LIU-IDA/KOGVET-G--24/030--SE

Linköping University

Bachelor Thesis, 18 Hp

Recommendations for the Educational Concept of Sweden's National Pre-Hospital Mass Casualty Triage System

Insights From Thematic Analysis and Comparative Literature Review in Cognitive Science

2024

Author: Victor Karlströmer
Supervisor: Peter Berggren
Examiner: Björn Johansson

LINKÖPINGS UNIVERSITET

Copyright

Abstract

This thesis provides recommendations for enhancing the educational concept of Sweden's National Pre-Hospital Mass Casualty Triage System (MCTS). The research is grounded in thematic analysis and comparative literature review within cognitive science and training research. It aims to address the need for an efficient and effective MCTS educational concept.

The study employs a qualitative approach, conducting semi-structured interviews with key stakeholders such as triage instructors, healthcare professionals, and emergency responders. The thematic analysis of these interviews reveals key elements for an effective educational concept: clear guidelines for correct and incorrect triage, integration into existing training programs with follow-up, and the necessity for short and simple educational modules to facilitate rapid dissemination. Additionally, cognitive science insights emphasise the importance of realistic simulations and a balanced approach to theory and practice in enhancing learning outcomes. Key training needs identified include understanding the dynamic flow of patients and resources, and adapting the utilitarian principles of MCTS, which focus on saving the greatest number of lives rather than individual patient care. The study also addresses the integration of various groups, including non-medical professionals, into the triage process, highlighting the need for strong inter-organizational cooperation and tailored educational strategies.

The findings contribute to the ongoing development of Sweden's national MCTS by offering practical recommendations for an educational system that is efficient, scalable, and capable of being consistently applied across different regions and emergency scenarios. This research underscores the critical role of structured, evidence-based training in preparing responders to effectively manage MCIs and improve overall disaster response outcomes.

Acknowledgements

I would like to thank my supervisor Peter Berggren for the great support and positive attitude which kept me on the right track. I would like to thank Erik Prytz and Carl-Oscar Jonson for giving me the opportunity to work with this project and for the help with making it happen by answering my questions. I would also like to thank all the other people at Katastrofmedicinskt centrum and nurses for providing participants, and participating in this study.

I would like to thank my friends and family for cheering me on and a special thanks to Zsófia Kecskés for giving me all the motivation I could ever need. And thank you to the stranger who made a great breakbeat playlist on spotify.

Victor Karlströmer,

Budapest in June 14, 2024

Contents

1. Introduction

Mass casualty triage is crucial for managing large-scale disasters with numerous injured individuals, requiring a robust decision-support system and efficient resource allocation. Currently, Sweden employs various local triage systems, but the aim is to implement a unified, national mass casualty triage system (MCTS). During mass casualty incidents (MCI), the number of victims often surpasses the available medical personnel, necessitating the efficient allocation of resources and prioritisation of care. This process involves diverse professionals, including different emergency services personnel from many regions. Therefore, a comprehensive educational system providing clear structures and support is essential. This project offers recommendations to support the development of a comprehensive educational system.

Mass casualty triage, in comparison to a normal triage system, is less about having the best care for each individual and more about allocating the limited amount of resources, such as personnel, medical tools, ambulances, and hospital beds to focus on affected groups of people in order to save as many people as possible (Moscicki et al, 2022). So, it uses a utilitarian principle - those who are in most need and most likely to benefit from the available resources are given access to the resources first. MCTSs work by first assessing the degree of danger people's injuries pose through global sorting with voice commands and visual assessment. In simple terms, there are four levels of triage in global sorting: green is given to people with minor injuries that can be treated outside the hospital. Yellow is given to people with moderate injuries that can wait but need hospital care. Red is given to people with life-threatening injuries needing immediate care. Black is assigned to those with no signs of life and not breathing despite a clear airway. After global sorting, the second step is to perform quick lifesaving interventions, such as stopping bleeding and securing airways. The third step involves making individual assessments and prioritisations. The fourth and last step is the provision of treatment or transport.

The international development and integration of MCTSs have been prompted by large-scale disasters. Notably, the USA developed the SALT (Sort, Assess, Lifesaving Interventions, Transport) system after the 9/11 attacks (Moscicki et al, 2022), which was later adopted with some modifications by Norway following the Utøya attack in 2011 (Pepper et al. 2019) Britain has also developed its own system called the 10-second triage, which, compared to other triage systems, has a more research-focused foundation (Prytz, personal communication, Feb 13, 2023). Triage systems are challenging to evaluate, and there is no definitive answer as to which system is superior to another, but it is crucial that a system is in place (Moscicki et al, 2022).

Today, Sweden educates triage at a local level where each district chooses how their educational concept ought to look. This is not desirable, as it creates a discrepancy between different regions' nomenclature and triage methods. In the event of a MCI, several regions will need to work together, as there is a lack of available resources to take care of the injured people. Therefore, each region and different groups within the region need to have a unified triage system, and consequently, a unified and effective educational concept for that system.

In response to a government regulation (S2021/02921) on emergency preparedness issued by Socialdepartementet (2021), the Swedish National Board of Health and Welfare (Socialstyrelsen) has begun developing a national MCTS in Sweden. The Centre for Teaching and Research in Disaster Medicine and Traumatology (KMC) in Linköping, in collaboration with Linköping University and the Region of Östergötland, has been given the responsibility to guide the implementation of this initiative. KMC's role includes investigating and

developing the structure for the national system, which involves conducting literature reviews on existing triage systems, summarising guidelines, preparing materials for workshops, soliciting expert feedback, and developing recommendations. This project contributes to these efforts by formulating recommendations for the educational concept of the MCTS, thereby advancing the ongoing development of the system.

1.1. Purpose

The aim of this project is to offer recommendations for the implementation of a new educational concept for mass casualty triage in Sweden. Utilising insights from cognitive science and conducting a thematic analysis, the project seeks to derive training needs and recommendations to satisfy them. Training theories and thematic analysis will guide the identification of these needs and the formulation of appropriate recommendations.

1.2. Research Questions

Based on the background provided and the project's defined purpose, the research seeks to address the following questions:

1. What constitutes an effective educational concept for pre-hospital mass casualty triage?
2. How can insights from cognitive science and existing training research enhance learning outcomes in a national mass casualty triage educational program?
3. What specific training needs do participants of the education have?
4. How can various groups be effectively integrated into the educational program?
5. What recommendations can be derived for the education of Sweden's MCTS based on the findings from the previous research questions?

1.3. Delimitation and Scope

This project focuses on providing recommendations for the MCTS educational concept based on thematic analysis results derived from interview data, which will be compared with relevant literature. The scope of these recommendations is inherently limited and will not comprehensively address the entire educational concept. Instead, they will concentrate on the perspectives and feedback from current educators and trainees involved in triage. These recommendations will align with the literature only insofar as it corroborates the sentiments expressed by these stakeholders. Consequently, the recommendations provided will be broad and not specific enough to design a fully-fledged educational concept.

2. Background

This section provides an overview of earlier works in the area of MCTSs, focusing on previous studies, reports, and training programs that have informed the current project. The following sections include experiences and findings from Sweden's MCTS, similar projects in Ukraine, the USA, and Norway. Additionally, various training methodologies such as the Train-the-Trainer model and the use of simulation training methods like the Emergo Train System® (ETS) are examined.

2.1. Sweden's MCTS

Moscicki et al. (2022) undertook a comprehensive study to support the development of a national MCTS in Sweden. Commissioned by the National Board of Health and Welfare, this study aimed to evaluate existing triage systems and propose a framework suitable for national implementation.

The research involved a two-part approach: a literature review and an interview study. The literature review included an analysis of relevant grey literature, public handbooks, guidelines, and review articles on MCTSs published in the last five years. The interview study gathered insights from Swedish and international experts through semi-structured interviews, followed by a thematic analysis of the responses.

Key findings emphasised the need for clear guidelines and standardised protocols to ensure effective triage during MCIs. The study highlighted the importance of adaptable and scalable triage systems that can respond to varying degrees of emergencies. It also stressed the significance of training non-medical personnel, such as rescue services and police, in basic triage principles to enhance overall response capabilities.

The researchers recommended prioritising the training of instructors, adopting flexible and regionally adaptable triage systems, and ensuring continuous evaluation and refinement of these systems based on practical experiences and emerging evidence. This work provided a foundational basis for the structured development and implementation of a national MCTS in Sweden.

2.2. Ukraine

The Ukraine Trauma Project, as detailed by Bury et al. (2023), focused on introducing advanced trauma-care skills to frontline emergency medical services responders. The project utilised the Medical Research Council framework for complex interventions to design and deliver a training program on haemorrhage control. The initiative demonstrated the feasibility of rapid training deployment in a wartime setting and highlighted the effectiveness of the Train-the-Trainer model (see section 2.5) in cascading essential skills and knowledge. The project's success underscores the importance of targeted training interventions and the potential for such programs to significantly improve emergency response capabilities.

Jonson et al. (2024) examined the Swedish Civil Contingencies Agency's (MSB) training initiative in Ukraine, aimed at supporting Ukraine's medical response following Russia's invasion in February 2022. The initiative used the Tactical Combat Casualty Care (TCCC) system, a well-known military medical training framework. The study involved qualitative research through semi-structured interviews with Swedish and Ukrainian TCCC instructors, analysing their experiences and insights. Thematic analysis highlighted the importance of prioritising instructor training, establishing clear guidelines, and adapting training for different languages with scenario-based methods. There was a strong emphasis on practical exercises and the safe execution of medical interventions. The study stressed the need for

early combat medicine training, continuous prioritisation of training even during wartime, and broad dissemination of competencies to civilian actors and reintroducing basic trauma management skills in Swedish medical education.

2.3. USA

The SALT (Sort, Assess, Lifesaving Interventions, Treatment/Transport) triage system was developed in response to the need for a more organised and efficient method of managing MCIs. The system aims to quickly identify and prioritise patients based on the severity of their conditions to maximise the number of survivors. The implementation of SALT involves sorting patients via voice commands, assessing each patient individually, performing lifesaving interventions quickly, and prioritising for treatment and transport. This system was developed after the 9/11 attacks and involved consultation with international experts to create a national triage plan suitable for various types of mass casualty events. The SALT system has been adopted and recommended by multiple organisations within the USA to ensure a standardised approach to triage in MCIs (Moscicki et al., 2022).

2.4. Norway

Following the tragic events of the 2011 Utøya attack, Norway adapted the SALT triage system to fit its unique emergency response structure. This adaptation emphasised a more integrated approach involving local emergency response teams and tailored protocols to suit Norway's healthcare infrastructure. Participants in the implementation process described the system as fulfilling a need for confidence in how to act during emergencies, with the system being widely disseminated and accepted across various emergency services. The Norwegian version includes specific adaptations for different types of mass casualty incidents, such as CBRNE (Chemical, Biological, Radiological, Nuclear, and Explosive) events, and emphasises continuous reassessment and dynamic triage throughout the incident (Moscicki et al., 2022).

2.5. Train the Trainer

The Train-the-Trainer model is another key component of effective MCTS training. This approach involves training a select group of individuals who then train others, creating a cascading effect of knowledge transfer. The model has been successfully implemented in various contexts, including the Ukraine Trauma Project, where it facilitated the rapid dissemination of critical skills and knowledge to a large number of responders. Berggren et al. (2023) highlight the effectiveness of this model in ensuring consistent, high-quality training across different levels of an organisation.

Berggren et al. (2023) explored the concept of "Training of Trainers" (ToT) to build capacity within organisations, particularly in the context of disaster medicine and healthcare. Their study investigated how ToT is perceived among trainers and examined its effectiveness in disseminating knowledge and skills. The research involved semi-structured interviews with trainers who have been involved in ToT courses, focusing on their experiences and insights. The data from these interviews were analysed using thematic analysis, which identified key themes and patterns.

The findings highlighted several themes: a common understanding of ToT's purpose in spreading knowledge efficiently, the importance of learning-by-doing through practical exercises, challenges in ensuring consistent quality across training iterations, and the need for grounding in ToT methodology and pedagogy. Participants noted that while ToT is effective in rapidly expanding the number of trained individuals, maintaining high standards and consistency across successive training steps can be challenging. Berggren et al. (2023) concluded that ToT is a valuable method for achieving organisational learning and

emphasised the need for ongoing support and quality assurance to ensure the training's effectiveness and sustainability.

2.6. Emergo Train System

The Emergo Train System® (ETS), developed and widely used in Sweden, is a simulation-based training method designed to prepare emergency responders for major incidents. ETS is used for low-fidelity simulations, focusing on the management of resources, communication, decision-making, and logistics during MCIs. Lindhagen (2022) discusses how ETS has been used to simulate major incidents, providing a controlled environment for responders to practise their skills and decision-making processes. The system allows for simulation of various scenarios, helping trainees understand the dynamics of MCIs and the importance of coordination among different emergency services. The system's ability to simulate various disaster scenarios makes it a valuable training tool for healthcare professionals (Lindhagen, 2023). Lindhagen's findings highlighted the need for clear goals and realistic scenario planning to enhance the training's effectiveness. The study also underscored the importance of creating a supportive and safe learning environment, where participants feel comfortable making mistakes and learning from them.

3. Theory

This section outlines the theoretical background in learning and training for the study and its methodology. These theories inform the approaches taken to gather and analyse data, ultimately guiding the suggestions for educational improvements.

3.1. Learning

Cognitive science provides a fundamental understanding of how individuals process information, learn new skills, and make decisions under pressure. Cognitive Load Theory (Paas et al., 2003) emphasises balancing the complexity of information with the learner's capacity to process it, which is crucial for designing effective and manageable MCTS training that prevents cognitive overload. Kolb's Experiential Learning Theory (2011) posits that learning is a cyclic process involving experiencing, reflecting, conceptualising, and acting. This cycle allows learners to refine their understanding and skills through repeated engagement with these stages, highlighting the importance of active engagement and reflection. Practical, hands-on experiences are essential for deep learning, supporting the integration of realistic simulations and practical exercises into MCTS education to enhance skill retention and application. Additionally, it is crucial to consider the transfer of training to ensure that skills and knowledge gained during training are effectively applied in real-world situations (Lindhagen, 2022). Transfer of training can be categorised into positive, zero, and negative, with effective transfer aligning training with real-life application (Rybing, 2018).

3.1.1. Cognitive Load Theory

Cognitive Load Theory (CLT), developed by Sweller (1988) and expanded by Paas et al. (2003), is central to designing effective instructional programs by focusing on the mental effort required to process information. CLT categorises cognitive load into three types: intrinsic, extraneous, and germane. Intrinsic load is inherent to the material being learned, extraneous load is the unnecessary effort imposed by the way information is presented, and germane load is the mental effort dedicated to processing and understanding the material. The goal of educational design, according to CLT, is to manage these loads to ensure that the intrinsic complexity of the material is presented in a way that encourages schema formation while minimising unnecessary cognitive burdens. This fosters an efficient and effective learning process by enabling easier recall of complex information with minimal cognitive overload. In the context of MCTS training, CLT informs the structuring of theoretical and practical components to ensure they are delivered in a manner that minimises extraneous load and maximises germane load. This approach improves the retention and application of critical triage skills under high-pressure conditions by promoting the construction and automation of schemas, making knowledge, skills, and abilities (KSAs) more accessible with reduced cognitive effort (Sweller et al., 2011).

Integrating simulation with these principles, as supported by Fraser et al. (2012), helps manage cognitive load effectively during complex scenarios, enhancing both learning and performance in real-life applications. Fraser's study highlights that emotions experienced during simulation training can significantly impact cognitive load and learning outcomes. They found that heightened emotions, such as invigoration, increased cognitive load, while emotions like tranquillity reduced it. This relationship shows the importance of managing emotional states during MCTS training to prevent cognitive overload. Since heightened mental states are expected during MCIs, simulations and training programs should reflect this to maximise the transfer of training and ensure effective learning outcomes.

3.2. Training

Training theory, which includes structured emergency response, simulations, and resilience, is essential for mass casualty triage systems (MCTS). Effective training programs should balance new learning and existing knowledge, focus on systematic emergency preparedness, present clear objectives, demonstrate required skills, allow practice, and provide feedback (Aguinis & Kraiger, 2009; Bisbey et al., 2021). A needs analysis helps identify training requirements and the best methods for delivery (Aguinis & Kraiger, 2009; Bisbey et al., 2021). Emergency responders need efficient training in both basic and advanced emergency medical care and disaster management (Grant & Cheng, 2016; Grossman & Salas, 2011; Thawley et al., 2020).

To further understand how to balance new learning and existing knowledge, Crossan et al. (1999) developed a framework for organisational learning that focuses on moving from intuition to institution. Crossan et al. highlight the need to balance exploration (new learning) and exploitation (using existing knowledge) through four key processes: intuiting, interpreting, integrating, and institutionalising. These processes occur at individual, group, and organisational levels. Effective learning requires continuous interaction among these levels to achieve strategic renewal, integrating new insights into formal systems and structures.

Intuiting involves individuals recognising patterns and possibilities based on their experiences. Interpreting is about explaining and sharing these insights with others, creating a common understanding. Integrating means developing shared understandings and coordinated actions within a group. Institutionalising involves embedding these new learnings into the organisation’s systems, structures, and routines. Crossan et al.'s study (1999) emphasises the importance of both cognitive and social dimensions in learning. Strategic renewal depends on managing the interplay between individual intuition, group interpretation, and organisational integration and institutionalisation.

Building on the idea of structured preparedness, the Homeland Security Exercise and Evaluation Program (HSEEP) provides a comprehensive framework for emergency response training (Homeland Security, 2020). HSEEP outlines a systematic approach for preparing for emergencies through a cycle of planning, training, exercises, and evaluation. This approach involves setting clear objectives, coordinating resources, and engaging senior leadership to guide and improve preparedness efforts. The cycle includes designing realistic training scenarios, conducting exercises to simulate real incidents, and evaluating performance to identify strengths and areas for improvement. Findings are documented in After-Action Reports (AARs), and corrective actions are implemented to enhance future preparedness. This integrated preparedness cycle ensures continuous improvement and readiness across the entire emergency response system, from the incident site to hospitals and primary care (Homeland Security, 2020).

For training programs to be effective, they should be designed and implemented with the primary goal of ensuring that participants achieve clearly defined learning objectives (Bisbey et al., 2021). The KSAs (knowledge, skills, and abilities) identified for a program guide its design. Several factors influence the outcomes of training programs, including the characteristics and conditions of the participants, their attitudes and motivation, the structure of the training, and the training environment (Grossman & Salas, 2011). A needs analysis is a method used to identify the relevant factors for a training program in relation to its KSAs (Bisbey et al., 2021). This analysis provides a structured and systematic approach to developing training programs. It involves determining who needs the training, what their

specific needs are, and how participants can most effectively assimilate the training. For this thesis, the training program participants are identified as emergency responders, both novice and experienced. They require training in basic and advanced emergency medical care and disaster management. There is also a significant need for time-efficient training due to the nature of emergency response work.

Bisbey et al. (2021) outline a fundamental structure for effective training programs. Initially, learning objectives should be presented to participants, followed by demonstrations of these objectives and the KSAs they encompass. Participants should have opportunities to practise and receive feedback during and after the training. Learning styles may vary during this process; for example, some individuals may better assimilate information visually, while others may prefer verbal presentations. An initial needs analysis, combined with a clear training structure, provides a solid foundation for a training program.

3.2.1. Simulation

Simulations serve as a vital learning tool by mimicking real-life situations to solve real-world problems (Rybing, 2018). They are particularly valuable in training environments that demand high-stakes decision-making under pressure, such as healthcare, emergency management, and military operations. The primary purpose of simulations is to provide a realistic yet controlled and safe environment where learners can apply skills, make decisions, and experience the consequences of their actions without real-world risks. To achieve this, effective simulation training incorporates principles from Cognitive Load Theory (CLT) by designing scenarios to align intrinsic load with the learner's cognitive capacity while minimising extraneous load (Paas et al., 2003). Scenarios should also be crafted based on learning objectives and KSAs, considering available resources such as instructors, environment, and time (Huffman et al., 2016). Simulations can vary in fidelity, with high-fidelity (detailed, realistic) simulations closely replicating actual conditions and simulating the mental states and complex decision-making tied to an MCI. However, they also take considerable time and resources and run the risk of leading to cognitive overload, especially for novices. Conversely, low-fidelity (simplified) simulations focus on core training tasks, minimising complexity and cost (Rybing, 2018).

Simulation-based training is widely recognized for its effectiveness in improving both technical and cognitive skills. Huffman et al. (2016) highlight that effective scenario design within simulation-based training must consider elements of engineering and psychological fidelity to ensure the simulations meet curricular goals and target audience needs. The use of both high-fidelity and low-fidelity simulations is crucial, as they address different learning stages and needs, from foundational knowledge to advanced application. Rudolph et al. (2007) explored the concept of realism in healthcare simulation through physical, conceptual, and emotional dimensions. They argued that focusing solely on physical realism is insufficient and that engagement in simulations is also influenced by conceptual understanding and emotional experience. Practical exercise is also supported by theories such as experiential learning, which posits that knowledge is constructed through direct experiences (Kolb, 2011). They suggest that both instructors and participants play roles in making simulations effective. High physical fidelity is crucial for developing kinaesthetic skills, while high conceptual fidelity aids in clinical reasoning. Emotional and experiential fidelity, evoking strong psychological responses, is essential for managing complex, emotion-laden situations. Rudolph et al. (2007) highlighted the need for balanced integration of these types of realism. This dual approach ensures that trainees are well-prepared for the various challenges they may face in MCIs. The importance of simulation in fostering resilience is also noted by Hermelin et al. (2020), who emphasise the role of simulation in

developing cognitive skills and adaptive capacity. By incorporating scenarios of increasing complexity and realism, simulation-based training can help trainees develop the necessary skills to handle unexpected situations effectively.

In MCTS training, scenario-based training can range from tabletop exercises to full-scale simulations with actors and realistic makeup. Realistic injury simulations with actors and makeup can enhance participant engagement compared to simpler training aids like ETS paper figures. High physical realism, such as using realistic wound simulations, is appropriate for practical skill training, while conceptual realism, such as accurate physiological responses to medical interventions, is essential for training in medical diagnostics and understanding (Rudolph et al., 2007). While high physical realism can increase training costs, it is often justified by the improved engagement and practical skill application it offers. However, for novices, high physical realism can be overwhelming. Training programs should balance physical realism with cognitive load, focusing higher realism on the most relevant aspects of KSAs and simplifying others (Paas et al., 2003). In summary, realistic scenario training, with appropriate levels of physical and conceptual realism, is a critical component in developing effective training programs for MCTS. The degree of realism should be tailored to participants' experience levels and specific training objectives, ensuring cognitive load is managed effectively to optimise learning outcomes.

3.2.2. Disaster Management Principles

Resilience in crisis management refers to the ability of organisations to adapt and respond effectively to unexpected challenges. Hermelin et al. (2020) describe how resilience can be operationalised through training, simulation, and reflection, highlighting the importance of developing cognitive skills and adaptive capacity among crisis management teams. By incorporating resilience training into MCTS, responders can better handle the dynamic and unpredictable nature of MCIs.

Disaster management principles provide the framework for understanding the unique challenges of MCIs. Comfort et al. (2010) developed a preliminary model of the dynamics of disaster response operations based on an agent-based simulation. They argue that different phases of disaster response require different types of information, equipment, and management skills. The efficiency of disaster response is influenced by the severity of the disaster, the type and amount of resources available, the number of jurisdictions involved, and the complexity of the response strategies. Interestingly, Comfort et al. found a positive relation between the number of jurisdictions involved and the efficiency of disaster response operations, counterintuitive to general observations from practice. Identifying critical nodes for core information exchange appears to be a key factor in improving efficiency. They concluded that the structure and content of information exchange, communication, and timeliness in coordination processes are crucial in disaster response.

3.3. Synthesis

Theoretical foundations—Cognitive Load Theory (CLT), experiential learning, organisational learning, simulation training, and disaster management principles—inform the study's methodology and recommendations. CLT helps manage cognitive load to optimise learning (Paas et al., 2003). Kolb’s Experiential Learning Theory emphasises practical engagement and reflection (Kolb, 2011). Organisational learning principles guide the integration of new knowledge (Crossan et al., 1999). Simulation training uses varied fidelity to create realistic, controlled learning environments (Huffman et al., 2016; Rudolph et al., 2007). Disaster management principles highlight resilience and efficient coordination (Comfort et al., 2010; Hermelin et al., 2020).

4. Method

The project employed a qualitative research design to explore the educational needs and practices within MCTSs. It integrated cognitive science theories and disaster medicine experiences, using a combination of theoretical research and semi-structured interviews with thematic analysis.

This project undertook a structured approach:

1. Research and familiarisation: Conducted extensive research and review of earlier works and relevant theories to establish a foundational understanding of the subject.

2. Stakeholder Interviews: Conducted semi-structured interviews with stakeholders to gather qualitative data on their perspectives regarding current practices and educational needs.

3. Thematic Analysis: Performed a detailed examination of interview transcripts to identify common themes and insights.

4. Training Needs Assessment (TNA): Conducted a targeted assessment to identify specific educational needs and address identified gaps. This included gathering qualitative data through interviews and literature review, identifying important tasks and skills, and comparing current skills with desired outcomes.

5. Recommendation Development: Formulated recommendations for the educational concept based on the analysed data, incorporating relevant theories derived from thematic analysis.

4.1. Interviews

To collect qualitative data concerning experiences and opinions about education of Sweden's national MCTS, semi-structured interviews were conducted. An interview guide was developed based on Jonassen et al.'s (1999) chapter on conducting semi-structured interviews for training needs assessment for instructional design, which will be further detailed in the procedure chapter (4.1.2). The interviews were conducted online and lasted approximately 30 minutes each.

A script, created with the support of the supervisor, ensured that relevant data was gathered regarding the participants' experiences and opinions on triage education. The script included 12 questions but was used flexibly to allow the conversation to flow naturally. Follow-up questions and digressions into interesting topics were encouraged, while prioritising the most important prepared questions to obtain the most useful information without exceeding the 30-minute time limit. The script was also slightly modified based on if the participants' roles in mass casualty triage was as an instructor or a trainee (Appendices 10.1 and 10.2).

4.1.1. Participants

Participants were recruited using convenience and snowball sampling techniques to reach individuals directly involved in mass casualty triage, including healthcare professionals, emergency responders, and trainers. The sampling strategy aimed to gather diverse perspectives from those experienced in performing, participating in, and developing MCTS education. Invitations were extended via email to networks based on recommendations from employees at KMC.

The study involved five participants, three males and two females, all based in the Östergötland region. They were healthcare professionals and educators with diverse backgrounds in nursing, ambulance services, emergency preparedness, and disaster medicine education.

Their collective experience in mass casualty triage and prehospital care was extensive, with years of experience ranging from over a decade to nearly two decades. Among the participants who specified their experience, three had been working since the early 2000s or earlier in roles such as ambulance services, education, or projects related to mass casualty preparedness. Others were specialist nurses in ambulance care with long teaching experience, training colleagues and future specialists at universities and disaster medicine centres. Some participants worked in senior roles in regional emergency preparedness, contributing to prehospital trauma and disaster medical education, and had been involved in various triage and mass casualty management projects. Additionally, the group included strategists responsible for national-level prehospital medical leadership training, with over a decade of experience in education and strategic planning. These individuals played significant roles in developing and leading triage projects as part of mass casualty preparedness. The participants also included educators focused on training prehospital personnel, including ambulance staff, and had experience in developing and conducting triage workshops.

4.1.2. Procedure

In line with Jonassen et al. (1999), the interview procedure and format were tailored to the nature of the information sought. Before conducting the interviews, the interviewer prepared by becoming task literate, familiarising themselves with the tasks being analysed to ask relevant questions and understand the responses. For the semi-structured interviews, a set of open-ended questions was developed. The interviewees were contacted via email with details about the project and the interview process. Each respondent was offered the option to participate digitally or in person and to choose a convenient time for them. Each participant chose to participate digitally. They received an invitation link to the meeting and a digital copy of the consent form (Appendix 10.3). This form outlined the project's purpose, procedures, ethical considerations, and details about participation and recording. Ethical considerations will be discussed further in section 4.4.

At the start of each interview, the interviewer reiterated the information laid out in the consent form and obtained verbal consent before beginning the recording. During the interview, a semi-structured format was used where deviations were allowed if valuable information emerged, along with open-ended follow-up questions like “What do you mean by X?”. Interviews were capped at 30 minutes to prevent fatigue. At the end of each interview, an open-ended question such as “What else is important to know?” was asked, which often yielded crucial insights. Participants were given opportunities to ask questions before and after the interviews.

The interview questions varied slightly between trainees and instructors. Trainees were asked about their professional roles, experiences with mass casualty triage, previous training, and perspectives on the introduction of a national MCTS. Instructors were questioned about their responsibilities, experiences in teaching mass casualty triage, and suggestions for improving education. Not all questions were asked to every participant due to the nature of semi-structured interviews, which allowed for follow-up questions and natural flow into interesting topics within the 30-minute time constraint. The full list of original Swedish questions asked to trainees and instructors can be found in Appendices 10.1 and 10.2, respectively.

4.1.3. Material

Each interview took place using the video conference tool Zoom, with the interviewer and interviewee using the microphone and video camera to communicate. Recording was done using the screen capturing tool OBS (Open Broadcaster Software) into .mp4 files. The .mp4 files were then converted into .mp3 files to be inserted and automatically transcribed orthographically with Microsoft Word's built-in transcription tool. The transcriptions were individually reviewed and corrected for any mistakes to ensure they accurately represented what and how the interviewees answered the questions. The final transcriptions were then exported to the qualitative analysis tool NVivo for thematic analysis.

4.2. Analysis

This section details the procedures used to process and analyse the collected data. It includes the methods of data handling and the specific analysis techniques employed. Thematic Analysis (TA) and Training Needs Assessment (TNA) are subsections under this analysis.

The interview script was designed to gather data not only on participants' experiences but also on their perspectives for improving education. The questions were designed so the data gathering would be suitable for identifying educational needs and formulating relevant recommendations. All interview sessions were recorded and then automatically transcribed orthographically. Orthographic transcription means using the standard spelling conventions of the language. It is used where details about the pronunciation of words are not important. This method was chosen because it preserves the participants' wording while focusing on the content rather than the pronunciation, which is crucial for TA. The transcription process involved careful review of the automatic transcriptions, followed by listening back to the recordings to correct any mistakes and ensure accuracy. Each transcription was then re-read multiple times, with annotations made on interesting points to highlight significant data.

TA was employed as the primary method for analysing the qualitative data. It followed Braun and Clarke’s (2006) reflexive TA, which will be explained further in section 4.2.1. TNA was also conducted to identify specific educational needs and gaps. The principles and methods of TNA guided the interview script and the development of recommendations. This modified TNA process will be further discussed in section 4.2.2. The gathered data was compared with relevant literature in cognitive science and training research introduced in Chapter 2: Background and Chapter 3: Theory.

4.2.1. Thematic Analysis

Thematic analysis (TA) was used to systematically interpret the transcribed data collected from the interviews, following Braun and Clarke’s (2006) reflexive TA. The structured approach began with initial coding, where open coding was applied to the transcriptions to identify preliminary themes. This was followed by a review of these codes, which were then grouped and refined into broader themes that captured underlying patterns in the data. Reflexive TA acknowledges that the researcher’s personal perspective influences data interpretation, positioning the researcher as an active and integral part of the analysis. This approach also required the researcher to critically examine their role, choices, and actions throughout the analysis process. Braun and Clarke encourage the analyst to consider this by defining the type of reflexive TA by considering three pairs of counterparts. The analysis conducted in this study is described using these counterparts:

Inductive-Deductive: The TA was both deductive and inductive. It was deductive because the research questions guided the questions asked to the participants and what themes were deemed relevant. However, data was also sorted inductively into new codes based on the

meaning of the utterances. And the research questions were slightly altered as they evolved through the coding process. Thus, themes were generated both deductively in relation to the research questions and inductively from the content.

Semantic-Latent: The analysis was semantic, focusing on explicit statements without seeking underlying meanings.

Realist-Constructionist: The analysis used both the realist and the constructionist methods. Realist, as it reports the real experiences of participants in education. It was also constructionist, as it examines how these experiences are an effect of things such as learning and training needs, or insights from training research.

Following Braun and Clarke's (2006) reflexive thematic analysis, this project followed their six steps as outlined below:

1. **Familiarisation with the data**: Familiarisation with the data was done firstly by carefully reviewing the automatic transcriptions and secondly by listening back to the recordings to correct any mistakes made. Each transcription was then re-read, and annotations were made on interesting points with notes about why they were interesting data points.

2. **Generating initial codes**: Interesting parts of the transcriptions were marked and saved into many small codes. These were revised many times to group similar codes and negate irrelevant ones. Some codes were later fitted as sub-codes under larger overarching codes. Most utterances were coded into at least two codes, creating a lot of overlap. This was later revisited and revised, making fewer, bigger codes.

3. **Searching for themes**: Themes were identified by examining each code for overlaps and creating sub-codes. Many general themes were initially identified to represent the diverse selection of code groupings, creating many themes.

4. **Reviewing themes**: The large number of themes was found to be too specific; many were similar or could work as sub-themes. This step was repeated several times to ensure that the themes were valid to represent the data while still adhering to the research questions.

5. **Defining and refining themes**: All the themes were eventually reorganised under the first four research questions, which act as the main themes and were slightly altered to match with the data better. The larger quantity of smaller themes were grouped together where there was overlap and became sub-themes.

6. **Producing the report**: Representative and compelling extracts from each theme were chosen and translated into English, while ensuring that the original linguistic characteristics and semantics of the original text were kept.

These steps were being done iteratively, going back to earlier steps to revise the codes and themes to produce the most accurate representation while keeping the focus on the research questions.

4.2.2. Training Needs Assessment

Training Needs Assessment (TNA) is a crucial process for developing effective training programs by setting clear objectives for Knowledge, Skills, and Abilities. Brown (2002) defines TNA as an ongoing process of gathering data to determine the training needs that exist

so that training can be developed to help the organisation accomplish its objectives. This process involves examining the current status of learners and the goals of their education to identify and prioritise training needs.

In this study, the principles and methods of TNA guided the interview script and recommendations. Data for the TNA was gathered from the thematic analysis of interviews and relevant literature, helping to understand the tasks, required knowledge, and the training environment (Jonassen et al., 1999). Due to time constraints and limited data, this study did not conduct a comprehensive TNA as described by Brown (2002). Instead, the following modified steps were taken to identify training needs:

1. Data Collection: Thematic analysis of semi-structured interviews with stakeholders and review of relevant literature were conducted to gather qualitative data on current practices and educational needs.

2. Task Identification: Necessary tasks and skills were specified based on the collected data, such as sorting in normal casualty triage education.

3. Gap Analysis: Current skills and knowledge were compared with desired goals to identify gaps. For instance, differences in sorting in mass casualty triage were noted.

4. Solution Design: Methods to address the identified training needs were developed, including instructional activities and practical exercises. Recommendations were formulated by combining insights from thematic analysis with existing literature.

Although this approach did not include a detailed analysis of the training environment, a critical step noted by Brown (2002), it still provided valuable insights into the specific educational needs of emergency responders.

4.3. Ethical Considerations

This study adhered to the guidelines set forth by the Swedish Research Council's ethical principles for humanities and social sciences research (Vetenskapsrådet, 2002). The study adhered to the four main criteria: the information requirement, the consent requirement, the confidentiality requirement, and the utilisation requirement. Participants were fully informed about the study's purpose and procedures by being read the consent form (Appendix 10.3), which included details about the data collection and storage procedures. Voluntary participation was ensured through this form, which outlined the project's purpose, the stakeholders, the interview procedure, participants' rights under the ethical principles, voluntary participation, the option to skip questions or withdraw, and details about recording and transcription. Consent was obtained verbally before each interview. To meet the confidentiality requirement, all names and details that could lead to identifications were removed, and all data was stored locally on one hard drive. Finally, in line with the utilisation requirement, the data was used solely for research purposes.

5. Result From Thematic Analysis

From analysing the five transcriptions, 128 interesting and relevant utterances were found, which led to the creation of 36 codes to which the utterances refer. The utterances referring to a specific code will therefore be called references for the remainder of Chapter 5. These codes were revisited and consolidated to address significant overlaps, resulting in 11 themes. These themes were further grouped to answer the research questions, culminating in four main themes, with the initial 11 themes organised as sub-themes (Figure 1). The four main themes are (1) Effective MCTS educational concept, (2) Cognitive science and learning, (3) MCTS training needs, and (4) Different groups. These main themes represent the gathered responses regarding the participants' views of education for an MCTS in Sweden, the current difficulties with triage education, and how an MCTS should be educated in terms of effectiveness, cognitive science, training needs, and the different groups involved in the education. The sub-themes delve into deeper detail about the common opinions raised regarding each main theme. According to the sixth and final phase of Braun and Clarke's (2006) thematic analysis, extracts that vividly represent the themes will be presented along with a description of the theme and an argument for their relation to the research question. In Chapter 6, a comparison is made with relevant literature to produce recommendations for the educational concept of Sweden's national MCTS.

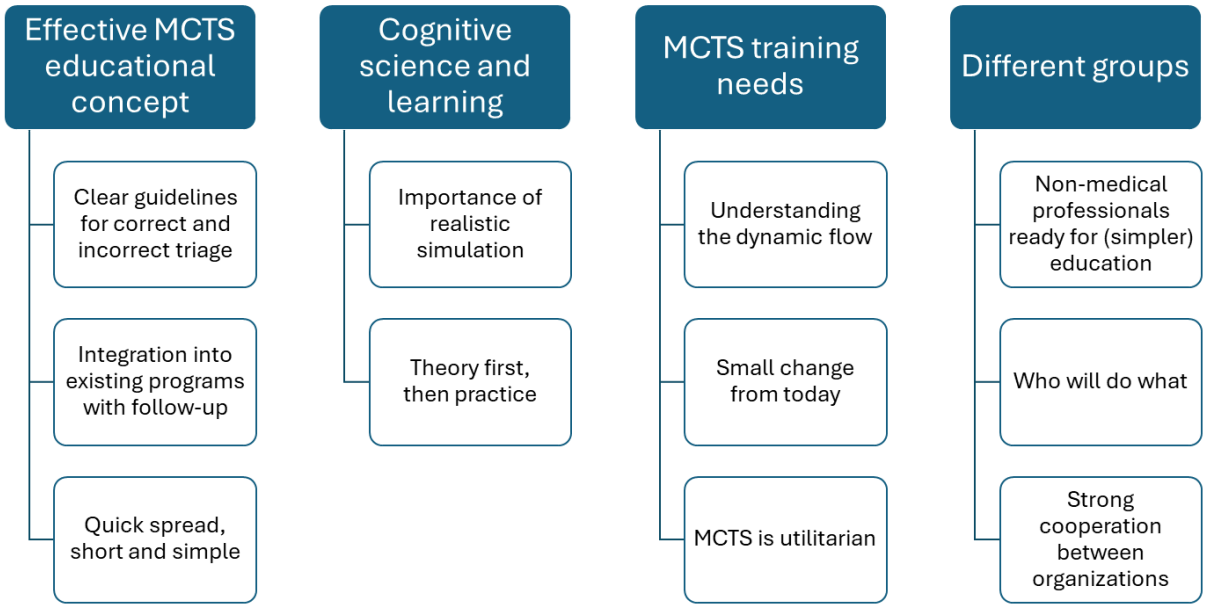

Figure 1. *Identified themes from the thematic analysis. Main themes corresponding to the first four research questions coloured in blue with their underlying sub-themes beneath.*

5.1. Effective MCTS Educational Concept

The main theme, *"Effective MCTS Educational Concept"* addresses the first research question: *"What constitutes an effective educational concept for pre-hospital mass casualty triage?"*. All five transcriptions referenced this theme, resulting in a total of 52 references. These utterances typically emerged when participants were asked how the educational concept could be made more effective or what they found ineffective in current triage education.

The first sub-theme, *"Clear Guidelines for Correct and Incorrect Triage"*, highlights a current problem in triage education: it is challenging to teach proper triage without clear distinctions between correct and incorrect actions.

The second sub-theme, *"Integration into Existing Programs with Follow-Up"*, combines two originally separate themes (integration and follow-up) due to significant overlap in their references. This sub-theme suggests that effective educational concepts should be integrated into existing training programs for blue light professionals rather than creating new, separate programs. This integration aims to save time and resources. Participants also emphasised the need for rigorous follow-up and feedback to ensure the education is effective.

The third and final sub-theme, *"Quick Spread, Short and Simple"*, includes extracts emphasising the importance of rapidly disseminating knowledge. Participants often mentioned that making education short and simple is crucial for achieving quick dissemination.

5.1.1. Clear Guidelines for Correct and Incorrect Triage

Every respondent expressed in some way (for a total of 18 references) that it is crucial that the teacher can have very clear guidelines to be able to show exactly what is the correct way to triage a patient regarding the circumstances.

I4: Yes but yes, but the big the problem with training in triage is that you assess patients differently. That it's hard as an instructor to say if you are right or wrong. Do you understand what I mean then that. How clear can one be when you evaluate an an intervention where you have triaged patients so the more clear it can become that this is a red, yellow, and green patient, the clearer one can be as an instructor also to say that 'this this is wrong, Victor, you have done wrong here. You should think in this way instead', that the it is a challenge we have as instructors.

This excerpt shows the need for an educational concept without ambiguities regarding the correct or incorrect way to triage. This would become an even greater need during a mass casualty situation when there are several different regions and groups of people who are triaging a large number of patients over a potentially large area.

5.1.2. Integration Into Existing Programs With Follow-Up

A common theme was that the most efficient way to integrate the MCTS was to integrate it into already existing training programs. This was covered in all five transcriptions for a total of 20 references. The blue light personnel already have several recurring training programs which the respondents seem to think work rather well. However, each training program takes up a lot of time and resources, and makes the whole educational process slower. Therefore, an important factor of introducing the education for MCTS was to integrate into already existing training programs rather than to introduce a new one.

I3: Then I think such a thing as triage, whichever triage model one uses that it should probably to a greater extent be integrated into other trainings then. It is indeed. The most important thing is not that we have an educational drive, like during something like a year, or some years, but that we actually keep at it afterwards and repeat and manage to

integrate. It should be our recurring exercises be recurring trainings too, building up some kind of management of this when we collect data what goes well and what does not go well and so on.

Interviewee 3 describes that the important factor for an effective education for the MCTS is not necessarily which triage model is being used, or that there is a big initial educational drive, but that it is integrated into existing programs, so that it can be maintained as a recurring educational program. Both the effectiveness of this sort of integration and the importance of maintenance with follow-up (or the fear of not having it) was mentioned several times on their own, but most often together as one.

I2: What I told myself not to forget to raise is just that thing with follow-up, so there I want to clarify like yes, I. I really wish that that one could set set the frameworks clearly and and be clear. [...] I have so many times experienced that one has had good intentions and thoughts about introducing new good things. Quite a lot of resources have been put on education, but then when there is never any follow-up and then looking from the outside at what happened with that then? Just yes, but they do a bit this way and they do a bit that way. No, but it's probably no one who follows that what we really wanted to accomplish so that's the part that I would so much like that that one that that one does not make the same mistakes.

Here, interviewee 4 raises concerns about the fear of a lack of follow-up with the education of MCTS, something that the person has experienced several times earlier with Sweden's medical educational concepts. Several others raised their concerns about the lack of follow-up together with their enthusiasm for a unified triage tool and educational concept. The positive aspects of a unified MCTS are great, but if there is no management or documentation which follows up how it is actually being educated and practised, then it risks having evolved into something different and no longer a unified practice by the time it would actually be needed to be used in a real life situation.

5.1.3. Quick Spread, Short and Simple

All participants, totaling 14 references, highlighted the need for the educational concept to achieve rapid dissemination. They noted that the key to this quick spread is making the education short and simple. Initially, this was divided into three separate themes (quick spread, short, and simple), but due to significant overlap, they were merged into a single sub-theme. This sub-theme is related to the previous one, as it also concerns the efficient integration of the educational concept in terms of time and resources, allowing a greater focus on follow-up and dissemination.

I3: I think that when we choose the implementation. How we are going to do it, I think that one needs to discuss the spread effect. We want a quick implementation so that is the message there and I don't know if you should have asked the question, but you were a bit into digital versus or theoretical versus practical and so on. Then one asks the question, should it be digital training or flipped classroom? Or however you choose

to do it? But I think indeed the different ways. One should have as an overarching goal. It is to succeed in spreading it quickly, which is also known to exist, but that one uses the train the trainer concept maybe with that. Yes, but maybe a strong central management centrally that really ensures that there is just information and educational material and follows up on it, follows up the efforts that are made nationally and really make sure to implement this now fully. As well as possible with the help of the responsible authorities.

Interviewee 3 explains further in the next excerpt that a reason for why a rapid spread with follow-up of a short and simple education is so important for education within mass casualty triage is because the actual triage component is a small (but important) training need in order to be adequately prepared for a real situation. This relates to the sub-theme *"Small change from today"*.

I3: Then a good triage training alone is not enough to handle a mass casualty incident. It requires much more competencies than just the knowledge to sort patients into colour categories. There also I think it's important that the training for the triage system is kept short and effective and very much - spot on - because if we think that training in a triage system increases the ability to handle a mass casualty incident for the individual working in the disaster area. Then I think we are a bit mistaken. However, I do believe that it is a prerequisite to be able to build on with other knowledge later so it is still very, very important but does not encompass everything.

Once again this goes hand in hand with the second sub-theme *"Integration into existing programs with follow-up"*, as there are many different training needs outside of a MCTS that are important to be able to be well prepared for a MCI. Therefore, a holistic education can be achieved by integrating it quickly with other training programs, and maintaining a high education standard with follow-up.

5.2. Cognitive Science and Learning

The second main theme *"Cognitive science and learning"* corresponds to the second research question *"How can insights from cognitive science and existing training research enhance learning outcomes in a national mass casualty triage educational program?"*. Since participants lacked a background in cognitive science, they were asked broader questions about cognitive load, emotional factors, stress, and the balance of theory and practice. This theme emerged in three transcriptions, with a total of 16 references. The utterances were divided into the sub-themes *"Importance of realistic simulations"* and *"Theory first, then practice"*.

The first sub-theme examines the significance of practising with realistic simulations. Participants mentioned various reasons for this, including the opportunity to test theoretical knowledge gained from digital lessons or lower-fidelity simulations. Realistic simulations were considered essential for learning and assessment, simulating cognitive effects like stress

and emotions that could arise during a mass casualty incident (MCI). They also capture the dynamic nature of real-life situations, which lower-fidelity simulations cannot fully replicate.

The second sub-theme *"Theory first, then practise"* was one of the less data dense sub-themes, but still an important theme for this project. Participants indicated that realistic simulations are more beneficial for experts than novices. They emphasised the necessity of teaching theory first, allowing learners to apply that knowledge in practical scenarios later. This sub-theme builds on the understanding that foundational theoretical knowledge is essential before engaging in practical, high-fidelity simulations.

5.2.1. Importance of Realistic Simulation

Three transcriptions referenced the importance of realistic simulation training for a total of 12 references. A realistic practice situation would allow the participants to practise their knowledge and reach mental states in a way they might not otherwise get the chance to.

I1: But it is one thing to talk about a situation and try to imagine working in those situations and then it is something completely different to stand in an environment that becomes realistic. They say that the brain can't distinguish between practice and reality and I believe that is correct if we can simulate an exercise that resembles reality. You can clearly see on the practitioners, I have indeed gone as an instructor on many of these exercises and you can clearly see when there are colleagues who are actors then the brain has no problem at all distinguishing this from from a live event. You don't go in, you don't work in the way you normally do. You don't get the stress load that actually comes with quite simple means.

Interviewee 1 emphasises the importance of realistic simulations in achieving mental states among trainees that are otherwise difficult to reach. They clarify that the actors involved in the simulation should not be colleagues of the participants, as this breaks immersion and diminishes the benefits of such training scenarios. Interviewees also highlighted an issue with ETS training, noting that it often fails to accurately reflect real-life situations. Realistic simulation is thus crucial for trainees to relate effectively to what ETS figures represent.

I5: I would like to have more practical than it is. Where I just think like this in the nurse role when you are (inaudible), you can learn as much as you want in theory, but you do. You have to do it practically for it to become proper so that you become skilled at it or for it to be really good. No but say in theory when we use the ETS and practice triage. I mean, it's like this, you have a paper figure in front of you where everyone has values and all parameters are there, you don't need to make a single assessment yourself really how a patient looks or you see no injuries and so, so everything is all that disappears and all the stress element disappears, which is good when you're supposed to like carry the basics. Absolutely, but we would like to get that down into like a realistic practical exercise. To also be able to like be so

when we are there to be able to be faster at it. So more practical.

This excerpt underscores the need for both low-fidelity and high-fidelity simulation training and suggests that more practical exercises are essential for skill development. Low-fidelity ETS training is beneficial for its ease of implementation and practice, as well as for teaching basic theory. However, its weakness lies in its inability to replicate the dynamic nature of triage or the stress of making immediate decisions. This limitation, however, can be advantageous for novices who need to master the fundamental theory of triage before progressing to more complex practical applications.

5.2.2. Theory First, Then Practise

This sub-theme was referenced a total of four times across three transcriptions. Although smaller, it is significant as it builds on the previous sub-theme by emphasising that education is not simply a matter of increased simulation practice leading to better outcomes. It is crucial to consider who is undergoing the training and at what stage in their education they are practising.

Interviewer: How do you think theory and practice should be balanced for the educational concept?

I2: Half, half approximately I think and preferably that one has prepared themselves in some way theoretically that everyone actually gets the same theory beforehand and should somehow have absorbed and begun to understand what they will then do on site and then I think max max max half theory, at least half practice.

This underscores the necessity of establishing a theoretical foundation before practical exercises can be effective for learning. Interviewee 2 emphasises that while practice is crucial, it should not overshadow theory. They suggest that an educational concept for MCTS should consist of at least 50% practice and no more than 50% theory. Without a solid theoretical foundation, trainees may lack clarity on what is expected during practice, and the feedback provided will not be aligned with an internal theoretical standard that would have been established during the theory sessions.

5.3. MCTS Training Needs

The main theme *"MCTS Training Needs"* corresponds to the third research question: *"What specific training needs do participants of the education have?"* This theme is a compilation of data from the transcriptions that highlight essential skills for effective mass casualty triage. All five transcriptions referenced this theme, resulting in a total of 31 references, which were further divided into three sub-themes.

The first sub-theme *"Understanding the Dynamic Flow"* addresses the complexity of triage beyond the simple act of colour sorting. The dynamic flow refers to the changing physiological status of patients and the fluctuating nature of available resources on-site. It also includes understanding the flow of transportation and subsequent actions post-pre-hospital triage. This training need focuses on identifying which critical patients should be transported first, to where, and why.

The second sub-theme *"Small Change from Today"* indicates that the transition from local, non-MCTS to a nationwide MCTS should not significantly alter current training needs. This perspective is based on the interviewees' belief that fundamentally, triage remains the same process and should not require extensive changes.

The third sub-theme *"MCTS is Utilitarian"* contrasts with the previous one by highlighting the significant differences in training needs between MCTS and small-scale triage situations. Current triage training emphasises individualised care, focusing on doing the best for each patient. However, MCTS requires a utilitarian approach, necessitating a shift in perspective and introducing new training requirements.

5.3.1. Understanding the Dynamic Flow

The most frequently cited example of an important training need for MCTS was understanding the dynamic flow of patients and the resources that come and go. This includes recognizing how choices made in the initial stages affect later stages of the response system. Four transcriptions referenced this sub-theme, resulting in a total of 18 references.

INTERVIEWER: Once you are on site, what do you think is the most important thing to have learned from this training, that is ingrained in you, so to speak, for efficient work?

I2: The different flows of time. That initially, the entire goal and purpose of triage is to find those who need help first, to identify those we call red. Those who really need care first. But then also to be able to adapt if there is a large group of seemingly unharmed who could disrupt my work in finding the reds, to also spend some time on these seemingly unharmed in some way to disperse and more easily find [the reds]. But clear goal-focus on the initial, on who really needs our help first. And then in a later stage or depending on how many resources come in then decide how to think about the others.

The most important part of triage is to identify and prioritise patients who need immediate care—the red category. However, this may not be the primary focus in education, as it is relatively straightforward. As Interviewee 2 describes, the most crucial learning objective for efficient on-site work might be understanding the dynamic flow of a mass casualty triage situation. Without comprehending how subsequent events might affect resource allocation and the status of yet unidentified patients, it becomes challenging to determine the appropriate time and care for each patient and the urgency of finding those in the red category or performing life-saving interventions.

I5: Just the tool, I think, well it's not that hard really. What becomes difficult then are the consequences after you have triaged and you need to decide who should go first, out of those you have triaged. Let's say we triage 10 red patients and then we have to start thinking about who out of these should we send first? It's not that they are all equally red. And that's always where discussions happen and where it gets difficult because we don't have very good tools for that. Except maybe some obvious things? So there, those always

become interesting discussions and that's where the knowledge varies greatly. And those answers can't really be given to 100 percent for everything, then you always have to say like this, 'it depends. It depends.' Yes, but do we have an incident where 60% are burn victims. How many? How many hospitals do we have that can take care of these types of patients and how widespread are the injuries and what other injuries do we have or so openly? Everything is always like this, it depends on where we are so what competence do we have on site and so on like that. Then I don't know. It's like the next step in triage. It's like how do we utilise triage? Well, now we have identified 10 reds, but then what? How do we know who is most important to send off, that is like perhaps the most challenging part.

"It's not that they are all equally red". This data point from Interviewee 5 highlights another crucial training need related to the dynamic flow of triage. The triage tool is contrasted with the difficulty of making on-site decisions; while the tool is relatively easy to understand, triage does not end with colour sorting. Decisions made on-site will impact the later stages of saving red-category patients, as there are a limited number of hospitals equipped to handle various types of injuries. Both excerpts emphasise that colour sorting is only a small part of the challenges in MCTS, which the educational concept must adequately address. Trainees must learn to consider these factors when triaging.

5.3.2. Small Change From Today

Three transcriptions referenced this sub-theme, resulting in a total of eight references. The utterances consistently describe the triage system in a mass casualty incident (MCI) as being similar to Sweden's current system, with opinions expressed that this continuity should be maintained. An overarching theme is that everyday triaging should not significantly differ from the rare occasions when the system is used in an MCI. Consequently, the training needs should not differ substantially either.

Interviewer: What experience do you have in being trained or in training others in triage, or perhaps even mass casualty triage?

I3: Well, first of all, I kind of take issue with the terms. I have a bit of a problem that I find it hard to grasp the difference between a triage system and a mass casualty triage system. Triage is triage, [...] It's about a method for sorting whether it's mass casualty or a smaller injury situation, the method should be quite similar anyway. [...] It's like the concept of crisis. You know, it's crisis all the time. But what the hell is a crisis really and what is triage? It's like inflation with different concepts.

Differentiating between mass casualty triage and "normal" triage is challenging. Interviewee 3 notes that both systems ultimately serve as tools for sorting patients by colour, and we should not overly differentiate the concepts. They also mention that the methods should not change

significantly. Introducing a clear distinction based on resource limitations or surge capacity could potentially address this issue.

Interviewer: How will the educational needs change when moving towards mass casualty triage?

I4: No, but actually, nothing will change regarding medical directional decisions and so forth.

Interviewee 4 gives another, medical, perspective on how there will be a small change in training needs. The medical decisions being made are based on the triage tool, and since the triage tool would not change significantly, so would not the directions of the medical decisions.

I1: I think I said earlier that a key factor if you want systems to work is that they must be applicable even in smaller situations. I don't believe in the setup that you triage 98% of incidents one way and then have a special system for these extremely rare incidents. Because the rare occasions will burden those who work so much either way, so to believe that you can also apply a a triage system in that incident which you are not accustomed to working with - I think that is very difficult. Instead, I believe in simplicity and that it should be applicable even in situations with multiple injuries, but which do not meet the criteria for a mass casualty situation.

Interviewee 1 provides a clear demonstration for maintaining consistency in systems and training needs. Given that a MCI is a rare event that significantly increases stress and workload, it would be unreasonable to expect responders not to revert to the triage methods they have used in past experiences. Consistency ensures that in high-pressure situations, responders can rely on familiar procedures, reducing confusion and improving effectiveness.

5.3.3. MCTS is Utilitarian

This sub-theme presents a stark contrast to the previous one, highlighting a dichotomy in training needs by arguing that MCTS is fundamentally utilitarian. Three transcriptions referenced this sub-theme, resulting in a total of five references. The utilitarian approach in training requires a shift from doing everything possible for each patient to focusing on the group level, quickly identifying those who need immediate assistance.

I1: We fall back a bit on the way we triage our patients in everyday situations when we just have one at a time, that’s where we have our greatest base of experience and that's what we rely on when making patient assessments. Then we make assessments on the same basis even when the injury outcome becomes larger. Unless we are specifically directed to go through the criteria according to the triage system we have today for the different colours and use it, because it is a blunter system and we are not used to working bluntly. We are used to having one patient and fine-tuning with them. So

that's where we have a knowledge gap today that needs to be filled.

Interviewee 1 explains how the utilitarian approach differs from their usual method of triaging patients, which focuses on providing detailed care to each individual. This individualised approach could act as a default method they revert to unless the education and triage tool enforce the utilitarian perspective early on.

I4: If you are at a larger incident and have a lot of injured people, you might have to lower the ambition level at the scene. Usually, we do everything for all patients and typically maintain a normal quality factor. Where we even perform advanced cardiac and pulmonary resuscitation on the patient when we have enough resources, but if there are a lot of patients, you might have to lower the ambition level, so that's mostly what we talk about and then you have to link that to a triage tool as well.

Previous themes have indicated that the triage tool is (and should be) the simplest aspect of triage. However, these excerpts and this theme demonstrate that while the triage tool is straightforward to follow, it might also represent the most significant shift in triage methodology during a mass casualty situation. Triaging according to a utilitarian approach differs greatly from standard triage practices, making it essential for this approach to be clearly reflected in the tool. Furthermore, the education must effectively teach users how to apply the triage tool within this new framework.

5.4. Different Groups

The fourth and final main theme, *"Different Groups"* corresponds to the fourth research question: *"How can various groups be effectively integrated into the educational program?"*. This question explores how not only nurses but also other blue light personnel, emergency responders, military, and trained laypersons could be taught to triage and participate in the education. All five transcriptions referenced this main theme, resulting in a total of 29 references, which were divided into three sub-themes.

The first sub-theme, *"Non-Medical Professionals Ready for (Simpler) Education"* highlights that other blue light personnel (and possibly military) are already educated and possess the necessary fundamentals for triage. It was suggested that they could participate in a simpler version of the triage education since they may not be as well-prepared for making life-saving interventions.

The second sub-theme, *"Who Will Do What"* addresses the confusion regarding the responsibilities of different groups in triage. Introducing non-medical personnel into the triage process raised questions about which groups would handle specific areas of responsibility.

The third sub-theme, *"Strong Cooperation Between Organizations"* presents solutions to the challenges of incorporating various groups into the education and triage process. The common idea was that the higher-ups designing the educational concept needed to involve other organisations in the planning and execution of the education to ensure effective cooperative training for all participants.

5.4.1. Non-Medical Professionals Ready for (Simpler) Education

When asked how different groups could participate in triage education, most respondents indicated that non-medical professionals are already sufficiently educated to perform triage. All five transcriptions referenced this sub-theme, totaling 11 references. A recurring idea, mentioned four times, was that non-medical professionals could be trained using a similar but simplified educational concept.

Interviewer: In your opinion, what are the fundamental training needs required for the different groups to perform triage?

I1: Yes, but some kind of training around... I know it's been a lot over the years, like first aid, some form of how to act at the scene of injury. That there's some kind of resource in the person doing the triage so that they can also address the potential life threats they encounter. Because I think that the fire service and police fundamentally have an adequate background to also step into some form of triaging, which is already happening today. They have (inaudible) a clear understanding of which patients are most critical and where care needs to initially focus its efforts, and that is rarely wrong. Then today, I think, I believe that they are today where we were 10 years ago in that there isn't any direct basis that they rely on but it becomes more of an arbitrary assessment by the common person on the scene. With that said, I think that they make pretty accurate assessments today, but... Just like we, or as I experienced when we got a triage system to rely on, it's an advantage that assessments become more standardised.

Generally, interviewees were positive about the idea of triaging alongside other blue light personnel during a MCI, a practice that already occurs, as noted by Interviewee 1. It was stated that these personnel possess the basic skills necessary to act correctly at incident sites, including understanding who needs help first and the ability to provide that help. The excerpt also mentions that any problems different groups might encounter during triage could be mitigated by using a standardised triage tool, which would enhance the accuracy and reliability of their assessments.

I4: We are thinking in different stages for professional healthcare providers, and then it could be in this system. One idea I have had is that we use educational material for ambulance personnel and possibly emergency department staff - because this is also something we have talked about, the first sorting - for the emergency department for spontaneous evacuation and so on, and a lighter training for the fire service, police, and the armed forces, I would say primarily.

Interviewee 4 suggests providing simpler educational material for non-medical professionals such as the fire department, police, and armed forces. This idea arises from the fact that much of MCTS requires advanced medical skills for making difficult assessments and life-saving

interventions, which typically fall outside the responsibilities of these groups. Discussions about having these groups perform life-saving interventions often led to confusion regarding the distribution of responsibilities. A simplified, tailored education based on skills, as determined by TNA, could improve dissemination efficiency and clarity.

5.4.2. Who Will do What

All five transcriptions referenced this sub-theme, resulting in a total of 12 references. When discussing educating different groups, confusion about who would perform various life-saving interventions was a common topic.

Interviewer: Do you think the same training can be given to all groups?

I5: And you look at whether you like narrow it down to ambulance and police and fire service. Then I think so. Because they have good healthcare training fundamentally or good enough. Then it depends on whether one should. Then you must have a triage system that is adapted for them as individuals, because they cannot start doing medical actions. If it is to be part of the triage system that one should. Well, they can stop bleeding, like those kinds of interventions. Obviously. They should do that. But they can't. I don't remember how it? SALT, if it includes needle decompression, for example that one should. [...] Ah, and then you start to get to this point, then it's extremely much about what opportunities there are to practise and train. Yes, the alternative might be to say that you would want a lighter version for say fire service and police and then there are other types of interventions for ambulance personnel. But. But overall, the police and fire service still have a foundation in healthcare. Like, they are not complete novices.

As Interviewee 5 points out, the difficulty in determining which interventions non-medical groups could perform is not only a problem of delegating responsibilities on-site but also creates a significant training need. If non-medical personnel are expected to perform advanced life-saving interventions like needle decompression, it would necessitate developing a whole new area of expertise, requiring considerable time and financial investment for such rare events. Instead, it would be more practical to provide these groups with a simpler educational concept tailored to their existing knowledge base, excluding advanced medical procedures.

5.4.3. Strong Cooperation Between Organisations

This sub-theme highlights the necessity of fostering strong collaboration between different groups involved in mass casualty triage systems (MCTS). Three transcriptions referenced this sub-theme for a total of six references, emphasising the importance of coordinated efforts and shared understanding among various stakeholders.

I2: I get the impression that now healthcare is doing this job and then, once that job is set, that's when I mean that it's important that the group setting the concept and foundation and holding the ideas doesn't wander off too quickly but

instead keeps close to their respective organisation to really involve them in the ongoing work moving forward.

In the first excerpt, Interviewee 2 emphasises the importance of maintaining a close connection between the group developing the concept and their respective organisations. This ensures continuous involvement and effective implementation of the educational concept.

I3: It's like one component in a larger package of knowledge that one needs to know. But for us to function as a system, we must have a common nomenclature where the education must provide for it. Because it's also important that the training not only targets ambulance personnel, since these are also the categories we report back in our system at both regional and national levels within certain proposals that exist. Which means, can we then be so clear with what we mean by these different colour categories? Yes, then we have at least taken some steps towards having better conditions to coordinate our different levels in the response system.

These excerpts illustrate two key reasons for strong cooperation and follow-up between the organisations of different groups. Firstly, it is crucial that all organisations are involved in the development and follow-up of the MCTS to maintain a shared nomenclature consistently applied over time. Secondly, Interviewee 3 underscores the importance of a unified understanding of the colour-coded categories at each stage of the triage process to streamline coordination across different groups and levels of the response system.

5.5. Summary of Results from Thematic Analysis

The thematic analysis of the interviews yielded 36 codes, which were consolidated into 11 themes and distilled into four main themes reflecting the research questions: *Effective MCTS Educational Concept, Cognitive Science and Learning, MCTS Training Needs,* and *Different Groups*. Each main theme represents critical insights and perspectives from the participants regarding the state and improvement of mass casualty triage education in Sweden.

The theme *Effective MCTS Educational Concept* encompasses participants' views on streamlining education. It underscores the importance of quick dissemination through short, focused training modules with clear guidelines to ensure fast and consistent education. Integration of training into existing educational programs with follow-up and assessment is emphasised as a key strategy for maintaining proficiency.

Cognitive Science and Learning focuses on the application of cognitive science principles to MCTS training. Discussions include the balance between theoretical knowledge and practical skills and the use of realistic simulations to mimic real-life scenarios, which are crucial for effective learning and performance under stress.

The theme *MCTS Training Needs* identifies specific training needs for MCTS. It includes recognizing minor changes from current practices, emphasising a utilitarian approach, and the need to understand the dynamic nature of MCIs and adapt training to reflect these conditions.

The theme *Different Groups* examines the varied needs of different groups of professional and non-professional responders involved in MCTS. It discusses the importance of tailored training approaches that consider the specific roles and responsibilities of each group, promoting better cooperation and coordination during mass casualty incidents.

6. Recommendations Based on Literature and Needs Analysis

Aimed at addressing research question 5, *"What recommendations can be derived for the education of Sweden's MCTS based on the findings from the previous research questions?"*, this project has formalised recommendations for the educational concept. These are based on the needs analysis and further supported by scientific research and theories on education. This formalisation does not present a detailed concept or a final training template but rather provides an initial framework to guide the development or creation of training for MCTS in Sweden.

6.1. Clear Guidelines for Correct and Incorrect Triage

The thematic analysis reveals the critical importance of having explicit guidelines to enhance the accuracy and consistency of triage decisions during MCIs. Well-defined guidelines support instructors in providing precise feedback and ensuring the uniform application of triage procedures across different regions and training groups. This consistency is crucial for streamlining the educational process and adhering to the best practices identified in the relevant literature.

Identified Training Need:

The analysis within this thesis highlights a significant gap in current triage training—the lack of clear, actionable guidelines that instructors can use to effectively assess triage accuracy. The absence of these guidelines leads to variability in triage decisions, which can result in inconsistent care during actual MCIs. Clear guidelines are essential to help instructors accurately convey to trainees what they did right or wrong, enhancing the overall learning process.

Comparison With Literature:

The literature consistently underscores the need for clear and actionable guidelines in triage training. Moscicki et al. (2022) advocate for the development of a national mass casualty triage system with well-defined guidelines and educational materials, emphasising the necessity of establishing golden standards and refining triage algorithms, particularly for paediatric patients.

Cognitive Load Management theories highlight the importance of breaking down complex tasks into smaller, manageable components and using repetition to build automaticity in critical life-saving procedures (Jonson et al., 2024). This approach aligns with the study's emphasis on clear guidelines and streamlined training modules, ensuring that responders can quickly and effectively integrate new knowledge and skills into their practice. Efficient training programs should introduce learning objectives from the start, involve hands-on demonstrations, and provide practice with feedback during and after exercises (Bisbey et al., 2021).

Behavioral Modeling techniques, as discussed by Grossman and Salas (2011), involve using positive and negative examples to teach proper triage techniques, coupled with opportunities for practice and feedback from instructors. Additionally, Homeland Security (2020) recommends that objectives should be Specific, Measurable, Achievable, Relevant, and Time-bound (SMART), reinforcing the need for clear and structured training guidelines.

Recommendation:

Develop and implement clear, standardised guidelines for triage training to ensure consistent and accurate triage decisions during MCIs, making it easier for instructors to provide specific, actionable feedback to trainees.

6.2. Integration Into Existing Programs With Follow-Up

Integrating the MCTS training into existing educational frameworks is highlighted as a strategic approach to maximise training efficiency and resource utilisation. The thesis underscores the importance of embedding MCTS training seamlessly into current programs, supported by rigorous follow-ups to ensure the sustainability of high training standards. This approach aligns well with established practices, promoting continuity and reducing inefficiencies in professional development.

Identified Training Need:

The need for integration is driven by the aim to streamline the educational process, making use of existing resources and infrastructure. This strategy minimises disruptions and leverages the established familiarity and routines of existing programs, thereby enhancing the overall learning experience.

Comparison With Literature:

The identified training need for integrating MCTS training into existing educational programs with follow-up activities is well-supported by various literature sources. Moscicki et al. (2022) emphasise the importance of embedding the triage system into everyday practice to ensure responders' familiarity and reduce errors during actual events. This aligns with the thesis's recommendation for seamless integration into current programs.

Grossman and Salas (2011) advocate for continuous feedback mechanisms post-training to reinforce learning and application in real scenarios. Similarly, Homeland Security (2022) highlights the need for collecting data during exercises to identify strengths and areas for improvement, advocating for continuous improvement and follow-up activities such as after-action reviews (AARs) to institutionalise learning.

The organisational learning framework by Crossan et al. (1999) supports this by recommending the institutionalisation of learned practices through continuous education and routine practice. They suggest systems and structures that ensure ongoing learning and adherence to best practices, which aligns with the need for follow-up activities to sustain high training standards.

The Train-the-Trainer model, as highlighted by Berggren et al. (2023), aligns with this need by advocating for standardised curricula, practical simulations, and regular follow-up sessions to maintain training quality. This approach ensures that trainers can effectively transfer knowledge and skills within the organisation, supporting the integration and sustainability of MCTS training.

Hermelin et al. (2020) recommend continuous learning and evaluation through regular AARs and feedback loops to help participants understand the impact of their decisions. Aguinis & Kraiger (2009) further support this by recommending a robust evaluation framework, such as the Kirkpatrick four-level model, to evaluate training effectiveness and identify areas for improvement.

Overall, the literature strongly supports the integration of MCTS training into existing educational programs with rigorous follow-up activities to ensure the sustainability and effectiveness of the training.

Recommendation:

Integrate MCTS training into existing educational programs such as ETS, PS, and PDV and establish a continuous feedback and evaluation mechanism to sustain high training standards and ensure long-term effectiveness.

6.3. Quick Spread, Short and Simple

The analysis emphasises the importance of quick, simple, and efficient training methodologies for the MCTS. Both the thesis and the literature underscore that concise and straightforward training enhances rapid knowledge dissemination and effective implementation, which is essential for the practical application of MCTS during emergencies.

Identified Training Need:

The necessity for MCTS training to be brief and uncomplicated is clear, facilitating its swift integration into existing emergency response practices. This approach ensures that the key concepts of MCTS are rapidly disseminated and easily retained, which is crucial in high-stress environments where quick decision-making is vital.

Comparison With Literature:

The literature strongly supports the identified training need for MCTS to employ brief and uncomplicated training methodologies. Moscicki et al. (2022) emphasise the importance of training triage officers, noting that the Train-the-Trainer model is effective for rapid and consistent knowledge dissemination across large organisations. Berggren et al. (2023) further corroborate the efficacy of the ToT model in emergency response training, highlighting its ability to ensure standardised, high-quality training that is easily scalable and updatable. The cascading effect of the ToT model allows for quick dissemination of the MCTS educational concept while fostering a network of knowledgeable trainers within the organisation.

Moreover, Berggren et al. (2023) stresses the importance of maintaining training quality to prevent degradation of information accuracy, suggesting a standardised curriculum, practical simulations and role-plays, a robust feedback mechanism, and regular follow-up sessions to reinforce learning. This comprehensive approach ensures that trainers develop both subject matter expertise and pedagogical skills necessary for effective knowledge transfer.

Jonson et al. (2024) also highlight the success of short, intensive training sessions. Their research underscores that such focused and concise training modules can effectively educate large groups in a short time span, as demonstrated in emergency training sessions in Ukraine. The success of the ToT model in this context, where a few trained instructors educated a large number of end-users, showcases the model's potential for rapidly expanding the reach of training programs.

Recommendation:

Implement a Train-the-Trainer model with a standardised curriculum and practical simulations to ensure quick, consistent, and high-quality dissemination of MCTS training across emergency response teams.

6.4. Importance of Realistic Simulation

The importance of realistic simulations in MCTS training is extensively highlighted in both the thesis and relevant literature. These simulations are pivotal in preparing trainees for the intense stress and critical decision-making required during MCIs. High-fidelity simulations, in particular, allow trainees to experience and adapt to the dynamic pressures of MCIs, crucial for building resilience and practical skills.

Identified Training Need:

Realistic simulations provide a controlled environment where trainees can experience the complexities and stress of MCIs without the risks associated with real events. These simulations are essential for understanding the utilitarian dynamics of triage and ensuring that responders can effectively manage their decision-making processes under pressure.

Comparison With Literature:

The literature consistently underscores the significance of realistic simulations in MCTS training, aligning well with the identified training need for such simulations. Rybing (2018) highlights the necessity of high-fidelity simulations in preparing individuals for high-stakes, pressure-filled decision-making scenarios, effectively mirroring real-life conditions. Similarly, Grossman & Salas (2011) emphasise the importance of scenario-based training that closely replicates real-world complexities, ensuring effective skill transfer.

Homeland Security (2020) advocates for the use of challenging and realistic scenarios to simulate MCIs, including various stress-inducing conditions such as limited resources and communication breakdowns. This approach is crucial for preparing responders to handle real-world challenges efficiently.

Jonson et al. (2024) stress the importance of scenario-based and practical training that incorporates realistic simulations to enhance cognitive retention and decision-making under stress. They also emphasise investing in realistic training equipment to better prepare trainees for actual battlefield conditions.

Rudolph et al. (2007) elaborate on the multi-dimensional nature of simulation fidelity, encompassing physical, conceptual, and emotional aspects. They argue that effective simulations should trigger physiological and emotional responses, allowing participants to engage deeply and realistically with the scenarios. This multi-faceted approach helps in developing procedural, clinical reasoning, and emotional management skills.

Salas (1998) introduces the concept of Stress-Exposure Training (SET), which prepares trainees to handle high-stress environments through a structured approach involving realistic information about stressors, training specific skills to manage stress, and applying these skills in progressively stressful conditions. This method is crucial for building resilience and effective decision-making under pressure.

Hermelin et al. (2020) emphasise the importance of emotional fidelity in simulations, which helps trainees engage deeply and behave as they would in real situations. They advocate for using well-scripted scenarios with varying levels of complexity to build resilience and practical skills, ensuring that training effectively prepares individuals for the dynamic pressures of MCIs.

Recommendation:

To enhance the effectiveness of MCTS training, it is recommended to integrate high-fidelity simulations that encompass physical, conceptual, and emotional realism, progressively increasing in complexity to build resilience and ensure practical skill transfer.

6.5. Theory First, Then Practise

The necessity of thorough theoretical training followed by progressively complex practical exercises is a recurring theme in MCTS education. This approach ensures that trainees grasp essential triage concepts and principles before applying them in increasingly challenging simulations. Such a structured training sequence is crucial for developing effective decision-making and performance in high-stress mass casualty incidents.

Identified Training Need:

It is vital that trainees receive comprehensive theoretical training before engaging in practical exercises. This ensures that they fully understand triage concepts and principles, which are critical for effective decision-making and performance in practical settings.

Comparison With Literature:

The literature consistently supports the identified training need that trainees receive comprehensive theoretical training before engaging in practical exercises. Grossman and Salas (2011) emphasise the importance of presenting learning objectives and theoretical foundations early in training to build a scaffold for future skill application. They advocate for simulating mass casualty scenarios using both low-fidelity (e.g., role-playing) and high-fidelity (e.g., full-scale simulations) approaches to familiarise trainees with their operating environments.

Homeland Security (2022) recommends a progressive exercise approach, starting with simpler exercises and gradually increasing complexity. This incremental approach ensures that participants build their skills step-by-step, preparing them adequately for more challenging scenarios. Similarly, Aguinis and Kraiger (2009) highlight the benefits of blending different training methods. Combining classroom instruction with hands-on simulations and technology-based training caters to various learning styles and reinforces learning through multiple channels.

Maran and Glavin (2003) further emphasise that a solid theoretical foundation is essential before engaging in practical simulations for MCTS. They stress the importance of identifying skills and procedures and developing training objectives prior to practical training. This ensures a clear understanding of theoretical concepts. The authors highlight deliberate practice and feedback, noting that new skills should be correctly demonstrated first, allowing time for rehearsal to manage cognitive load effectively. They argue that simulation acts as a bridge, allowing interactive and immersive activities in a risk-free environment, ensuring that theoretical knowledge translates effectively into practice. Continuous reflection-in-action and reflection-on-action are deemed crucial for reinforcing theoretical knowledge and improving practical skills, thus optimising learning outcomes and enhancing the ability to manage complex, high-stress situations.

Recommendation:

Implement a structured training program that prioritises comprehensive theoretical instruction followed by progressive practical exercises to ensure trainees develop a deep understanding of mass casualty triage concepts and can effectively apply them in real-world scenarios.

6.6. Understanding the Dynamic Flow

The thesis identifies understanding the dynamic flow of patients and resources during MCIs as a critical training need. It recommends enhancing educational materials with digital videos to illustrate how decisions affect the overall emergency response, emphasising the importance of dynamic situational awareness in disaster management.

Identified Training Need: The ability to manage and understand the dynamic flow of resources and patient care during MCIs is crucial. Training needs to equip responders with the skills to assess how their decisions will influence the outcome of the incident and adapt their strategies in real-time.

Comparison With Literature:

The literature consistently underscores the critical importance of dynamic situational awareness and adaptability in managing MCIs. Frykberg (2005) emphasises the necessity of incorporating training scenarios that mirror the unpredictable and fluid nature of MCIs, enabling responders to navigate complex situations effectively. Similarly, Moscicki et al. (2022) advocate for disaster triage protocols that are dynamic and responsive to patient surges and resource availability, highlighting the need for training that fosters adaptability in real-time.

Comfort et al. (2010) elaborate on the importance of early decisions and resource allocation, stressing that these initial actions significantly impact the overall efficiency of disaster response. They suggest that training programs should incorporate scenario-based modules simulating various disaster conditions, focusing on real-time information sharing, multi-agency coordination, and continuous reassessment. This approach aligns well with the identified training need by emphasising the development of skills to manage and understand the dynamic flow of resources and patient care during MCIs.

Woods (2015) highlights the necessity of pre-existing capabilities for managing dynamic flows during MCIs, suggesting that scenario-based exercises are crucial for practising decision-making and understanding the interconnected effects of actions. He also points to the importance of incorporating lessons from past events into training to improve preparedness. Woods' focus on graceful extensibility and dynamic situational awareness reinforces the need for training that equips responders to adapt their strategies in real-time, thereby enhancing the effectiveness of emergency response.

Recommendation:

Develop training programs that incorporate scenario-based modules simulating real disaster conditions, emphasising real-time information sharing, multi-agency coordination, and continuous reassessment to enhance dynamic situational awareness and adaptability in managing MCIs.

6.7. Small Change From Today

The thesis underscores the importance of aligning MCTS training closely with existing triage protocols to facilitate ease of adoption and minimise confusion during actual MCIs. This approach leverages the familiarity of responders with current practices, enhancing their ability to adapt quickly under stress.

Identified Training Need:

It is essential that MCTS training does not deviate significantly from standard triage training. This ensures that responders are comfortable and confident with the triage processes they already understand, which is crucial during the high-pressure scenarios of MCIs.

Comparison With Literature:

The literature underscores the necessity of aligning MCTS training with established triage protocols to enhance ease of adoption and minimise confusion during MCIs. Moscicki et al. (2022) emphasise the importance of a unified national mass casualty triage system that is simple, adaptable to local contexts, and easy to use without relying on complex procedures or technical equipment. This approach ensures quick understanding and application, even under high-stress conditions.

Similarly, Hermelin et al. (2020) stress the need for training that incorporates new concepts within the framework of familiar practices, reducing the cognitive load on responders during high-stress situations. Their study highlights the importance of developing cognitive skills through mental models, which rely on familiar causal beliefs and are crucial for effective crisis management. By aligning training with existing triage protocols, responders can build on their existing mental models, enhancing their ability to adapt quickly and confidently under pressure.

Both studies support the identified training need that MCTS training should not deviate significantly from standard triage training. This continuity in training ensures that responders are comfortable and confident with the triage processes they already understand, which is essential during the high-pressure scenarios of MCIs.

Recommendation:

Maintain and enhance MCTS training by closely aligning it with existing standard triage protocols to ensure familiarity and ease of use during MCIs.

6.8. Mcts is Utilitarian

The thesis highlights the utilitarian nature of the MCTS, which marks a significant paradigm shift from traditional triage methods. MCTS prioritises maximising overall survival over extensive individual care, aligning with the essential principles of disaster management where resource allocation focuses on saving the most lives possible.

Identified Training Need:

It is crucial for responders to understand the utilitarian approach of MCTS, where the emphasis is on making quick decisions that benefit the greatest number of people rather than providing the most comprehensive care to each individual. This shift requires a clear explanation and integration into both the triage tools and educational modules to ensure that responders can adapt their decision-making processes appropriately during MCIs.

Comparison With Literature:

The concept of utilitarianism in mass casualty management, as embodied by the MCTS, is well-supported by disaster management principles across various studies. Frykberg (2005) emphasises that in crisis situations, ethical and practical decision-making must prioritise the overall welfare of the population, necessitating tough choices about resource allocation. This is fundamental to ensuring the effective use of limited resources in emergencies.

Comfort et al. (2010) highlight the importance of core information in disaster response, demonstrating through agent-based simulations that timely and accurate information enables informed, efficient decision-making. This supports the MCTS's focus on benefiting the greatest number of people by prioritising quick, informed decisions that maximise overall survival over extensive individual care.

The Homeland Security Exercise and Evaluation Program (HSEEP) underscores the importance of critical tasks in evaluating capabilities (Homeland Security, 2020). HSEEP advises that exercises should assess performance against specific capability-based objectives and identify essential tasks for achieving these goals. This aligns with the MCTS principle of making rapid decisions to benefit the most people. HSEEP further recommends incorporating subject matter experts and realistic scenarios into training to help responders effectively simulate and adapt to conditions requiring rapid, life-saving decisions.

These perspectives align with the identified training need, which calls for responders to understand the utilitarian approach of MCTS. Training programs must integrate this approach into triage tools and educational modules to ensure that responders can adapt their decision-making processes appropriately during mass casualty incidents.

Recommendation:

Integrate realistic, scenario-based training modules that emphasise the utilitarian approach of MCTS, focusing on quick, informed decision-making to maximise overall survival during mass casualty incidents.

6.9. Non-Medical Professionals Ready for Simpler Education

The thesis underscores the need for a simplified educational concept for non-medical professionals like firefighters and police officers, who play crucial roles during MCIs. These responders possess basic training suitable for MCTS but require streamlined educational modules tailored to their specific responsibilities in emergency situations.

Identified Training Need:

Non-medical professionals should receive MCTS training that is adapted to their roles, focusing on essential triage principles without delving into complex medical details unnecessary for their duties. This approach ensures that they are effectively prepared to support medical teams during MCIs, enhancing the overall response capability.

Comparison With Literature:

The necessity for simplified, role-specific training for non-medical professionals, such as firefighters and police officers, is well-supported by the literature. Moscicki et al. (2022) emphasise the importance of streamlined educational modules focused on essential triage principles, avoiding complex medical details to enhance response efficiency. Jonson et al. (2024) highlight the need for clear and concise training to ensure that non-medical responders

can perform critical tasks without being overwhelmed by advanced medical procedures. Crossan et al. (1999) also underscore the importance of targeting training to the specific responsibilities of non-medical professionals, ensuring they are effectively prepared to support medical teams during MCIs.

Homeland Security (2020) supports the idea of role-specific training, emphasising that training modules should be accessible and applicable to the responsibilities of non-medical professionals. Comfort et al. (2010) add that effective information networks are crucial for disaster response, suggesting that training should include the understanding and utilisation of these networks to facilitate rapid information sharing. Huffman et al. (2016) further reinforce the need for training tailored to the learners' needs and expertise, ensuring that non-medical responders are well-prepared to enhance overall response capability during MCIs.

Recommendation:

Develop streamlined MCTS training for non-medical professionals that focuses on essential triage principles and the effective use of information networks, ensuring the training is accessible, role-specific, and avoids unnecessary medical complexities.

6.10. Who Will do What

The thesis highlights the necessity of clear delegation of responsibilities among different responder groups to enhance the effectiveness of the MCTS. It underscores the importance of ensuring that all educational programs adequately clarify the roles and necessary cooperation among these groups to streamline operations and improve service delivery during MCIs.

Identified Training Need:

The need for explicit delineation of roles and responsibilities among responder groups is essential to prevent service overlap and ensure coordinated efforts during MCIs. This clarity facilitates better collaboration and efficiency in emergency situations.

Comparison With Literature:

The necessity for clear delegation of responsibilities among responder groups in MCTS is well-supported by existing literature. Moscicki et al. (2022) emphasise that training programs should be tailored to the specific roles of different blue light personnel, such as paramedics, firefighters, and police, to ensure seamless coordination and effective use of resources during emergencies. This involves cross-disciplinary role-specific training to foster collaboration and ensure all personnel understand their responsibilities within the triage process, which helps mitigate confusion and enhance response efficiency.

The organisational learning framework presented by Crossan et al. (1999) supports this need by highlighting that effective training should facilitate learning at individual, group, and organisational levels. This means that training should build individual competencies, incorporate collaborative exercises to mimic real-life scenarios, and institutionalise learned practices through organisational drills and simulations.

Homeland Security (2020) underscores the importance of clear role delineation to enhance coordination and efficiency during MCIs. The HSEEP outlines the necessity of defining roles explicitly and engaging all relevant stakeholders in the planning process to ensure cooperation and clear role understanding in both training and actual response operations.

Comfort et al. (2010) also emphasise the critical need for core information and efficient coordination among disaster response organisations. Their research indicates that clear delegation of responsibilities and access to critical incident information significantly improve the efficiency of mass casualty triage systems. Agent-based simulations revealed that coordination and communication problems can be mitigated through explicit role delineation in training programs.

Aguinis and Kraiger (2009) highlight the importance of incorporating interpersonal skills and structured teamwork into training programs. They stress that enhancing communication, planning, and task coordination within teams is essential for ensuring that responder roles are clearly defined, preventing service overlap, and promoting coordinated efforts during MCIs.

Salas and Cannon-Bowers (2001) discuss the importance of team training strategies such as cross-training, team coordination training, and team self-correction. These strategies align with the need for clear role delineation by improving teamwork, ensuring that all team members understand their specific roles, and fostering necessary cooperation. This approach changes attitudes towards teamwork, imparts relevant competencies, and leads to streamlined operations and improved service delivery in emergency situations.

Recommendation:

Develop comprehensive training programs that emphasise clear role delineation and foster collaboration among different responder groups to enhance coordination and efficiency during mass casualty incidents.

6.11. Strong Cooperation Between Organisations

The thesis underscores the critical importance of strong cooperation among various levels of the response system to ensure a unified approach and shared nomenclature in MCTS operations. This unified approach is essential for maintaining consistency across different organisations during MCIs.

Identified Training Need:

Effective MCTS operations require robust inter-organisational cooperation. This involves consistent training across different entities and the use of common nomenclature to ensure all parties are on the same page during emergency operations.

Comparison With Literature:

The identified training need for effective MCTS operations requiring robust inter-organisational cooperation is well-supported by existing literature. Woods (2015) underscores the importance of effective communication and shared training protocols, highlighting that these elements are crucial for a successful response during MCIs. Similarly, Crossan et al. (1999) emphasise the need for integrating and institutionalising practices across different organisational levels to ensure coherent and unified actions.

Comfort et al. (2010) provide further support, noting that disaster response efficiency improves significantly with strong inter-jurisdictional cooperation. They highlight the critical role of identifying key nodes for information exchange, which facilitates streamlined communication and coordination among multiple jurisdictions. This aligns with the thesis's emphasis on the importance of a unified approach and shared nomenclature in MCTS operations.

Moreover, Homeland Security (2020) recommends prioritising effective coordination and communication among responders, suggesting that training should include scenarios that test communication protocols and the ability to coordinate across multiple agencies and jurisdictions. This recommendation reinforces the need for consistent training and common terminology to ensure all parties are aligned during emergency operations.

Overall, the literature converges on the necessity of strong cooperation and consistent training across different entities to enhance the efficiency and effectiveness of disaster response operations. The unified approach and shared nomenclature are consistently highlighted as critical factors for maintaining consistency and improving organisational performance during MCIs.

Recommendation:

Develop a comprehensive training program that emphasises inter-organisational cooperation, consistent use of common terminology, and scenario-based exercises to enhance coordination and communication across multiple agencies during emergency operations.

6.12. Summary of Recommendations

In summary, the results from the thematic analysis, training needs analysis, and literature review all coincided to create these 11 recommendations for the implementation of the educational concept of Sweden's new national pre-hospital mass casualty triage system. These 11 recommendations correspond to the 11 themes derived from the thematic analysis, which were developed to answer the research questions. These recommendations aim to ensure consistency, improve training effectiveness, and foster collaboration among all responders involved in mass casualty incidents. The recommendations are as follows:

1. **Clear Guidelines for Correct and Incorrect Triage**: Establish explicit guidelines to enhance the accuracy and consistency of triage decisions during mass casualty incidents (MCIs), ensuring that instructors can provide precise feedback. This aligns with literature emphasising the need for clear, actionable guidelines to reduce variability in triage decisions and improve consistency (Grossman & Salas, 2011; Homeland Security, 2020; Jonson et al., 2024; Moscicki et al., 2022).

2. **Integrate MCTS Training into Existing Programs**: Seamlessly incorporate MCTS training into current educational frameworks, supported by continuous follow-up to maintain high training standards and promote continuity. This recommendation is supported by literature that highlights the importance of embedding training into existing structures and ensuring continuous improvement through feedback mechanisms (Berggren et al., 2023; Grossman & Salas, 2011; Homeland Security, 2022; Moscicki et al., 2022).

3. **Implement a Train-the-Trainer Model for Fast Dissemination**: Implement brief and uncomplicated training methodologies, such as the Train-the-Trainer model, to facilitate rapid knowledge dissemination and effective implementation. The literature supports the need for concise and straightforward training to enhance rapid knowledge transfer and retention in high-stress environments (Berggren et al., 2023; Jonson et al., 2024; Moscicki et al., 2022).

4. **Enhance Training with High-Fidelity Simulations**: Integrate high-fidelity simulations into training to provide practical, hands-on experience and prepare responders for real-life scenarios, building resilience and practical skills. This

recommendation is extensively supported by literature emphasising the critical role of realistic simulations in preparing responders for the complexities of MCIs (Grossman & Salas, 2011; Homeland Security, 2020; Jonson et al., 2024; Rybing, 2018).

5. **Teach Theory First, Then Practise**: Implement a structured training programme that prioritises comprehensive theoretical instruction followed by progressive practical exercises to ensure a deep understanding of mass casualty triage concepts. Literature consistently supports the need for a strong theoretical foundation before engaging in practical simulations (Aguinis & Kraiger, 2009; Grossman & Salas, 2011; Homeland Security, 2022; Maran & Glavin, 2003).

6. **Scenario-Based Training Modules**: Develop training programmes that incorporate scenario-based modules simulating real disaster conditions, emphasising real-time information sharing, multi-agency coordination, and continuous reassessment. Literature highlights the importance of dynamic situational awareness and adaptability in managing MCIs (Comfort et al., 2010; Frykberg, 2005; Moscicki et al., 2022; Woods, 2015).

7. **Align MCTS Training with Existing Protocols**: Ensure that MCTS training is closely aligned with existing triage protocols to facilitate ease of adoption and minimise confusion, leveraging the familiarity of responders with current practices. Literature underscores the necessity of aligning new training with established protocols to reduce cognitive load and enhance effectiveness (Hermelin et al., 2020; Moscicki et al., 2022).

8. **Utilitarian Approach in Scenario-Based Training**: Integrate realistic, scenario-based training modules that emphasise the utilitarian approach of MCTS, focusing on quick, informed decision-making to maximise overall survival during mass casualty incidents. Literature supports the utilitarian approach, prioritising overall survival and efficient resource allocation (Comfort et al., 2010; Frykberg, 2005; Homeland Security, 2020).

9. **Streamlined Training for Non-Medical Professionals**: Develop streamlined MCTS training for non-medical professionals that focuses on essential triage principles and the effective use of information networks, ensuring the training is accessible and role-specific. The literature supports the need for simplified, role-specific training for non-medical responders to enhance their effectiveness (Crossan et al., 1999; Homeland Security, 2020; Jonson et al., 2024; Moscicki et al., 2022).

10. **Emphasise Role Delineation and Collaboration**: Develop comprehensive training programmes that emphasise clear role delineation and foster collaboration among different responder groups to enhance coordination and efficiency during mass casualty incidents. Literature emphasises the importance of clear role delineation and effective teamwork in disaster response (Aguinis & Kraiger, 2009; Comfort et al., 2010; Crossan et al., 1999; Homeland Security, 2020; Moscicki et al., 2022).

11. **Promote Inter-Organisational Cooperation**: Emphasise inter-organisational cooperation, consistent use of common terminology, and scenario-based exercises to enhance coordination and communication across multiple agencies during emergency operations. Literature highlights the need for strong inter-organisational cooperation and consistent training protocols to ensure effective disaster response (Comfort et al., 2010; Crossan et al., 1999; Homeland Security, 2020; Woods, 2015).

7. Discussion

This section will discuss the results of the study in relation to the research questions, the methodology used, and the limitations encountered during the research process.

7.1. Results Discussion

The purpose of this study was to develop recommendations for the educational concept of Sweden's National Pre-Hospital Mass Casualty Triage System (MCTS) by integrating insights from cognitive science and conducting a thematic analysis based on semi-structured interviews. The study aimed to address several research questions regarding the effective educational concept, the enhancement of learning outcomes through cognitive science, the specific training needs of participants, and the integration of various groups into the educational program. This section discusses the results in detail, analysing how the research questions were addressed, and highlighting both theoretical and practical contributions.

7.1.1. Research Question 1

In addressing the first research question about what constitutes an effective educational concept for pre-hospital mass casualty triage, the study identified several key elements through thematic analysis of interviews with relevant stakeholders. Three main sub-themes emerged. Firstly, clear guidelines for correct and incorrect triage were deemed essential. Participants emphasised the importance of having unambiguous guidelines to differentiate correct from incorrect triage actions during education. This clarity is crucial for instructors to provide accurate feedback and for trainees to understand the criteria for decision-making in mass casualty situations, which aligns with Moscicki et al. (2022) who found that clear guidelines and standardised protocols are necessary for effective triage during MCIs. The results further indicate that an effective educational concept should include these clear guidelines for triage, integrated into existing programmes with continuous follow-up, and be rapidly disseminated, concise, and straightforward. These findings align with Cognitive Load Theory (CLT), which emphasises the importance of managing cognitive load to prevent overload and facilitate learning (Sweller, 1988; Paas et al., 2003). By providing clear guidelines and simplifying the educational content, the intrinsic and extraneous cognitive loads are minimised, allowing learners to focus on the germane cognitive load essential for schema construction and automation. This approach is supported by Lindhagen (2022), who highlighted the need for clear goals and realistic scenario planning to enhance training effectiveness.

Additionally, the study by Moscicki et al. (2022) on Sweden’s MCTS highlighted the necessity of clear guidelines and standardised protocols to ensure effective triage during MCIs. Their recommendation for continuous evaluation and refinement based on practical experiences and emerging evidence aligns with the need for follow-up and maintenance identified in this study. The study emphasised the importance of adaptable and scalable triage systems, capable of responding to varying degrees of emergencies, and the integration of non-medical personnel into the triage process to enhance overall response capabilities.

Secondly, integrating training into existing programmes with follow-up was highlighted as a vital aspect. Effective education should be integrated into existing training programmes for blue light professionals to save time and resources. Additionally, continuous follow-up and feedback are crucial to ensure that the training remains relevant and effective. This approach is mirrored in the findings of Berggren et al. (2023), who explored the "Train-the-Trainer" model and its effectiveness in disseminating knowledge and skills within organisations.

Finally, the need for quick spread, short and simple training was stressed. The educational concept needs to be disseminated rapidly, which requires the training to be concise and straightforward. This approach ensures that a larger number of personnel can be trained efficiently, maintaining a high standard of preparedness across various regions and groups. This is consistent with the Ukraine Trauma Project (Bury et al., 2023), which demonstrated the feasibility and effectiveness of rapid training deployment using the Train-the-Trainer model.

7.1.2. Research Question 2

Exploring the second research question on how insights from cognitive science and existing training research can enhance learning outcomes in a national mass casualty triage educational programme, the study found two significant sub-themes. Firstly, the importance of realistic simulations was underscored, as they are essential for effective learning. Realistic simulations allow trainees to practise under conditions that closely mimic real-life scenarios, helping in managing cognitive load and preparing responders for the stress and dynamic nature of mass casualty incidents. This corresponds with Kolb's Experiential Learning Theory, which posits that learning is a cyclic process involving experiencing, reflecting, conceptualising, and acting (Kolb, 2011). Realistic simulations enable learners to engage actively in the learning process, thereby enhancing retention and application of skills.

The Emergo Train System (ETS), discussed by Lindhagen (2022), provides a controlled environment for responders to practise their skills and decision-making processes, highlighting the importance of creating realistic scenarios. However, the limitation of ETS in replicating dynamic and stressful real-life situations was noted, reinforcing the need for high-fidelity simulations. High-fidelity simulations, while resource-intensive, can better replicate the complexities and emotional stress of actual mass casualty incidents, providing a more comprehensive training experience. This need for high-fidelity simulations aligns with the findings of Fraser et al. (2012), who noted that emotions experienced during simulation training significantly impact cognitive load and learning outcomes. They found that heightened emotions, such as invigoration, increased cognitive load, while emotions like tranquillity reduced it. This underscores the need for training programmes to manage emotional states effectively to prevent cognitive overload and maximise learning outcomes.

The balance between theory and practice was another crucial sub-theme identified. A strong emphasis on theoretical understanding before practical application ensures that trainees have a solid foundation of knowledge, which they can then apply and refine through hands-on practice. Cognitive Load Theory (CLT) supports this approach, suggesting that an initial focus on theoretical learning helps to manage intrinsic cognitive load, making it easier for learners to assimilate and apply practical skills later. This phased approach helps in constructing and automating schemas, which are essential for effective performance in high-stress environments (Sweller, 1988; Paas et al., 2003).

Integrating these insights, it is evident that an effective mass casualty triage educational programme should begin with a solid theoretical foundation, followed by progressively complex practical applications. This ensures that trainees first build a comprehensive knowledge base, which is crucial for understanding the underlying principles of triage and emergency response. Once this theoretical framework is established, practical simulations can then reinforce and expand upon this knowledge, allowing trainees to experience realistic scenarios in a controlled environment. The use of both low-fidelity and high-fidelity simulations can cater to different stages of learning, with low-fidelity simulations focusing on basic skills and high-fidelity simulations addressing complex, dynamic situations.

Ultimately, the combination of a theory-first approach followed by practical, high-fidelity simulations provides a balanced and comprehensive training programme. This method not only enhances cognitive and practical skills but also prepares responders to manage the emotional and psychological challenges of real-life mass casualty incidents. The integration of these elements, supported by cognitive science and existing training research, ensures that the educational programme is robust, effective, and capable of producing highly skilled and resilient emergency responders.

7.1.3. Research Question 3

In addressing the third research question on the specific training needs of participants, the thematic analysis identified several critical areas. Understanding the dynamic flow of mass casualty incidents (MCIs) emerged as a paramount need. Trainees need to grasp the dynamic nature of these incidents, including the changing physiological status of patients and the fluctuating availability of resources. This understanding is crucial for making informed decisions about patient prioritisation and resource allocation.

Comfort et al. (2010) underscore the importance of early decisions and resource allocation in disaster response, which significantly impact overall efficiency. Training programmes should thus include scenario-based modules that simulate various disaster conditions, focusing on real-time information sharing, multi-agency coordination, and continuous reassessment. This approach aligns with the need for fostering dynamic situational awareness and adaptability among responders.

The idea that there should be only a small change from today's practices was also noted. The transition to a national MCTS should not drastically alter current training practices. Maintaining continuity with existing triage protocols ensures that responders are comfortable and confident with the processes they already understand, which is crucial during high-pressure scenarios. Moscicki et al. (2022) emphasise the importance of a unified national triage system that is simple, adaptable to local contexts, and easy to use. This ensures quick understanding and application, even under stress.

However, the study also highlighted the need for a utilitarian approach in MCTS training, where the goal is to maximise overall outcomes rather than individual patient care. This shift in perspective requires new training strategies to help responders prioritise effectively in mass casualty situations. Frykberg (2005) and Comfort et al. (2010) both emphasise that in crisis situations, ethical and practical decision-making must prioritise the overall welfare of the population, necessitating tough choices about resource allocation. Integrating this utilitarian approach into both triage tools and educational modules will ensure that responders can adapt their decision-making processes appropriately during MCIs.

In summary, effective MCTS training needs to focus on understanding the dynamic nature of MCIs, maintaining alignment with existing triage protocols, and adopting a utilitarian approach. By incorporating these elements, training programmes can better prepare responders to manage the complexities of mass casualty incidents, ultimately improving the effectiveness of emergency responses.

7.1.4. Research Question 4

When examining the fourth research question on how various groups can be effectively integrated into the educational programme, the study found that non-medical professionals are already adequately prepared for triage and can be trained using a simplified version of the

educational concept. This ensures they are sufficiently equipped to assist in mass casualty situations without requiring extensive additional training.

The necessity for simplified, role-specific training for non-medical professionals, such as firefighters and police officers, is well-supported by the literature. Moscicki et al. (2022) emphasise the importance of streamlined educational modules focused on essential triage principles, avoiding complex medical details to enhance response efficiency. Jonson et al. (2024) highlight the need for clear and concise training to ensure that non-medical responders can perform critical tasks without being overwhelmed by advanced medical procedures. Crossan et al. (1999) also underscore the importance of targeting training to the specific responsibilities of non-medical professionals, ensuring they are effectively prepared to support medical teams during MCIs.

There was also a clear need to delineate roles and responsibilities among different groups to avoid confusion and ensure effective coordination during a mass casualty incident. Moscicki et al. (2022) stress that training programmes should be tailored to the specific roles of different personnel, such as paramedics, firefighters, and police, to ensure seamless coordination and effective use of resources during emergencies. This involves cross-disciplinary role-specific training to foster collaboration and ensure all personnel understand their responsibilities within the triage process, which helps mitigate confusion and enhance response efficiency.

Strong cooperation between organisations was seen as essential. Effective integration requires robust collaboration between different organisations involved in mass casualty response, extending to the planning and execution of the educational programme to ensure that all participants receive consistent and comprehensive training. Comfort et al. (2010) emphasise the critical need for core information and efficient coordination among disaster response organisations. Their research indicates that clear delegation of responsibilities and access to critical incident information significantly improve the efficiency of mass casualty triage systems. Homeland Security (2020) underscores the importance of clear role delineation to enhance coordination and efficiency during MCIs. The HSEEP outlines the necessity of defining roles explicitly and engaging all relevant stakeholders in the planning process to ensure cooperation and clear role understanding in both training and actual response operations.

Overall, the literature supports the need for simplified, role-specific training for non-medical professionals, clear delineation of roles and responsibilities, and strong inter-organisational cooperation. By addressing these needs, the educational programme can ensure that all responders are well-prepared to work together efficiently during mass casualty incidents, thereby enhancing the overall effectiveness of the response.

7.1.5. Research Question 5

The fifth research question focused on deriving recommendations for the education of Sweden's MCTS based on the findings from the previous questions. Several key recommendations emerged.

Developing clear, standardised guidelines for triage is essential to ensure consistency and accuracy in decision-making across different regions and groups. Integrating MCTS training into existing programs will leverage current resources and ensure widespread implementation. Continuous follow-up and feedback are necessary to maintain high standards and allow for ongoing improvements. Incorporating realistic simulations into the training program will provide practical, hands-on experience, better preparing responders for the complexities and

stress of mass casualty incidents. Balancing theory and practice is also important, ensuring that trainees have a strong theoretical foundation before engaging in high-fidelity simulations to maximise learning outcomes. Emphasising the dynamic nature of triage and training responders to adopt a utilitarian approach will help them prioritise effectively in mass casualty situations. Simplifying training for non-medical professionals and clearly defining roles and responsibilities will avoid confusion and ensure effective coordination. Promoting strong inter-organizational cooperation will enhance coordination and ensure that all participants are adequately prepared.

These recommendations, drawn from the TNA and literature review, aim to create a robust and unified MCTS educational framework that enhances the preparedness and response capabilities of Sweden's emergency responders.

7.2. Theoretical and Practical Benefits of the Results

The study advances theoretical understanding by integrating cognitive science principles into the design of MCTS training. Insights from cognitive load theory informed the structuring of the training program to manage cognitive load effectively, ensuring that trainees can process information efficiently without becoming overwhelmed. The emphasis on realistic simulations aligns with experiential learning theory, highlighting the importance of practical, hands-on experiences in skill development and retention.

Practically, the study provides recommendations for the development and implementation of a national MCTS educational program. Clear, standardised guidelines for triage are essential to ensure consistency and accuracy in decision-making across different regions and groups. Integrating MCTS training into existing programs and ensuring continuous follow-up will enhance the effectiveness and sustainability of the training. Incorporating realistic simulations into the training program will better prepare responders for the complexities and stress of mass casualty incidents.

7.3. Method Discussion

The methodology of this project was grounded in data collected from semi-structured interviews aimed at exploring the experiences and insights of stakeholders involved in Sweden's National Pre-Hospital Mass Casualty Triage System (MCTS). The data were analysed using thematic analysis, a suitable method for qualitative research. The analysis was both inductive and deductive, as the data collection was guided by predefined research questions while allowing for an exploratory approach. Thematic analysis does not generate an objective truth or generalizable results; instead, it reflects the subjective experiences of the informants and the researcher’s interpretation (Braun & Clarke, 2006). This method was appropriate for achieving the project's aim of understanding and formalising the experiences of the informants. Additionally, a training needs assessment was conducted to identify specific educational requirements. While a needs analysis is a suitable framework for designing training programs, it is not entirely aligned with the current project's objective. However, the factors encompassed by needs analysis are still relevant for the development of an existing training program. This framework enables a more systematic approach and was thus utilised in the formalisation process. The data used for formalisation were the same as those for the thematic analysis. Formalising the informants' experiences could be further complemented by more objective measures, such as performance indicators, to assess the effectiveness of the training.

7.4. Limitations

This study faced several limitations that must be acknowledged. Firstly, the semi-structured interviews, while allowing for nuanced qualitative data, led to inconsistencies in the information collected. Because of the nature of semi-structured interviews, some questions were prioritised over others due to time constraints. This affected the depth and breadth of data collected, potentially missing out on critical insights from some respondents. Additionally, conducting interviews via digital platforms posed challenges in ensuring a uniform experience for all participants. Technical issues, such as poor internet connections, influenced the quality of one interview, which further increased the time constraint of the interview. Furthermore, the inability to observe non-verbal cues in online settings might have led to a loss of contextual information that could have enriched the analysis.

The sample size and selection method also posed constraints. Participants were chosen using convenience and snowball sampling, which introduces bias as it relies heavily on personal networks and availability. As the number of participants was just five responders and educators involved in MCTSs, this significantly limited the generalizability of the findings. Moreover, the focus on the Östergötland region may also limit the applicability of the results to other contexts. The specific organisational structures, resources, and cultural factors unique to this region might not be entirely transferable to different settings, where different challenges and dynamics could exist.

In terms of data analysis, the thematic analysis approach, while rigorous, is inherently subjective. The researcher's interpretations and biases could influence the identification and categorisation of themes, despite efforts to maintain reflexivity. The iterative nature of thematic analysis is time-consuming and requires careful management to ensure consistency and reliability in the findings. Additionally, a limitation of this study is that there was no opportunity for cross-validation of the thematic analysis coding by a second researcher, which could have provided a second opinion and enhanced the reliability of the themes identified.

Although a training needs assessment is a good option for this type of project, limited time prevented the collection of sufficient data and the conduct of a detailed analysis of individuals, tasks, and the organisation. Future studies should aim to address these limitations by including larger and more diverse samples.

8. Conclusion

The purpose of this study was to develop recommendations for the educational concept of Sweden's National Pre-Hospital Mass Casualty Triage System (MCTS) by integrating insights from cognitive science and conducting thematic analysis and training needs assessment. Through interviews and thematic analysis, the study identified key elements of an effective MCTS educational program. These recommendations emphasise the following:

1. **Clear Guidelines For Correct And Incorrect Triage**

Develop and implement clear, standardised guidelines for triage training to ensure consistent and accurate triage decisions during MCIs, making it easier for instructors to provide specific, actionable feedback to trainees.

2. **Integrate MCTS Training into Existing Programs**

Integrate MCTS training into existing educational programs such as ETS, PS, and PDV and establish a continuous feedback and evaluation mechanism to sustain high training standards and ensure long-term effectiveness.

3. **Implement a Train-the-Trainer Model for Fast Dissemination**

Implement a Train-the-Trainer model with a standardised curriculum and practical simulations to ensure quick, consistent, and high-quality dissemination of MCTS training across emergency response teams.

4. **Enhance Training with High-Fidelity Simulations**

To enhance the effectiveness of MCTS training, it is recommended to integrate high-fidelity simulations that encompass physical, conceptual, and emotional realism, progressively increasing in complexity to build resilience and ensure practical skill transfer.

5. **Teach Theory First, Then Practise**

Implement a structured training program that prioritises comprehensive theoretical instruction followed by progressive practical exercises to ensure trainees develop a deep understanding of mass casualty triage concepts and can effectively apply them in real-world scenarios.

6. **Scenario-Based Training Modules**

Develop training programs that incorporate scenario-based modules simulating real disaster conditions, emphasising real-time information sharing, multi-agency coordination, and continuous reassessment to enhance dynamic situational awareness and adaptability in managing MCIs.

7. **Align MCTS Training with Existing Protocols**

Maintain and enhance MCTS training by closely aligning it with existing standard triage protocols to ensure familiarity and ease of use during MCIs.

8. **Utilitarian Approach in Scenario-Based Training**

Integrate realistic, scenario-based training modules that emphasise the utilitarian approach of MCTS, focusing on quick, informed decision-making to maximise overall survival during mass casualty incidents.

9. **Streamlined Training for Non-Medical Professionals**

Develop streamlined MCTS training for non-medical professionals that focuses on essential triage principles and the effective use of information networks, ensuring the training is accessible, role-specific, and avoids unnecessary medical complexities.

10. **Emphasise Role Delineation and Collaboration**

Develop comprehensive training programs that emphasise clear role delineation and foster collaboration among different responder groups to enhance coordination and efficiency during mass casualty incidents.

11. **Promote Inter-Organisational Cooperation**

Develop a comprehensive training program that emphasises inter-organisational cooperation, consistent use of common terminology, and scenario-based exercises to enhance coordination and communication across multiple agencies during emergency operations.

This study contributes to the theoretical understanding of disaster medicine education and offers practical insights for developing an effective MCTS educational concept. While the study's qualitative approach provides nuanced insights, future research should aim to include larger, more diverse samples and quantitative methods to validate these findings. This research assists in future advancements in MCTS training, ultimately aiming to enhance preparedness and response effectiveness in mass casualty incidents.

9. References

Aguinis, H., & Kraiger, K. (2009). Benefits of Training and Development for Individuals and Teams, Organizations, and Society. *Annual Review of Psychology*, *60*(1), 451–474. https://doi.org/10.1146/annurev.psych.60.110707.163505

Berggren, P., Ryrberg, T., Lindhagen, A., & Johansson, B. (2023). Building capacity – conceptualizing training of trainers. In J. Radianti, I. Dokas, N. LaLone, & D. Khazanchi (Eds.), *Proceedings of the 20th Global Information Systems for Crisis Response and Management Conference (ISCRAM 2023)* (pp. 701-708). University of Nebraska at Omaha. ISBN 979-8-218-21749-5; ISSN 2411-3387.

Bisbey, T. M., Grossman, R., Panton, K., Coultas, C. W., & Salas, E. (2021). Design, Delivery, Evaluation, and Transfer of Effective Training Systems. In *HANDBOOK OF HUMAN FACTORS AND ERGONOMICS* (pp. 414–433). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119636113.ch16

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brown, J. (2002). Training Needs Assessment: A Must for Developing an Effective Training Program. *Public Personnel Management*, *31*(4), 569–578. https://doi.org/10.1177/009102600203100412

Bury, G., Fitzpatrick, C., Heron, B., Cullen, W., Scully, E., Kachurets, K., & Zacharchenko, L. (2023). Ukraine Trauma Project: the feasibility of introducing advanced trauma-care skills to frontline emergency medical services responders. *BMJ open, 13*(11), e077895. https://doi.org/10.1136/bmjopen-2023-077895

Comfort, L. K., Ko, K., & Zagorecki, A. (2004). Coordination in rapidly evolving disaster response systems: The role of information. *American Behavioral Scientist, 48*(3), 295-313. https://doi.org/10.1177/0002764204268987

Crossan, M. M., Lane, H. W., & White, R. E. (1999). An organizational learning framework:

From intuition to institution. *Academy of Management Review, 24*(3), 522-537. https://doi.org/10.5465/amr.1999.2202135

Prytz, E., Jonson, C.-O., & Rybing, J. (2020). *Nuvarande forskningsläge för träning.* Myndigheten för samhällsskydd och beredskap (MSB). https://www.msb.se/publikationer/msb1482-februari-2020 (Original work published 2017)

Fraser, K., Ma, I., Teteris, E., Baxter, H., Wright, B., & McLaughlin, K. (2012). Emotion, cognitive load and learning outcomes during simulation training. *Medical Education, 46*(11), 1055-1062. https://doi.org/10.1111/j.1365-2923.2012.04355.x

Frykberg, E. R. (2005). Triage: Principles and Practice. *Scandinavian Journal of Surgery*, *94*(4), 272–278. https://doi.org/10.1177/145749690509400405

Grossman, R., & Salas, E. (2011). The transfer of training: What really matters. *International Journal of Training and Development, 15*(2), 103–120. https://doi.org/10.1111/j.1468-2419.2011.00373.x

Hermelin, J., Bengtsson, K., Woltjer, R., Trnka, J., Thorstensson, M., Pettersson, J., Prytz, E., & Jonson, C.-O. (2020). Operationalising resilience for disaster medicine practitioners: Capability development through training, simulation and reflection. *Cognition, Technology & Work*, *22*(3), 667–683. https://doi.org/10.1007/s10111-019-00587-y

Homeland Security. (2020). *Homeland Security Exercise and Evaluation Program (HSEEP)*. https://www.fema.gov/media-library/assets/documents/204201

Huffman, J. L., McNeil, G., Bismilla, Z., & Lai, A. (2016). Essentials of Scenario Building for Simulation- Based Education. In V. J. Grant & A. Cheng (Eds.), *Comprehensive Healthcare Simulation: Pediatrics* (pp. 19–29). Springer International Publishing. https://doi.org/10.1007/978-3-319-24187-6_2

Ivarsson, C. (n.d.). *Centrala insikter och lärdomar från massutbildning i stridssjukvård under aktivt krig* [Course project]. 769A36 ceciv084.

Jonassen, D. H., Tessmer, M., & Hannum, W. H. (1999). *Task analysis methods for instructional design* (ISBN 0-805-83085-5). Lawrence Erlbaum Associates.

Jonson, C.-O., Prytz, E., Holmgren, A., Ivarsson, C., & Gower, C. (2024). *"Börja nu": Erfarenheter och lärdomar från MSB:s utbildningsinsats i Ukraina* (KMC-FO-2024-01). Katastrofmedicinskt centrum (KMC).

Kolb, A. Y., & Kolb, D. A. (2011). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. In S. J. Armstrong & C. Fukami (Eds.), *Handbook of management learning, education and development* (pp. 42-68). SAGE Publications. https://doi.org/10.4135/9780857021038.n3

Lindhagen, A. (2022). *A guide to novel instructors in Emergo Train System*® (Master's thesis, Linköping University, Department of Computer and Information Science). http://www.ep.liu.se/LIU-IDA/KOGVET-A--22/010--SE

Maran, N. J., & Glavin, R. J. (2003). Low- to high-fidelity simulation – a continuum of medical education? *Medical Education, 37*(s1), 22-28. https://doi.org/10.1046/j.1365-2923.37.s1.9.x

Moscicki, K., Lindhagen, A., Loftås, P., Lönnqvist, S., & Jonson, C.-O. (2022). *Masskadetriage: Underlag för utredning av nationellt införande av ett masskadetriagesystem* (KMC-FO-2022-06). Katastrofmedicinskt centrum (KMC).

Salas, E., Bowers, C. A., & Rhodenizer, L. (1998). It Is Not How Much You Have but How You Use It: Toward a Rational Use of Simulation to Support Aviation Training. *The International Journal of Aviation Psychology, 8(*3), 197–208. https://doi.org/10.1207/s15327108ijap0803

Salas, E., & Cannon-Bowers, J. A. (2001). The science of training: A decade of progress. *Annual Review of Psychology, 52*, 471-499.

https://doi.org/10.1146/annurev.psych.52.1.471

Socialdepartementet. (2021). *Uppdrag att ta fram underlag m.m. samt att samordna, stödja, följa upp och utvärdera regionernas arbete med hälso- och sjukvårdens beredskap och planering inför civilt försvar* (Diarienummer: S2021/02921). Regeringen.se. https://www.regeringen.se/regeringsuppdrag/2021/04/uppdrag-att-ta-fram-underlag-m-m-samt-att-samordna-stodja-folja-upp-och-utvardera-regionernas-arbete-med-halso--och-sjukvardens-beredskap-och-planering-infor-civilt-forsvar/

Sweller, J. (2011). Cognitive load theory. In J. P. Mestre & B. H. Ross (Eds.), *The psychology of learning and motivation: Cognition in education* (pp. 37–76). Elsevier Academic Press. https://doi.org/10.1016/B978-0-12-387691-1.00002-8

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285. https://doi.org/10.1207/s15516709cog1202_4

Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive Load Theory and Instructional Design: Recent Developments. *Educational Psychologist*, *38*(1), 1–4. https://doi.org/10.1207/S15326985EP3801_1

Pepper, M., Archer, F., & Moloney, J. (2019). Triage in complex, coordinated terrorist attacks. *Prehospital and Disaster Medicine, 34*(4), 442-448. https://doi.org/10.1017/S1049023X1900459X

Rudolph, J. W., Simon, R., & Raemer, D. B. (2007). Which reality matters? Questions on the path to high engagement in healthcare simulation. Simulation in Healthcare: *The Journal of the Society for Simulation in Healthcare, 2*(3), 161-163. https://doi.org/10.1097/SIH.0b013e31813d1035

Rybing, J. (2018). *Studying simulations with distributed cognition* (Linköping Studies in Science and Technology, Dissertation No. 1913). Department of Computer and Information Science, Linköping University.

http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-145307

Thawley, A., Aggar, C., & Williams, N. (2020). The educational needs of triage nurses. *Health Education in Practice: Journal of Research for Professional Learning, 3*(1). doi:10.33966/hepj.3.1.14121.

Vetenskapsrådet. (2002). *Forskningsetiska principer inom humanistisk-samhällsvetenskaplig forskning*. Vetenskapsrådet.

Woods, D. D. (2015). Four concepts for resilience and the implications for the future of resilience engineering. *Reliability Engineering & System Safety, 141*, 5-9. https://doi.org/10.1016/j.ress.2015.03.018

10. Appendices

10.1. Interview Questions to Trainees (In Swedish)

1) Kan du beskriva din yrkesroll? Hur ser den ut vid en mass vid en masskadetriage situation?
    a) Hur länge har du gjort det?
    b) Har du jobbat med annat inom ett liknande område?

2) Har du erfarenhet av masskadetriage, antingen i verkliga situationer eller i träningssammanhang?

3) Vilken typ av utbildning och träning har du tidigare fått för att hantera triagering och masskadetriagering?
    a) Hur tränas ni nu för masskada?
    b) Vad fungerar bra / kan förbättras?
    c) Hur balanseras teoretisk kunskap med praktisk tillämpning i utbildningen?

4) Hur ser du på införandet av det ett nationellt masskadetriagesystemet i Sverige?
    a) Möjligheter
    b) Utmaningar

5) Hur påverkas utbildningsbehoven inom ditt arbetsområde?
    a) Jämföra med andra grupper
    (t.ex. sjukvårdspersonal, räddningstjänst, tränade lekmän)

6) Vilka förkunskaper tror du är viktiga att ha innan man går igenom utbildningen för masskadetriage?

7) Från ditt perspektiv, vad är viktigast att kunna för ett effektivt arbete inom masskadetriage?

8) Kan du identifiera några specifika utmaningar eller kunskapsluckor som du stött på eller förväntar dig inom området masskadetriage?

9) Hur viktigt är det med praktiska övningar och scenariobaserad träning?
    a) icke-praktisk?
    b) Är den praktiska träningen lik verkligheten?

10) Finns det några aspekter av kognitiv belastning eller beslutsfattande under stress som du anser är särskilt viktiga att adressera i utbildningsmaterialet?

11) Finns det någonting jag har glömt fråga, eller något annat du vill ta upp?

10.2. Interview Questions to Instructors (In Swedish)

1) Kan du beskriva din roll och dina ansvarsområden när det gäller utbildning för masskadetriage?
    a) Hur länge har du arbetat med masskadetriage och/eller utbildning relaterad till detta område?

2) Hur skulle du beskriva det nuvarande utbildningssystemet för masskadetriage?
    a) Vilka styrkor och svagheter ser du i det nuvarande systemet?
    b) Hur balanseras teoretisk kunskap med praktisk tillämpning i utbildningen?

3) Kan du dela med dig av en specifik erfarenhet där du har använt din utbildning i masskadetriage i praktiken?
    a) Vilka utmaningar stötte du på och hur hanterade du dem?

4) Utifrån din erfarenhet, vilka huvudsakliga utbildningsbehov finns det för personal som arbetar med masskadetriage?
    a) Har du några förslag på hur utbildningen kan förbättras för att bättre möta dessa behov?

5) Vilka möjligheter och utmaningar ser du med införandet av ett nationellt masskadetriagesystem i Sverige?

6) Hur skiljer sig utbildningsbehoven hos olika grupper, som sjukvårdspersonal, räddningstjänst, och lekmän?
    a) Finns det särskilda behov som behöver särskild uppmärksamhet?

7) Kan du identifiera några specifika utmaningar eller kunskapsluckor som du stött på eller förväntar dig inom området masskadetriage?

8) Vilka grundläggande kunskaper och färdigheter anser du är nödvändiga innan man går en utbildning för masskadetriage?

9) Vilka specifika färdigheter är avgörande för effektivt arbete under en masskadetriage?

10) Reflekterar de praktiska övningarna realistiska scenarier du kan möta i verkligheten?
    a) Vilka förändringar skulle göra träningen mer verklighetstrogen?

11) Vilka delar av nuvarande utbildning för masskadetriage tycker du är mest utmanande att lära ut?

12) Finns det något mer du skulle vilja tillägga som vi inte har täckt i den här intervjun?

10.3. Consent form (In Swedish)

Samtyckesformulär för deltagande i intervju för behovsanalys

Utbildningskoncept för masskadetriage

Informerat samtycke

Du är inbjuden att delta i en studie som syftar till att utveckla utbildningskoncept för masskadetriage med hjälp av kognitionsvetenskapliga principer. Denna intervju inriktar sig på att samla information om dina erfarenheter och synpunkter på utbildning och masskadetriage, inklusive dina tankar kring införandet och förväntningarna på masskadetriagesystemet.

Projektets mål är att ta fram ett utbildningskoncept som är anpassad efter de unika behoven hos olika målgrupper och att optimera inlärningsresultaten genom att integrera kognitionsvetenskapliga insikter. Genom din medverkan bidrar du till att skapa en mer effektiv och målinriktad utbildning för att förbereda vårdpersonal och räddningstjänst för masskadesituationer.

Personlig information som samlas in begränsas till din yrkesroll och arbetsrelaterad information. Ditt deltagande är anonymt, och inspelade svar används endast för detta projekts syfte och raderas efteråt. Ingen information delas externt och all data hanteras konfidentiellt.

Ditt deltagande är frivilligt, och du kan när som helst avbryta utan att ange anledning, samt välja att inte svara på specifika frågor.

Tack för ditt deltagande och bidrag till utvecklingen av detta viktiga utbildningskoncept.

Med vänliga hälsningar,
Victor Karlströmer

Genom att signera nedan bekräftar jag mitt medverkan i studien och bekräftar att jag har förstått informationen ovan:

…… ……

Signatur Namnförtydligande