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Abstract. This paper presents a multi-case study on universal crisis information design, focusing on individuals with communication disorders, the elderly, and immigrants. Using a research-through-design approach and various qualitative data collection methods, the study explores accessible information solutions by examining the accessibility of crisis information design and developing universal crisis information design guidelines based on the findings. The findings highlight the necessity for simplified crisis messages, multimodal communication, and the involvement of community facilitators. This leads to a set of guidelines for universal crisis information design, including integrating adaptive technologies and multiple communication channels to enhance trust and inclusivity in crisis management. The study underscores the importance of community-based strategies and the role of personalized, clear, and trustworthy information in improving crisis preparedness and response among vulnerable groups.

Keywords. Crisis Information Design, Design for All, Research Through Design

1. Introduction

Due to emerging political conflicts and the climate change crisis, preparedness is gaining more importance than ever before. Effectively communicating vital information to all segments of society is crucial for crisis mitigation. Without a universal design approach, certain groups risk exclusion from crisis communication, which affects both their well-being and overall societal resilience [1]. While well-established universal design guidelines exist, applying them to crisis information design presents challenges. One reason for this is the hierarchical nature of crisis management and the complexity of evaluating designs during actual crises. Current literature primarily focuses on high-level strategies and training instructions for decision-makers and communicators [2, 3]. However, limited exploration remains in universal crisis information design guidelines. This multi-case study, using a research-through-design approach, conducts three case studies to understand the problems vulnerable groups and stakeholders face with crisis information. The three case studies involve individuals with communication disorders, the elderly, and immigrants. The research questions are: RQ1: How can crisis information be designed to ensure accessibility and understandability for individuals

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with communication disorders, the elderly, and immigrants within the context of Swedish society? RQ2: What lessons can be learned from these groups to develop universal crisis information? Each study includes qualitative research and participatory design workshops aimed at developing information design solutions. Through the studies, diverse data types, such as interview transcripts, reflection notes, survey results, and conceptual ideas, were collected. Although the cases had similarities, they differed in terms of event sequences, data collection methods, and participant numbers.

2. Background

Current literature on crisis information and communication emphasizes a few key approaches to ensuring accessibility including developing macro-level communication strategies [4], such as identifying audience segments and crisis contexts to improve planning for vulnerable groups [5]. This helps select effective communication channels for specific groups and situations. An additional approach is embedding crisis communication within local authorities and organizations, which better understand vulnerable groups and can more flexibly address their needs [6]. Another approach is focusing on the preparedness of crisis communicators, mainly by improving the psychological and interpersonal skills necessary for coping with and communicating during a crisis [7,8]. Using various communication tools, including those that utilize technology, is an approach that focuses on instruments of communication to make crisis information universally accessible. Examples include universally understandable visual codes and icons [9], as well as coordinating and quality assurance solutions for spreading understandable and relevant crisis information [10, 11]. Finally, there are studies that address specific groups and contexts with higher vulnerability during a crisis. Such studies often suggest tailored communication solutions and strategies for specific crisis situations and vulnerable groups [12,13,14]. Although the existing approaches towards universal crisis communication and information are diverse, they often do not provide comprehensive design guidelines or strategies for universal information design. In current literature, the term design, within the context of crisis information, is usually used for describing the development of technology, specifically digital communication [15,16,17]. However, information design involves the practice of arranging and presenting information by considering clarity, effectiveness, and usability and requires combining various media such as text, audio, and visuals to communicate information effectively to its intended audience [18]. Given the general gap in crisis information design, it follows that universal crisis information design is also underexplored.

3. Method

Considering the gap in the literature, this multiple case study attempts to develop a set of universal crisis information design guidelines based on findings from three vulnerable groups: individuals with communication disorders, the elderly, and immigrants, within the context of Swedish society. To develop these guidelines, we applied a 'research through design' approach, meaning that activities during the design process, such as user studies and co-design workshops, as well as the design solutions generated, were used as the main sources of data for research [19]. Research through design is a promising approach for developing well-integrated solutions to complex and

uncertain challenges involving multiple stakeholders [20]. This is particularly relevant in the challenging field of universal crisis information design. Collected data from cases were analysed using thematic coding to identify common themes and ensure robustness through triangulation of various methods such as interview, survey, and workshop data.

3.1. Case one: individuals with communication disorder

The first case study investigates crisis communication for individuals with complex communication needs, including people with aphasia and users of Blissymbolics. Aphasia is a communication disorder that impairs understanding and expressing spoken and written language, often due to brain damage. Blissymbolics is a visual language of symbols, each representing a unique concept. Symbols can be combined to represent new concepts, aiding communication for those with severe speech and physical impairments. As shown in Table 1, data collection involved semi-structured interviews, group workshops, and questionnaires. To facilitate communication a Supported Conversation for Adults with Aphasia (SCA) approach was used. The SCA approach trains communication partners to facilitate conversations with individuals with aphasia, using strategies like acknowledging competence, multimodal communication, and focusing on one idea at a time. In the workshops, the Talking Mats tool was utilized. Talking Mats is a visual tool that helps people with communication difficulties express their thoughts using pictures and symbols on a mat, enabling participation in discussions. Data collection was conducted by a speech and language pathologist.

Table 1. Summary of case one data collection methods

Data Collection	Scope	Participants	Specification
Semi-structured Interviews	Investigate personal experiences and pre-understanding of crisis scenarios	3 participants with aphasia	30-minute interviews using the SCA approach discussed participants' backgrounds, external support, COVID-19 information evaluation, trust in societal crisis care, and their capacity to assist others.
Codesign Workshops	Crisis-specific problems	3 participants with aphasia (first workshop), 4 Blissymbolics users (second workshop)	Two 90-minute workshops demonstrated crisis scenarios. Participants used Talking Mats to rate nine problems, with pictures and symbols aiding understanding.
Questionnaires	Evaluate current support, crisis handling, and trust in authorities	16 participants with aphasia	A 10-question survey, aided by a pathologist, addressed participants' support, crisis management, trust in authorities, and crisis help preferences.
Expert Interview	Provide expert insight into participant functionality and reliability	1 speech and language pathologist	A 60-minute expert interview, audio-recorded and semi-structured, provided insights into participants' functionality and reliability from a pathologist's view.
Individual Interview	Personalized input from a Blissymbolics user	1 Blissymbolics user	A 60-minute interview, semi-structured and assisted, ensured accurate understanding of participant's input.

3.2. Case two: elderly

The second case addressed crisis communication for elderly individuals, focusing on climate related crises such as flooding, storms, and wildfires. The study employed participatory design methods to engage the elderly in developing inclusive communication strategies. Data collection methods included unstructured group interviews, web surveys, focus groups, and workshops (Table 2). The unstructured group interviews were conducted at senior meeting places to gather initial insights. A web survey distributed through senior associations provided quantitative data on how seniors currently receive and prefer to receive crisis information. Focus groups with seniors living on islands explored specific needs and preferences, while various workshops and activities facilitated the co-design and evaluation of communication solutions.

Table 2. Summary of case two data collection methods

Data Collection	Scope	Participants	Specification
Unstructured Group Interview	Initial exploration of information sources and preferences	5 seniors	Informal discussion at senior meeting places to understand general information behaviours and preferences.
Web Survey	Broad assessment of information needs and trust	693 seniors	Survey distributed via senior associations, exploring preferred channels, trust in information sources, and specific information needs during crises.
Focus Groups	In-depth exploration of crisis communication preferences	9 seniors living in an archipelago	Two focus groups discussing crisis communication preferences, focusing on the differences between city and island living seniors.
Emotion Workshop	Creative exploration of crisis communication strategies	5 participants representing Multiple stakeholders	Workshop with seniors and crisis management authorities to co-design communication solutions.
Telephone Interviews	In-depth exploration of trust issues and preferences	5 seniors	Conducted via telephone to gain deeper insights into trust issues and communication preferences.
Co-design Workshops	Co-design and evaluation of communication solutions	5 seniors	Conducted in two parts: scenario-based board game and idea generation. Participants empathized with personas to develop crisis communication strategies.
Post-it Evaluation	Gathering feedback on proposed solutions	Workshop participants	Participants provided feedback and suggestions on proposed solutions using post it notes during workshops.

3.3. Case three: immigrants

The third case study explores crisis communication within Swedish metropolitan suburbs, specifically focusing on individuals with foreign cultural backgrounds and

lower socio-economic status. Emphasis was placed on trust. As shown in Table 3, the study began with an exploratory literature review, followed by multiple user studies, including cultural probes and interviews with communicators, other experts, and the target group. This phase was summarized using six different personas. Subsequently, individual idea generation activities and idea-generating workshops were carried out, resulting in a conceptual design with four variations. The final design proposals were evaluated through a survey, with the responses qualitatively analysed.

Table 3. Summary of case three data collection methods

Data Collection	Scope	Participants	Specification
Cultura Probes	Understanding daily lives and communication habits	14 participants from the target group	Digital format over five days, capturing routines, neighbourhood views, media habits, crisis information opinions.
Interviews	In-depth exploration of target group needs	5 participants from the target group	Gathering detailed insights on crisis information needs and behaviours.
Design Workshops	Translating research outcomes into communication solutions	6 designers	Scenario-based board game and idea generation. Participants empathized with personas to develop crisis communication strategies.

4. Results

4.1. Results of case one, individuals with communication disorder

Participants with aphasia could manage crisis information if they stayed at home but struggled with complex instructions and had not considered stocking up on essentials. Blissymbolics users relied heavily on personal assistants and faced life-threatening risks without them. Both groups expressed low trust in societal support but had strong personal networks. Based on a qualitative synthesis of data from different methods, the most common themes related to the research questions include simplifying crisis messages, ensuring multi-modal communication, and involving these individuals in crisis planning to enhance their preparedness and trust in crisis management systems.

Table 4. Summary of case one results

Data Collection	Findings
Semi-structured Interviews	Participants with aphasia could manage crisis information at home but struggled with complex instructions and lacked plans for essentials.
Codesign Workshops	Blissymbolics users heavily relied on personal assistants; without them, they faced life-threatening risks. Both groups emphasized the need for simplified crisis messages and multi-modal communication tools.
Questionnaires	Participants expressed low trust in societal support but had strong personal networks. They preferred personalized and clear crisis information.
Expert Interview	Confirmed that participants had varying abilities to manage crisis situations independently, highlighting the importance of tailored communication strategies.

Individual Interview	The Blissymbolics user indicated complete reliance on personal assistants for effective crisis management, stressing the need for assistant-inclusive plans.

4.2. Results of case two, elderly

The elderly prefer concise, clear, and reliable information delivered through familiar channels such as TV, radio, and text messages. There is a need for personalized communication strategies that account for the cognitive and sensory impairments common among the elderly. Trust in information sources varies, with authorities and rescue services being the most trusted. Both the web survey and focus groups revealed a reliance on neighbourly cooperation and social networks, especially among those living in the archipelago. This emphasizes the importance of community-based communication strategies. The workshops facilitated the development of several innovative communication concepts, including automatic voice SMS, updated outdoor signals like Hesa Fredrik using drones, and neighbourhood chat groups.

Table 5. Summary of case two results

Data Collection	Findings
Unstructured Group Interview	Seniors rely heavily on TV and radio for information and social interactions at meeting places enhance information dissemination.
Web Survey	Trust in authorities and rescue services is high; seniors prefer concise and clear information. Personalized messages and updates on the situation and expected duration are crucial.
Focus Groups	Neighbourly cooperation is vital, especially on islands. Information should be clear, concise, and adapted to local contexts.
Emotion Workshop	Developed concepts include automatic voice SMS, drone-delivered outdoor signals, and neighbourhood chat groups for crisis communication.
Telephone Interviews	Revealed specific trust issues and communication preferences unique to the target group.
Co-design and Evaluation Workshops	Seniors actively contributed to the creation and assessment of crisis communication concepts, emphasizing the need for clear and direct messaging.
Post-it Evaluation	Participants provided constructive feedback on proposed solutions, emphasizing the need for localized and trusted communication channels.

4.3. Results of case three, immigrants

Trust in authorities and crisis information is generally lower in these areas, primarily due to socioeconomic factors, previous experiences, and perceived inequities. The study found that two-way interpersonal communication significantly increases trust and effectiveness in reaching the target group. Community facilitators, multilingual and multicultural individuals from the given areas, emerged as a crucial element in bridging the information gap. The design proposals focused on creating processes to reduce this gap by involving these facilitators, who would collect and relay information to crisis communicators to tailor messages better suited to the target group.

Table 6. Summary of case three results

Data Collection	Findings
Cultural Probes	The importance of familiar communication channels and the need for trust-building through everyday interactions.
Interviews	Challenges in reaching the target group due to low trust in authorities, socioeconomic disparities, and cultural differences. Importance of clear, concise information and the role of community facilitators.
Workshops	Concepts including multilingual facilitators, community-based information sessions, and digital tools for real-time updates.

5. Discussion and conclusions

Qualitative synthesis of results from cases revealed common themes in target group challenges, stakeholders' challenges, and design requirements. All participants encountered communication challenges related to accessibility, trust, and inclusivity during crises. These findings directly address RQ1 by demonstrating the necessity for simplified, multi-modal communication strategies tailored to the needs of individuals with communication disorders, the elderly, and immigrants. A recurring theme in all three studies emphasized the importance of flexible communication strategies tailored to the diverse needs of participants [21, 22]. These strategies aim to ensure that everyone receives timely, clear, and trustworthy information during crises. The stakeholders faced challenges related to effective reach and trust-building with diverse community groups. The studies highlighted the importance of stakeholders developing adaptable communication strategies to build trust between authorities and the communities. Design requirements from all three cases emphasized accessible, adaptable, and inclusive crisis communication systems. The messages needed to be relevant, timely, credible, transparent, and actionable. Examples of solutions included automatic voice SMS, drone outdoor alarms for remote areas, and multicultural facilitators bridging gaps between authorities and communities. It is unsurprising that achieving universal crisis information design necessitates participation. However, facilitating such participation is not easy due to limitations of some target groups and difficulties in evaluating designs in crisis situations. Moreover, security concerns sometimes dictate a waterfall decision-making approach. Therefore, there is always a chance that crisis information design is being partially developed using a top-down approach. Design guidelines for overcoming these challenges include the use of adaptive technologies, communication through multiple channels and media, facilitators who can bridge the communities and policymakers, and constructing universal design solutions around common communication challenges such as mistrust, need for iteration, exhaustion, confusion, delusions, and processing delays. A key limitation is the small sample sizes and focus on Swedish society, which may affect the generalizability of the findings. Future research should test these findings in diverse cultural contexts with larger populations to validate the guidelines.

Acknowledgements

References

[1] Nilsson EM, Lundälv J, Eriksson M. Design opportunities for future development of crisis communication technologies for marginalised groups–Co-designing with Swedish disability organisations. J Enabling Technol. 2022;16(3):159-171.

[2] Becerra I. Design principles for crisis information management systems. Int J Inf Syst Crisis Response Manag. 2015;7(2):1-20.

[3] Gjøsæter T, Radianti J, Chen W. Universal design of ICT for emergency management from stakeholders' perspective. Inf Syst Front. 2021;23:1213-25.

[4] Frandsen F, Johansen W, editors. Crisis Communication. In: Schulz PJ, Cobley P, editors. Handbooks of Communication Science. Vol. 23. Berlin, Boston: De Gruyter Mouton; 2020.

[5] Kim Y, Miller A, Chon M-G. Communicating with Key Publics in Crisis Communication: The Synthetic Approach to the Public Segmentation in CAPS (Communicative Action in Problem Solving). J Contingencies Crisis Manag. 2016;24(2):82-94.

[6] Tanović M, Šašić Đ, Ajdinović A, Čizmić E. Analysis of Effective Crisis Management and Crisis Communication in Public Sector Organizations. In: New Technologies, Development and Application IV (NT 2021). Lecture Notes in Networks and Systems, volume 233. Springer; 2021. p. 1141–1148

[7] Belasen A, Eisenberg B. Building Trust for Better Crisis Communication: Lessons for Leadership Development. In: New Leadership Communication—Inspire Your Horizon. Springer; 2023. p. 93–110

[8] Vovk NP, Diachkova OM, Mokhnar LI. Psychological approaches of improvement of the efficiency of communication in the conditions of anti-crisis management. Int J Innov Technol Soc Sci. 2021.

[9] Fitrianie S, Rothkrantz LJM. Communication in Crisis Situations Using Icon Language. Proceedings of the 2005 International Conference on Multimedia and Expo (ICME). 2005.

[10] Netten N, van Someren M. Improving communication in crisis management by evaluating the relevance of messages. J Contingencies Crisis Manage. 2011;19(2):75-85.

[11] Laajalahti A, Hyvärinen J, Vos M. Crisis Communication Competence in Co-Producing Safety with Citizen Groups. *Social Sciences*. 2016;5(13).

[12] Stans SEA, Dalemans R, de Witte L, Beurskens A. Challenges in the communication between 'communication vulnerable' people and their social environment: An exploratory qualitative study. Patient Educ Couns. 2013;92(3):302-312.

[13] Marynissen H, Lauder M. Stakeholder-focused communication strategy during crisis: A case study based on the Brussels terror attacks. Int J Bus Commun. 2020;57(2):176-93.

[14] Ireland CA. Application of mental illness and cognitive impairment to the critical incident: considerations and implications. In: Conflict and Crisis Communication: Principles and Practice. Taylor & Francis Group; 2011.

[15] Nikolai CM, Johnson T, Prietula M, Becerra-Fernandez I, Madey GR. Design principles for crisis information management systems: From closed local systems to the web and beyond. International Journal of Information Systems for Crisis Response and Management. 2015 Oct 1;7(4):26-45.

[16] Mathaisel D. Using data visualizations as information communication tools during a crisis: a critical review. Journal of Information, Communication and Ethics in Society. 2024 Jan 5.

[17] Ma Y, Yuan S, Zhang H, Liu Y. Framework design for operational scenario-based emergency response system. InISCRAM 2013 Jun.

[18] Diefenthaler A. Information Design. In: Erlhoff M, Marshall T, editors. Design Dictionary. Board of International Research in Design. Basel: Birkhäuser; 2008. p. 218–219.

[19] Zimmerman J, Stolterman E, Forlizzi J. An Analysis and Critique of Research through Design: towards a formalization of a research approach. Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10). 2010:310-319.

[20] Maher R, Maher M, Mann S, McAlpine CA. Integrating design thinking with sustainability science: a Research through Design approach. Sustain Sci. 2018;14(2):561-573.

[21] R. Hansenäs and S. Samuelsson, Inclusive communication of crisis information: An explorative study through participatory design with elderly, MSc thesis, Industrial Design Engineering (MPDES), Chalmers University of Technology, 2022.

[22] S. Svensson and W. Wessblad, Crisis Communication in Swedish Metropolitan Suburbs: Exploring improvements for an effective and trustful crisis communication system, MSc thesis, Industrial Design Engineering (MPDES), Chalmers University of Technology, 2022.