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Field Triage Tools in Mass Casualty Incidents: A Narrative Review

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Review Article

ABSTRACT

Mass casualty incidents (MCIs) pose significant challenges to healthcare systems, requiring rapid and effective triage strategies to optimize patient outcomes and resource utilization. This narrative review explores the evolution, effectiveness, ethical considerations, global perspectives, and future directions of field triage tools in MCIs. Beginning with the historical perspective, milestones in triage development, such as the Simple Triage and Rapid Treatment (START) protocol and its adaptations like Jump START and Sort, Assess, Lifesaving Interventions, Treat/Transport (SALT), are discussed. Current field triage systems are evaluated, including their application, limitations, and impact on patient outcomes. Training and education programs, challenges in triage education, and ethical/legal considerations in resource allocation and informed consent are examined. Global variations in triage systems, cultural factors, collaboration efforts, and standardization initiatives are explored to understand regional differences and promote interoperability. Future directions emphasize enhancing triage accuracy, integrating triage with healthcare systems, and research priorities. The review concludes with implications for practice and policy, calling for continued research, collaboration, and innovation to advance field triage capabilities and improve emergency response worldwide.

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1. INTRODUCTION

Mass casualty incidents (MCIs) are events that overwhelm local healthcare resources and infrastructure due to a sudden influx of injured or ill individuals [1]. These incidents can result from natural disasters such as earthquakes, hurricanes, or floods, as well as human-made disasters like terrorist attacks, mass shootings, or transportation accidents [2]. MCIs present unique challenges to healthcare systems, requiring rapid and efficient triage, treatment, and resource allocation to save lives and minimize morbidity [3]. Mass casualty incidents are defined as events that result in a large number of casualties, overwhelming the capacity of local healthcare systems to provide adequate care. The World Health Organization (WHO) defines an MCI as "an event characterized by a number of casualties that exceeds the local healthcare system's available resources, requiring extraordinary measures for medical management [1-3]." MCIs can vary in scale and complexity, ranging from localized incidents with dozens of casualties to large-scale disasters affecting hundreds or thousands of individuals [4].

Field triage is a crucial component of emergency response in MCIs. It involves the systematic evaluation and prioritization of patients based on the severity of their injuries or medical conditions [5]. The primary goal of field triage is to identify and prioritize patients who require immediate life-saving interventions and transport to appropriate healthcare facilities, while also ensuring the efficient use of limited resources [5,6]. Effective field triage can significantly impact patient outcomes by reducing mortality rates and improving the allocation of critical care resources. Field triage is the process of rapidly assessing and categorizing patients at the scene of an MCI to determine the priority of care and transport [7]. The goal of field triage is to allocate resources effectively by identifying patients who require immediate life-saving interventions (Immediate category), those who can tolerate delayed treatment (Delayed category), those with minor injuries or non-urgent medical needs (Minor category), and those who are deceased or beyond help (Expectant category). Field triage protocols are designed to ensure the efficient use of limited resources and maximize the survival chances of critically injured patients [6,8].

2. OBJECTIVES OF THE REVIEW

The objective of this review is to provide a comprehensive overview of field triage tools used in mass casualty incidents. By examining the evolution, current practices, and emerging trends in field triage, this review aims to evaluate the effectiveness of existing triage systems, identify challenges and limitations, and propose recommendations for enhancing field triage strategies. Through a narrative synthesis of relevant literature, this review seeks to contribute to the body of knowledge guiding emergency response and disaster preparedness efforts worldwide.

2.1 Evolution of Field Triage Tools

The evolution of field triage tools can be traced back to the early 20th century, with significant advancements occurring in response to various mass casualty incidents (MCIs) and wartime experiences [9]. During World War I, for instance, rudimentary triage methods were used to sort wounded soldiers based on the severity of their injuries and the likelihood of survival. Over time, these early triage concepts evolved into more structured protocols and algorithms designed to prioritize patients in emergency settings [9-11].

The 1970s marked a pivotal period in the development of modern field triage systems. The Simple Triage and Rapid Treatment (START) protocol emerged as one of the first standardized triage systems, emphasizing rapid assessment and categorization of patients into four triage categories: Immediate (red), Delayed (yellow), Minor (green), and Expectant (black). START's simplicity and ease of use made it widely adopted in prehospital and disaster response settings [9,10].

In subsequent decades, advancements in trauma care, emergency medicine, and disaster preparedness led to the refinement and adaptation of field triage tools to meet evolving challenges. New triage systems, such as JumpSTART for pediatric patients and the Sort, Assess, Lifesaving Interventions, Treat/Transport (SALT) method, were introduced to address specific population needs and improve triage accuracy [9,11].

2.2 Milestones in Field Triage Development

Several key milestones have shaped the development of field triage tools and protocols. In the 1980s, the concept of mass casualty triage gained prominence with the publication of guidelines by organizations like the American College of Surgeons (ACS) and the National Disaster Medical System (NDMS). These guidelines provided frameworks for triage decision-making and emphasized the importance of rapid assessment and resource allocation in MCIs [11,12].

The 1990s saw further advancements with the integration of technology into triage systems. Electronic triage tags, handheld devices, and computerized algorithms enhanced the speed and accuracy of triage assessments, enabling real-time communication and data sharing among responders and healthcare facilities [9].

The early 2000s witnessed the introduction of innovative triage methods, such as the Smart Triage System, Care Flight triage system, ASAV Triage System, Sieve Triage System, and the Emergency Severity Index (ESI) in hospital settings. These systems incorporated additional criteria for prioritizing patients, such as capillary refill time, pulse rate, Glasgow Coma Scale (GCS), and the ability to follow commands, leading to more nuanced and tailored triage decisions [11,13].

2.3 Current Field Triage Systems

2.3.1 START (Simple triage and rapid treatment)

The START (Simple Triage and Rapid Treatment) system is one of the most widely used field triage protocols in mass casualty incidents (MCIs). Developed in the 1970s, START is designed to quickly assess and categorize patients based on the severity of their injuries or medical conditions. The system utilizes a color-coded tagging system with categories including Immediate (red), Delayed (yellow), Minor (green), and Expectant (black) [8,14].

The principles of START revolve around rapid assessment of breathing, circulation, and mental status to prioritize patients for treatment and transport [15]. Patients in the Immediate category require immediate life-saving interventions and are typically transported first. Those in the Delayed category have injuries that are not immediately life-threatening but may require treatment within hours. Minor category patients have minor injuries or medical needs that can be addressed later, while Expectant category patients are deemed unlikely to survive given available resources [8].

START's simplicity and ease of use make it valuable in high-stress and resource-limited environments. However, the system has faced critiques and limitations regarding its sensitivity and specificity in accurately triaging patients, particularly in complex scenarios with mixed injury severities [15,16].

2.3.2 Jump START

Jump START is a modification of the START protocol specifically designed for pediatric patients. Children have unique physiological and anatomical differences that necessitate tailored triage approaches. JumpSTART incorporates age-appropriate assessment criteria and prioritization strategies to ensure timely and appropriate care for pediatric patients in MCIs [17].

The system considers factors such as respiratory rate, perfusion, and mental status in children to determine triage categories. Like START, Jump START utilizes color-coded tags (red, yellow, green, black) to categorize patients based on acuity. It aims to identify critically ill or injured pediatric patients who require immediate interventions while also addressing the needs of less severe cases [18,19].

Studies evaluating JumpSTART's effectiveness in pediatric triage have shown promising results, highlighting its ability to accurately identify and prioritize children with life-threatening conditions. However, challenges such as age determination, communication barriers, and limited pediatric-specific training among responders can impact the system's performance in real-world scenarios [18].

Comparisons between START and JumpSTART have shown differences in triage outcomes and accuracy, underscoring the importance of specialized protocols for different patient populations in mass casualty incidents [20].

2.3.3 SALT (Sort, Assess, Lifesaving Interventions, Treat/Transport)

The Sort, Assess, Lifesaving Interventions, Treat/Transport (SALT) triage system is another approach used in mass casualty incidents. Developed as an alternative to START, SALT aims to streamline the triage process by focusing on key interventions and treatments that can be initiated at the scene to improve patient outcomes [20,21].

SALT categorizes patients into Immediate (red), Delayed (yellow), Minimal (green), and Expectant (black) based on a simplified assessment algorithm. The system emphasizes rapid assessment of airway, breathing, circulation, and severe bleeding to prioritize patients for appropriate interventions and transport [22].

Studies evaluating the effectiveness of SALT in real-world scenarios have shown varying results. While SALT has demonstrated success in rapidly identifying and treating critically ill patients, some studies have raised concerns about its accuracy and reliability compared to other triage systems like START [20,23].

One study compared SALT and START in terms of triage accuracy and found differences in over-triage and under-triage rates, indicating potential areas for improvement in SALT's performance. However, SALT's focus on lifesaving interventions and efficient resource utilization remains a valuable aspect of its approach to field triage [20-23].

Overall, current field triage systems like START, JumpSTART, and SALT play essential roles in emergency response efforts during mass casualty incidents. Continual evaluation, refinement, and training are necessary to optimize these systems' effectiveness and ensure timely and appropriate care for patients in crisis situations.

3. IMPACT ON PATIENT OUTCOMES

The effectiveness of field triage systems is often measured by their impact on patient survival rates in mass casualty incidents. Studies have shown that timely and accurate triage decisions can significantly improve survival outcomes by prioritizing critical interventions for patients with life-threatening injuries or conditions [24,25].

For example, triage systems that effectively identify and prioritize immediate category (red) patients for rapid treatment and transport to appropriate medical facilities have been associated with higher survival rates among critically injured individuals. The ability to quickly assess and triage patients based on the severity of their injuries plays a crucial role in optimizing outcomes and reducing mortality in MCIs [8,14,24].

Field triage systems also impact resource allocation and operational efficiency during mass casualty incidents. By categorizing patients based on acuity and treatment priorities, triage protocols help allocate limited resources such as medical personnel, equipment, and transportation assets more effectively [20,24].

Efficient triage systems reduce unnecessary delays in treatment for critically ill patients while ensuring that less severe cases receive appropriate care without overwhelming healthcare facilities. Studies evaluating resource utilization and operational outcomes associated with different triage systems provide insights into optimizing resource allocation strategies and enhancing overall system efficiency during crisis situations [4,7,13].

4. VARIATIONS IN TRIAGE SYSTEMS WORLDWIDE

Triage systems vary globally based on regional practices, healthcare infrastructure, cultural norms, and resource availability. While core triage principles such as prioritizing critical patients remain consistent, variations in triage protocols, algorithms, and terminology exist across different countries and healthcare systems [26].

For example, some regions may use modified versions of established triage systems like START, SALT, or ESI to suit local needs and preferences. Cultural factors, language barriers, and socio-economic considerations can also influence triage practices and decision-making processes in diverse healthcare settings [8,16,20].

5. COLLABORATION AND STANDARDIZATION EFFORTS

Collaboration and standardization efforts are essential for promoting consistency, interoperability, and best practices in field triage worldwide. International organizations, government agencies, professional associations, and disaster response networks collaborate to develop and disseminate guidelines, training resources, and quality improvement initiatives related to triage practices [26,27].

Standardization efforts aim to align triage protocols, terminology, data collection methods, and performance metrics to facilitate seamless communication, coordination, and information sharing among healthcare providers and stakeholders. By fostering collaboration and standardization, global healthcare systems can enhance preparedness, response capabilities, and patient outcomes in mass casualty incidents across borders [28,29].

6. CONCLUSION

In conclusion, field triage tools and protocols play a critical role in emergency response, disaster preparedness, and patient care optimization during mass casualty incidents. The evolution of triage systems, training programs, ethical considerations, and global perspectives highlight the complexity and importance of triage practices in diverse healthcare settings. Key findings from this narrative review include the historical evolution of triage systems, effectiveness in patient outcomes, training and education challenges, ethical and legal considerations, global variations, future directions, and research priorities. Advances in triage technology, interoperability, collaboration, and evidence-based practices offer opportunities to enhance triage accuracy, integration with healthcare systems, and overall emergency response capabilities.

7. FUTURE DIRECTIONS AND RECOMMENDATIONS

Future directions in field triage focus on enhancing accuracy, reliability, and efficiency in triage decision-making processes. Advancements in technology, such as mobile applications, wearable devices, telemedicine platforms, and artificial intelligence (AI) algorithms, offer opportunities to automate triage assessments, streamline data collection, and improve decision support for healthcare providers.

Integration of predictive modeling, data analytics, and machine learning algorithms into triage systems can enhance risk stratification, resource allocation, and early identification of high-risk patients in MCIs. Research and innovation efforts should prioritize developing evidence-based triage tools, validation studies, and interoperable solutions to address evolving healthcare challenges.

8. IMPLICATIONS FOR PRACTICE AND POLICY

The implications for practice and policy include the need for standardized triage protocols, ongoing training and education, interdisciplinary collaboration, ethical frameworks, legal guidelines, cultural competence, data-driven decision-making, and research investments. Policies supporting triage standardization, quality improvement initiatives, technology adoption, and resource allocation strategies can strengthen healthcare system resilience and responsiveness to mass casualty incidents.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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