next, system concepts were explored, taking the Human Factors risks and challenges into consideration. One of the HF risks identified is the levels of stress experienced by different first responders, which can negatively impact cognitive resources, making it harder to process information in critical situations. We therefore explored the literature on the effects of stress on human information processing, and extracted mitigating design principles that guide the development of HMI’s, tailored for high-risk environments.

Stress mainly affects attention, memory, and decision-making capabilities (Wickens, 2000). One commonly observed effect is attentional narrowing, where operators tend to focus on a limited subset of information, ignoring peripheral cues. Although this can improve focus on a central task, it can lead to missed cues, hindering situational awareness (Endsley, 2004). To mitigate this, interface design can distribute attentional demand across modalities and support efficient visual processing with various strategies (Wickens et al., 2004).

Stress also impairs working memory, reducing the capacity to hold and manipulate information. This can negatively affect the integration of multiple data sources and degrade situational awareness (Endsley, 2004). Interface design can improve these limitations by externalizing information and reducing reliance on memory. Approaches include presenting higher-level situational information (Endsley, 2004), predictive aiding, and the principle of “knowledge in the world,” where necessary information is directly available in the interface (Wickens, 2004).

Finally, stress also affects decision-making. One effect is cognitive narrowing which can increase susceptibility to confirmation bias (Wickens et al., 2013), leading operators to focus on information that supports an existing hypothesis. Interface designs can mitigate this by visually linking new information to currently attended data (Hancock & Szalma, 2003) and presenting evidence in graphical layouts that encourages balanced evaluation (Cook & Smallman, 2008).

Based on these insights from the literature, and many more not discussed in this abstract, a set of HMI design principles were extracted and applied to the development of the CHIMERA SA application. These principles informed both the evaluation of existing interface elements and the proposal of design improvements, including enhanced visualization techniques, multimodal alerting, and object-based representations within the system’s components, ensuring optimal use of the application for first responders working under high-stress situations.

KEYWORDS: CBRN Incident Response, C2 Application, Stress, Performance, Design Principles



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CONTENT OF THE POSTER

The poster will visualize an introduction to the CHIMERA project. It will then visualize the process of a CBRN incident response, including the various roles involved. Then it will describe the CHIMERA SA application and point out where the Human Factors issues of stress are expected to decrease first responders performance in relation to this application.

Based on the literature on cognition and stress, relevant design principles are proposed that are expected to help design the CHIMERA SA application to fit the various first responders in a CBRN incident, even those that are experiencing high levels of risk and stress.

INFORMATION ABOUT THE PRESENTING AUTHOR

Iris Cohen received a PhD in 2015 in the field of applied cognitive psychology from Delft University of Technology and TNO Human Factors. She has extensive research experience in the field of human factors, with research topics such as stress and human performance, measures of mental states, highly-automated driving systems, and social robotics. At Thales Netherlands B.V., her research includes descriptive modelling of experts' decision making processes, Human Machine Teaming and Human-AI interaction. She uses methods from the Cognitive Engineering and Naturalistic Decision Making research fields, with the objective to create guidelines for system and interface design.



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How “Panic” Shapes Behaviour in Acute Crises – A Survey Approach

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ABSTRACT

How do civilians respond to acute crises under extreme stress? The concept of “mass panic” as reaction to acute crises remains widespread in public discourse, yet research suggests that such behaviour is not common and more complex than assumed. Rather than uniform “panic” responses, civilians may still experience varying degrees of stress-induced dysregulation in response to acute threats, shaping their ability to react in crises. In a preceding interview study with first- and second-level responders ($N = 9$) across several acute crises, participants frequently referred to “panic” as a cause to “illogical” reactions to acute threats but attributed that to physiological “panic” responses. In this study, we therefore use the term “panic” as physiological state associated with emotional, cognitive, and behavioural dysregulation. Building on this definition, we aim to further explore how such “panic” states may influence behavioural responses during acute crises through a survey approach.

To achieve that, we are developing a survey tool to explore the relationship of the experienced level of panic (A) to behavioural responses of civilians (B), accounting for prior crisis experience and demographic factors (C). The survey operationalises the level “panic” through multiple items capturing emotional and physiological activation alongside cognitive and behavioural dysregulation (A). It further assesses a range of behavioural reactions and strategies, e.g. including compliance with instructions, information seeking, flight behaviour, crowd following, and prosocial orientations (B), as well as prior crisis experience, preparedness, relevant crisis-related skills, and demographic characteristics (C). Given the limited empirical evidence on how “panic” shapes civilian behaviour in acute crisis contexts, the study adopts an exploratory approach. Though the direction of these relationships remains open, we hypothesise that higher panic levels might influence key behavioural responses.

We plan to deploy the survey in future work for multiple purposes: (1) a scenario-based study examining anticipated behavioural responses to crises, (2) a retrospective survey with individuals who have experienced real crisis events, and (3) validation of the measures after experimental studies to triangulate findings across methodological approaches. The development of the survey instrument builds on findings from the preceding interview study, which indicated that civilian behaviour in crises is highly heterogeneous and additionally suggested that behavioural responses may vary across demographic and contextual factors. In addition to informing the conceptual framework, the interview participants also provided feedback on an initial version of the survey instrument and we aim to further refine it based on feedback from the ISCRAM community and through pre-testing.

By examining how panic-related dysregulation relates to anticipated behavioural reactions and strategies, this study aims to provide exploratory empirical insights into civilian responses during acute crises. The insights gained from this project may contribute to the development of behavioural models for crisis simulations and support training and decision-making for stakeholders in emergency and crisis management.

KEYWORDS

Crisis Behaviour, Survey, Quantitative Research, Panic

Public Values and Social Media Logic in Crisis Communication: A Case Study of krisinformation.se

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ABSTRACT

This study examines how social media logic shape crisis communication at the Swedish Civil Defence and Resilience Agency, through their national web portal krisinformation.se. The portal functions as a central hub for public emergency information in Sweden, disseminating updates from multiple government agencies through its website, social media channels, and a mobile application. As digital infrastructures increasingly shape how authorities communicate with citizens during crises, it becomes important to understand how digital platforms influence and shape communication practices and public values. Using an ethnographic approach, the study explores how social media and platform logic shape the daily work of the editorial team behind krisinformation.se. The empirical material consists of site visits, online meetings, in-depth interviews with communication officers, and digital ethnographic observations of the team's work practices and online interactions.

The findings show that the editorial team strongly epitomize and actively strive to uphold public sector values such as democracy, transparency, and impartiality in their crisis communication. At the same time, the study identifies tensions that arise when these values are enacted through digital platforms. For example, the team's commitment to publishing only verified information can create frustration among followers when news media publish updates faster. The editors therefore must balance the external demand for speed with the responsibility of ensuring accuracy and reliability. The engagement-driven logics of social media—such as visibility, shareability, and likeability—can conflict with the professional norm of impartiality expected of public servants. The editors describe internal expectations to create posts that perform well within platform algorithms while maintaining neutrality and avoiding institutional branding or promotional tones. Several editors also explain how a harsher online climate has affected how they interact with the public, as well as their preferred platform choices. Over time, internal policies have been developed to ensure staff safety, leading to the use of anonymous signatures; previously, editors signed their replies with their own names.

The challenges of a whole-of-society versus whole-of-government approach in crisis governance are notable when considering the public values portrayed by the editors and the market-driven social media logic by digital platforms. The editorial team operates at the intersection of multiple agencies, functioning as a mediator and curator of information, moving between a centralized focus and a participatory dialogue with the public online. Certain posts, especially those concerning immediated crises are framed as informational and do not encourage interaction, whereas others on for instance crisis preperadness encourage engagement and interaction.

KEYWORDS

Crisis Communication, Digital Platform, Public Values, Social Media Logic, Whole-of-Government, Whole-of-Society

Posters

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Operational AI for Crisis Management¹

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ABSTRACT

We propose that Artificial Intelligence (AI) technology could be used to support decision makers (DM) during crisis management by providing verified and accurate real-time analyses based on the current state of the crisis. The AI tool or agent could be designed to analyze the complex, nonlinear dynamics of the crisis and the impacts of the DM's decisions on the environment – which is characterized as VUCA (Volatile, Uncertain, Complex, Ambiguous). The AI tool could use machine learning algorithms to analyze patterns in the data and predict the likely consequences of different decisions, events and scenarios.

The AI tool could provide real-time recommendations to the DM based on its analyses, such as suggesting specific courses of action (CoA) that are likely to be effective in resolving the emergency or crisis. It could also provide warnings or alerts if it detects potential risks or unintended consequences of decisions. Additionally, the AI tool could be designed to learn from decisions and their outcomes – even from self-play. The AI could adapt its recommendations over time based on the DM's preferences and the evolving dynamics of the crisis.

An example of such a newly developed AI tool is BINOM Medic (www.binom.no), which is an emergency advisory software application that communicates verbally and assists first responders and bystanders to large accidents by providing them with precise, quality-assured Norwegian mass casualty triage advice based on official guidelines and procedures from the Norwegian Medical Association and the Norwegian Directorate of Health.

Target users of BINOM Medic are doctors, nurses and paramedics (ER, ambulance and SAR personnel), operation centers, emergency call centers, universities and colleges (for teaching, testing and development), industrial organizations and public agencies. We have carried out pilot tests with the University of Inland Norway, and the system is now operational with voice, text, and image-based diagnosis. The purpose of this poster is to demonstrate the actual system in operation and discuss the potential for applications in other domains and contexts as well, which include military, police, firefighting, process industry, and critical infrastructure (power, telecom, logistics).

A particular capacity of BINOM is the possibility to support training, exercises and operations in protected mode (data stored on shielded server with encryption) and offline mode (downloaded to a personal device), making the application ideal for services that handle sensitive and classified data. Built from actual training sessions with operative personnel, a complete knowledge base may occupy less than 5 GB on a smartphone, tablet or laptop.

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KEYWORDS

Crisis Management, Preparedness, Artificial Intelligence, Decision Making, VUCA.

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A Community-Embedded Coastal Risk Observatory for Disaster Preparedness and Recovery in Nova Scotia

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ABSTRACT

Coastal regions are increasingly at risk from climate change, facing challenges such as storm surges, coastal flooding, shoreline erosion, and ecosystem degradation. These risks are intensified by anthropogenic factors and the socio-economic vulnerabilities of coastal communities. Although predictive modeling and emergency response systems are essential for disaster risk management, they often fail to account for the complexity and evolving nature of coastal changes. Continuous, localized monitoring is vital for enhancing disaster preparedness and improving recovery efforts. This poster presents a community-based coastal risk observatory situated on the Eastern Shore of Nova Scotia, Canada, aimed at bridging the gaps in current disaster risk management practices. By integrating citizen science, environmental monitoring, and organized data governance, the observatory serves as a distributed platform that generates long-term datasets on coastal conditions, weather patterns, and oceanographic factors. Engaging residents in data collection, interpretation, and sharing enhances community awareness, knowledge, and trust in the data. This model not only enhances monitoring capabilities in underserved rural areas but also creates a hybrid system in which local insights complement traditional scientific methods. Ultimately, the observatory strengthens the connection between knowledge production and decision-making in complex coastal environments. Conceptually, the observatory is founded on the principles of the International Risk Governance (IRGC) framework, which stresses inclusion, transparency, and adaptive learning amid complexity and uncertainty. Coastal risks often epitomize these challenges, underscoring the need for stakeholder engagement and ongoing knowledge production. The observatory also addresses common governance issues, such as fragmented data systems, limited stakeholder engagement, inadequate communication, and weak feedback channels between communities and institutions. By embedding monitoring capabilities within local communities and linking them to academic and institutional frameworks, this initiative enhances knowledge integration, legitimizes risk assessments, and creates more responsive governance processes. To evaluate the effectiveness of this approach, an expert focus group was convened with researchers and practitioners specializing in risk governance and citizen science. Feedback was collected using Mentimeter and indicated that the observatory model is particularly effective at addressing gaps in generating risk knowledge, fostering stakeholder involvement, and responding to early warning signals. Participants emphasized the importance of improving factual knowledge production and community capacity to respond while also valuing the understanding of system changes and informing management strategies. Throughout the disaster risk cycle, the observatory functions as a continuous socio-technical infrastructure rather than a reactive solution during events. It supports pre-disaster risk assessment through ongoing data generation, enhances situational awareness during extreme events, and facilitates recovery through post-event analysis and learning. The implementation of digital tools further improves data accessibility,

interoperability, and long-term management, ensuring that citizen-generated data is both credible and useful. This study highlights the potential of community-based observatories as a scalable infrastructure to build coastal resilience. By placing citizen science at the core of risk governance, this initiative paves the way for more inclusive, adaptive, and knowledge-driven strategies for disaster preparedness and recovery in coastal regions.

KEYWORDS

Risk Governance, Citizen Observatory, Citizen Science, Climate Change, and Flood Governance.

Strengthening Resilience and Optimizing Responses to Cascading Effects in Critical Infrastructures (FORTE)

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ABSTRACT

Recent crises have demonstrated how disruptions in one sector can quickly spread across interconnected systems. The COVID-19 pandemic revealed vulnerabilities in global supply chains and the dependence of production and distribution systems on reliable logistics. Similarly, the Russian invasion of Ukraine triggered an energy crisis that exposed how shortages in one resource, such as natural gas, can propagate through multiple sectors. These developments highlight the importance of understanding cascading effects across critical infrastructures. Because modern societies rely on tightly interconnected systems, failures in one sector can trigger disruptions in others, creating complex crisis situations that are difficult for decision makers to anticipate and manage. At the same time, existing research and policy frameworks often analyze sectors individually, which limits the ability of authorities and companies to anticipate cross-sector disruptions.

To address this challenge, a consortium of research institutions and applied research organizations, in collaboration with industry partners, launched the project Strengthening Resilience and Optimizing Responses to Cascading Effects in Critical Infrastructures (FORTE), funded by the German Federal Ministry of Research, Technology and Space (BMFTR). The project aims to improve the understanding of cascading effects between the critical infrastructure sectors of energy, information and communication technology, transport and logistics, and food production. At the beginning of the project, the project partners collect examples of disruptions and threats through interviews with stakeholders, workshops, and literature analysis. Based on this information, up to ten threat situations are systematically described. Each threat situation includes a description of the triggering event, the affected actors, and the potential cascading effects across sectors. These threat situations are then consolidated into six scenarios that represent particularly relevant and plausible crisis situations.

These scenarios form the basis for the analytical work in work packages 2 to 5, where each project partner models the dynamics of disruptions within its respective domain (logistics, IT, energy, food) and analyzes how cascading effects propagate between sectors. For example, work package 5, led by the Kühne Logistics University, focuses on the food sector and models how disruptions in energy supply or logistics affect food production and distribution. This includes detailed case studies with industry partners, the development of mathematical models of production systems, and simulation analyses that show how shortages in electricity, gas, and transport can cascade into reduced food production and distribution capacity.

Based on the insights from these sector-specific models, the project develops two demonstration tools in collaboration with an external software developer. These tools visualize selected scenarios, the modeled cascading

effects, and the potential impact of mitigation measures. They are designed to support decision makers in government and industry by making complex interdependencies between sectors more transparent and by enabling interactive exploration of crisis situations. The tools will be tested in workshops with stakeholders and are intended to support training, preparedness activities, and strategic planning for crisis management.

KEYWORDS

Cascading Effects, Critical Infrastructure Resilience, Cross-Sector Interdependencies, Crisis Scenario Analysis.

ESCORT: An Integrated Platform for Telemedicine and Resilient Healthcare Management

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ABSTRACT

Healthcare emergencies place intense pressure on clinical coordination, timely communication, and continuity of care across pre-hospital, remote, and hospital environments. This poster and live demonstration present **ESCORT**, an integrated digital health solution designed to strengthen **healthcare resilience during emergencies** through the combined use of a mobile application for patients and a desktop coordination platform designed for primary healthcare providers. The system is motivated by the growing need for **integrated healthcare management** solutions that can support rapid triage, remote consultation, structured symptom reporting, and shared situational awareness of patients and care coordinators. This aligns with current international emphasis on digital health, people-centred care, telemedicine, and resilient health systems.

The ESCORT demonstration focuses on a realistic tele-medicine workflow in which a patient uses the mobile app to submit symptoms, capture structured observations, and share physiological or wearable-device data. The desktop application acts as a clinical and operational command interface, allowing healthcare professionals to review incoming patient information, monitor status changes, visualise symptom trajectories, and initiate **telemedicine** interactions where appropriate. The platform is designed to support continuity from first contact to follow-up, thereby reducing fragmentation between field reporting, remote assessment, and clinician decision-making. In demonstration mode, the audience will be shown how the two interfaces work together to support digital use of self-reporting toolkit via the mobile application, remote communication, and coordinated case management in time-sensitive scenarios. The approach reflects evidence that telemedicine and mobile health can enhance accessibility, and care coordination when integrated into broader service pathways.

From a systems perspective, ESCORT is positioned as a resilience-enabling tool rather than a standalone communication app. Its contribution lies in integrating symptom self-reporting, patient monitoring, clinician oversight, and remote consultation into one operational workflow. This supports more adaptive healthcare delivery during periods of disruption, surge demand, or limited physical access to services. The expected outcomes of the demonstration are threefold: first, to show how integrated mobile–desktop workflows can improve shared awareness and response coordination; second, to illustrate how telemedicine can extend clinical reach during emergencies; and third, to highlight how digitally enabled care pathways can contribute to safer, more responsive, and more resilient healthcare services. Overall, the poster argues that ESCORT offers a practical and scalable pathway for combining emergency informatics, connected care, and resilience-oriented health-service design that delivers stronger futures and public safety.

KEYWORDS

Integrated Healthcare Management; Telemedicine; Healthcare Resilience; Emergency Care Coordination; Mobile Health Applications

Artificial Intelligence in Emergency Medical Services for Disasters and Health Emergencies

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Background: The increasing complexity of health emergencies has made decision-support tools essential for effective decision-making within healthcare systems. In this context, Artificial Intelligence (AI) has emerged as a key approach due to its ability to mimic human reasoning while processing large volumes of heterogeneous data. Additionally, pre-hospital care systems play a pivotal role in mitigating risks associated with health emergencies, serving as the first point of contact between the population and the healthcare system. **Methods:** In accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, a systematic review was conducted using the PubMed, IEEE Xplore, Web of Science, and Embase databases, covering studies published between 2015 and 2025. To be included, studies had to be open access and fall within one of the following fields: AI, Emergency Medical Services (EMS), forecasting, health emergencies, public health, or disaster management. This review focused on studies with prospective data and real-world evidence, prioritizing those with robust methodologies over cohort, comparative, and retrospective studies. **Results:** The application of the PRISMA methodology to the queried articles resulted in 138 publications. An analysis of key information extracted from titles, keywords, and abstracts-using natural language processing techniques, LiteRev, and clustering methods- reveals the need to structure the literature review around thematic areas such as: AI applications for predicting epidemics and natural disasters; in-depth exploration of AI uses in EMS; AI algorithms and their complexity; and issues of explainability, interpretability, and uncertainty quantification. **Conclusion:** This study highlights the pivotal role of AI in forecasting and preparing responses to health emergencies. Likewise, AI is an essential tool for transforming pre-hospital care systems, which are crucial in responding to such events. However, despite its widespread adoption and significant progress, AI systems continue to face several challenges, including data incompleteness, representativeness, model interpretability and explainability, the inability to quantify uncertainties, adversarial attacks, and the need for human and ethical safeguards. Furthermore, one of the findings of this study reveals the opportunities of integrating AI into emerging EMS for disaster and health emergencies, addressing country-level infrastructural and systemic constraints.

KEYWORDS

Artificial Intelligence; Uncertainty; Emergency Medical Services; Disasters; Health Emergencies.

«Causal Mapping for Redefining Criticality toward Systemic Risk»

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ABSTRACT

Recent work (Lundberg, 2026) contends that the overall expansion of Critical Infrastructure (CI) has tended to include a broad, inclusive list of facilities. The expansion has led to misaligned priorities, wasted resources, and protection that is not grounded in the statutory threshold of debilitating national consequences. CI preparedness and resilience must shift from presuming assets to be inherently critical toward assessing their criticality in relation to the systemic risks generated by specific threat scenarios.

“The science of systemic risk and systemic risk management is still in a primordial state” (UNDRR, 2022, p.146). Thus, systemic risk approaches able to deliver impactful and practical strategies are still very rare. Notably, a recent browser-based group decision support method approach (Strategyfinder™) has succeeded in impactful strategies targeting systemic risk in past (COVID) and future pandemics (Bryson et al., 2023; Eden & Gonzalez, 2023; Eden et al., 2024). The approach is based on over 50 years research at a leading business school, with practical applications in profit and non-for-profit organizations in many countries (Ackermann & Eden, 2011).

The success of the approach resides on its ability to achieve all these things:

1. The right people must participate in the process, often from different locations. It must be ensured that the required, fragmented expertise and that stakeholders are represented; also, to ensure that the resulting action plans are implemented, the process must engage at least one person who can take decisions.
2. The process must use little time; it must be easy for the group members to meet and work concurrently; and a browser-based solution is required (same time, different locations).
3. “Procedural justice”: each member of the group must have equal opportunity to safely (anonymously) contribute with ideas, and each idea reaches the whole group.
4. The process must yield a causal map: the causal map is a ‘transitional object’: it changes as the group members change mind through new insights and negotiations; by capturing cause-effect relations, the map provides means-ends; the display of means-ends allows to suggest action plans.
5. The group can evaluate the action plans for both impact and practicability: action plans deemed impactful are likely to have high leverage; action plans deemed practical are likely to be executed within available time and with available resources; the most impactful and practical action plans provide strategy portfolios likely to be both successful and robust.

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KEYWORDS

Redefining CI; Impactful Strategies; Practical Strategies; Strategy Mapping; Disaster Risk Reduction

Situation Awareness Application for CBRN Response

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Purpose - CBRN incidents can have a broad range of consequences, e.g.: casualties, psychosocial impact, financial costs, and environmental harm. It is therefore important that emergency organisations and their networked partners have shared capacities for effective response. The development and integration of novel software and hardware tools could enhance responders' detection, identification, and monitoring capabilities, if tooling is carefully adapted to their work practices. The CHIMERA project realises a CBRN system prototype that aims to support responders with:

1. a multipurpose heterogeneous sensor node for CBRN detection to aid HAZMAT measurement teams in data collection;
2. database combining C, B, and RN substance/agent characteristics and data fusion algorithms to enable substance identification;
3. real-time dispersion modelling software for C&R agents to provide dispersion models and source estimations
4. a multiplatform Situation Awareness (SA) application for Incident commander(s), HAZMAT officers and crisis centres allowing for the area of interest overview, asset management, and real-time data visualization.

Approach - An iterative User-Centered Design approach 'Keystone' was used to investigate work processes, translate user needs to requirements and design the SA application prototype in 3 iterations. Methods used were: 4 interviews, a cognitive task analysis and 13 design workshops with fire service and HAZMAT officers, and a field trial. Human Factors research insights on stress reduction helped to design the 'Threat map' that supports reasoning about the threat of substance dispersion in relation to vulnerable sites in the area (see other poster about 'Stress reduction').

Outcome - Final user testing is to be conducted, preliminary outcomes are based on subjective user feedback. We delivered a Human-Machine-Interaction concept that distinguishes between three operational views: 1) the *monitoring view*: the SA application displays fixed-sensor data, providing an early warning capability to HAZMAT specialists; 2) *incident response view*: after substance spill the user creates an incident, the application displays portable and fixed sensor data, the Incident Commander and HAZMAT officers reason about handling the cause/effects of the spill. A dispersion model helps to predict future substance dispersion, in combination with the Threat Map that displays vulnerable assets in the area; 3) an *after action view* to evaluate historic incidents. Two main design aspects need to be further addressed: how such technology fits organisational design of various organisations: e.g. which roles are allowed to see updates on the dispersion model? And challenges lie in reasoning about dispersion prediction vs. the real-time status of resources, as visible on the map. Opportunities to improve the system lie in further (semi-)automated (AI-enhanced) analyses, 3D modeling, speech-to-text technologies, semi-autonomous drones integration.

The authors acknowledge the work of colleagues Rafal Hryniewicz, Susanne Plank-Konrad and Pascal Hoetmer-Schuijff on design and development; the end-user representatives, and CHIMERA consortium colleagues.

The presenting author works as business anthropologist at Thales Nederland B.V. (Naval - Advanced Development Systems/Studies) in the Human Factors research area.

KEYWORDS

CBRN Response, Situation Awareness, Information Sharing, Sensor Management, Dispersion Modelling.



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Maladaptation in Crisis-Response Supply Chains

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ABSTRACT

Climate change and geopolitical tensions demand increased adaptability from crisis-response supply chains. Advanced information technologies such as Artificial Intelligence have been proposed as an effective tool for achieving this increased adaptability. Recent evidence shows that such technologies can also lead to new vulnerabilities and risks, a phenomenon we refer to as *maladaptation*. Understanding when and why maladaptive outcomes occur is critical for improving adaptation strategies. Although maladaptation has been studied extensively in climate-change adaptation, it remains poorly understood in the context of crisis-response supply chains. In particular, it is unclear how the design of information systems shapes whether adaptive actions lead to improved performance or to maladaptive outcomes.

To address this gap, we developed an agent-based discrete event simulation model (ABM-DES) to simulate the adaptive behavior of actors in the crisis response supply chain. The model extends Lont's model of Crisis Response Adaptation (Lont et al., 2025) and is inspired by the collaboration with the Dutch Ministry of Defence. The model defines three organizations with two types of actors: managers and workers. Managers share information and make adaptation decisions based on their performance level. Input parameters include variables that influence disruption dynamics and adaptation behavior, such as the technologies used and the speed at which information flows. Given the large number of parameter combinations and the uncertainty surrounding their values, we use exploratory modelling to systematically explore a wide range of scenarios. The scenarios include two distinct crisis patterns: demand peaks and sudden regime shifts. Rule induction is then applied to identify the specific conditions under which adaptive and maladaptive outcomes arise.

The study contributes to the field of crisis response adaptation by providing critical elements for measuring and understanding the emergence of maladaptation. Preliminary findings reveal that maladaptation in crisis response is shaped by information system characteristics. Increasing information delays cause adaptive actions to rely on outdated signals, making them mistimed and counterproductive. Restricted information alignment between managers hinders coordinated recovery and amplifies maladaptive outcomes. Critically, information technologies do not uniformly prevent maladaptation: under specific combinations of disruptive patterns and organisational characteristics, technologies intended to accelerate information flow may inadvertently increase future vulnerabilities. These findings carry direct implications for the design of information systems supporting crisis-response supply chains in humanitarian and military contexts.

KEYWORDS

Adaptation Process, Maladaptation, Crisis-Response Supply Chain, Resilience

ABOUT THE PRESENTING AUTHOR

Yvonne Lont is a PhD candidate at the Faculty of Technology, Policy and Management of the Delft University of Technology. Her research focuses on decision-making for reliable crisis-response supply chains. She collaborates with the Dutch Ministry of Defence on improving the rapid procurement and distribution of essential supplies.

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Scenario Planning in Crisis Situations

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ABSTRACT

Over the past several years, Dutch crisis management organizations have increased efforts in professionalizing scenario planning. Interdisciplinary crisis teams are trained in scenario planning, different scenario methods are explored, and policies are created on when and how to activate a scenario team (Luesink & Boin, 2023; Luesink et al., 2024; Luesink & Landsman, 2025).

Extensive literature on scenario planning exists in foresight and futures studies, yet research on scenario planning in crisis management, specifically on applying scenario planning during a crisis, is scarce. A transfer of insights from foresight and futures studies to crisis management requires a considerable translation, because a crisis imposes restrictions on scenario planning due to a threat, urgency, stress and limited availability of information.

One of the main questions Dutch crisis management organizations aim to tackle is when and how to apply scenario planning in a crisis situation to facilitate sensemaking. This research proposes a draft version of a model for scenario planning in different crisis situations. The model is based on data collection through semi-structured interviews and literature analysis. A total of eighty interviews with Dutch crisis managers, primarily from the twenty-five safety regions, were conducted between 2022 and 2024. Furthermore, literature on foresight and scenario planning as well as on sensemaking has been studied to propose scenario planning as a tool for prospective sensemaking in crisis situations. The theoretical and empirical analyses have led to the creation of a draft version of a model (see Figure 1) which proposes four crisis situations and adhering options for scenario planning.

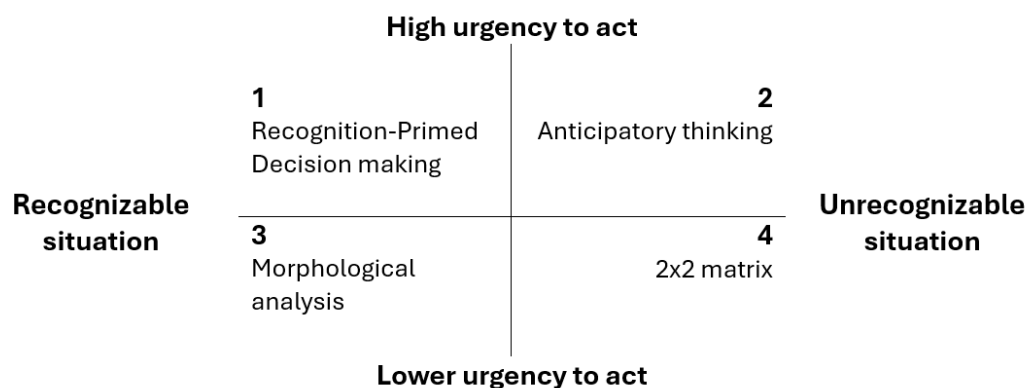


Figure 1. First draft of a model for scenario planning in different crisis situations

This poster for ISCRAM 2026 provides an opportunity to test the model amongst a critical audience with relevant expertise. Moreover, it provides the opportunity to explore possibilities for information systems and modelling in the model.

¹ Nederlands Instituut Publieke Veiligheid

KEYWORDS

Scenario Planning, Crisis Management, Sensemaking, Scenario Methods

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How Families Experience Temporary Housing After Induced Earthquakes in The Netherlands

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ABSTRACT

In Groningen, the north of the Netherlands, management of gas extraction and associated earthquakes disrupts children's living environment. Over the last decades, more than 1700 earthquakes caused minor damage to buildings in the area, while disaster management fell short on meeting the needs of inhabitants. Adults and children perceived this situation as unjust and developed feelings of hopelessness, health concerns and distrust towards involved organisations. Many houses still have to be demolished and rebuilt, during which some families have to move to allocated temporary housing for months or years, while being structurally exposed to institutional demands. This challenges their family resilience; their capacity to withstand adversity. Recently, increasing attention has been given to the societal impact of the situation, instead of prioritising the technical aspects, yet knowledge about family resilience and how policy can meet their needs remains limited. Our research question is as follows: *What factors challenge the resilience of families exposed to temporary housing in Groningen, and what are their needs?* Our study included N=25 families from Groningen who live(d) in temporary housing or are planning to. In 21 families, one child (aged 7–16) and one parent participated; in two families, only one child; and in two families, only one parent. This research is part of a longitudinal study on how young people from Groningen experiences the earthquake affairs (2024-2027). Interviews and questionnaires were used to assess family resilience, disaster exposure, and living environment.

The poster presentation will focus on the challenges that families face during the reinforcement process and how they can be supported to mobilise resilience by adjusting to their needs. Preparing for reinforcement often brings uncertainty regarding what will happen to the house and when. Parents are preoccupied with the administrative tasks involved and try to shield their children from their stress and frustrations. Parents mention the need for clarity so that they can provide stability for their children. Children mainly want everything completed as quickly as possible, but reinforcement often suffers from delays. After moving to temporary housing, families must adjust to a less adaptable, often smaller home, usually on the town's edge. This sometimes affects family dynamics, prevents them from feeling at home and hinders maintaining social relationships. After returning to their own house, most families feel relieved, but acknowledge the precious time they lost. Results show how disaster management organisations can hinder family resilience by expecting families to be patient, flexible, and alert.

This exploratory study highlights the importance of maintaining a stable living environment for children in relation to practice and policy concerning critical infrastructure failures. Limiting the procedural burden on parents by honest, personal and understandable communication will make it easier for parents to deal with unavoidable changes and inform their children. For families to stay resilient throughout changes in their living environment, uncertainty should be kept to a minimum by providing a quick response and few changes in policy. Lastly, children's perspectives should be taken into account by adjusting to their needs, instead of the other way around.

KEYWORDS

Families, Children, Gas-extraction, Temporary Housing, Earthquakes

Gamified Mobile Walk Preparing Citizens for Landslide Emergencies

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ABSTRACT

This poster, along with the associated demonstration, will present a mobile application designed to help civilians learn about disaster preparedness. The presentation will also highlight one of the application's content packages, referred to as walks, which provides essential knowledge and practical skills for managing landslide emergencies. The selected walk is based on a recent landslide disaster in Gjerdrum, which resulted in 10 fatalities and the need to evacuate 16,000 people, December 2020¹. Based on real incidents and disasters, and a mobile application for developing gamified walks, this poster will demonstrate current challenges for mobile-supported learning about landslides.

This application belongs to B-prepared² (Building PREPAREDness with Collaborative Knowledge Platform, Gamification, and Serious Game in Virtual Reality), an open ecosystem that supports the development of disaster survival competencies and a culture of disaster preparedness among European citizens, inspired by real historical events. A mobile application named IM-prepared was developed within the project, which represents one of the core products of the B-prepared project. The mobile application is available on the Google Play Store and the Apple App Store under the name IM-prepared.

IM-prepared offers thematic walks as downloadable content packages. The gamified, guided walks contain Points of Interest (POIs) enriched with multimedia (e.g., pictures, games, Augmented Reality (AR), and videos) to provide location-sensitive disaster preparedness content. IM-prepared applies gamification to encourage more active knowledge acquisition. The landslide walk includes various types of mini-games, such as quizzes, jigsaw puzzles, and word searches, as well as an AR activity on cardiopulmonary resuscitation (CPR).

The Gjerdrum landslide walk can be used either on-site or remotely. In on-site mode, users start at the walk's starting point and are guided along a predefined route using an interactive map. The appropriate content and minigames will start automatically when players approach the given POIs using the mobile device's location service (GPS). In distant mode, users do not need to be present at the disaster site. They can explore the POIs by selecting them from a list in any order.

The Gjerdrum landslide occurred relatively recently, and adverse weather conditions further complicated the rescue operation. Several potential contributing factors were identified, including increasingly mild, rainy winters and human-induced terrain modifications.

It is important for society to learn from recent disasters, but this must be balanced with the risk of upsetting the people who experienced them. Applications that show disaster areas can also raise challenges. While visitors may want to explore these places for learning, residents may feel disturbed by the attention. Therefore, learning through remote or virtual experiences may often be a better option.

While the application provides lessons on landslide prevention, early warning signs, and preparedness, several ethical questions remain unresolved and warrant further examination.

KEYWORDS

Disaster Preparedness, Game-Based Tools, Landslide, Horizon Europe, Citizen Survival.

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¹Official Numbers from the Norwegian Government Investigation (NOU 2022:3).

²[B-prepared Project](#) (retrieved 16 March 2026).