

Literature Review



**COMPARATIVE ANALYSIS OF THE EFFECTIVENESS OF THE
START AND CTAS TRIAGE SYSTEMS IN DISASTER MANAGEMENT
IN EMERGENCY DEPARTEMENT: A SYSTEMATIC LITERATURE
REVIEW**

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ABSTRACT

Background:

Emergency departments (ED) are often overwhelmed during mass casualty incidents (MCI). The trade-off between the speed of Simple Triage and Rapid Treatment (START) and the accuracy of the Canadian Triage and Acuity Scale (CTAS) poses a management dilemma. This study aims to evaluate and compare the effectiveness of START and CTAS in ED.

Methods: A systematic literature review (SLR) was conducted using the PRISMA guidelines. Sixteen publications from PubMed, Google Scholar, ScienceDirect, and PMC were evaluated with five main articles analyzed for direct comparison.

Results: The study shows that START is proven to be much faster (average of 33 seconds/patient) with high sensitivity in critical patients but has a high risk of under triage, whereas CTAS takes longer (138 seconds/patient) but excels in clinical accuracy and resource allocation precision. There is no single ideal instrument for MCI.

Conclusion: The implementation of a dual triage model using START at the ED entrance followed by CTAS in the care area is highly recommended to optimally balance response speed and patient safety.

Keywords: Triage, Emergency Department, Mass Casualties, START, CTAS

INTRODUCTION

The role of the Emergency Department (ED) as the frontline of the hospital is crucial, especially when faced with extraordinary emergency situations such as a surge in casualties due to disasters or Mass Casualty Incidents (MCI). In conditions where there is an extreme imbalance between the number of patients arriving and the availability of medical resources, initial decision-making through an efficient triage process becomes the main determinant in minimizing mortality rates (1).

In daily emergency services, accurate clinical identification is a top priority to prevent the deterioration of patient conditions. Comprehensive instruments such as the Canadian Triage and Acuity Scale (CTAS) are widely relied upon for their ability to guide nurses in analyzing physiological parameters in detail. Pivina (2) noted that this system offers a high level of reliability in accurately mapping medical urgency in various countries. However, this in-depth clinical approach requires a significant amount of examination time. Research by Curran-Sills & Franc (3) shows that evaluation using the CTAS method requires an average of 138 seconds per patient, a duration that has the potential to cause patient bottlenecks and delays in treatment when the emergency room is flooded with mass disaster victims.

The Simple Triage and Rapid Treatment (START) method offers a much faster triage process in response to the need for time efficiency in crisis situations. Curran-Sills & Franc (3) proved that START can drastically reduce evaluation time to an average of only 33 seconds per patient. This operational speed is reinforced by the findings of Lin et al (4), who proved that the START protocol has a sensitivity of up to

100% in identifying patients in the critical (Red) category during the evacuation of mass accident victims to the ER. However, the use of START in hospital settings has sparked debate regarding its clinical accuracy and potential dangers. Wisnesky (5) highlight the significant risk of under-triage in the START method, where critically ill patients are classified into a lower severity level. This contrasts with CTAS, which, according to Koşargelir & Akpınar (6), has been proven to have excellent validity in predicting the allocation of medical resources and minimizing triage errors.

The above literature review reveals an empirical gap in the form of a trade-off phenomenon between meeting the need for "speed of triage" during a crisis and "clinical accuracy" for long-term patient safety. Abdul-Nabi & Hitti (7) emphasize the urgency of integrating disaster triage tools into hospital triage systems to bridge this gap. So far, research that comprehensively compares the operational feasibility of the two methods in the context of the transition from daily emergency room services to disaster response situations in Indonesia is still very limited.

This study aims to evaluate and compare the effectiveness of the START and CTAS triage systems in the ED through a Systematic Literature Review. This review focuses on aspects of time efficiency, clinical accuracy, and resource management implications, with the hope of providing strategic recommendations for nursing staff in optimizing the adaptation of triage systems when dealing with mass casualties.

MATERIAL AND METHODS

This study used a Systematic Literature Review (SLR) design by adopting the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) framework. The use of this design aims to present a structured, transparent, and reproducible review. The population in this review was global scientific literature evaluating the implementation of emergency triage systems, with the final sample specifically focused on articles comparing the effectiveness of Simple Triage and Rapid Treatment (START) and the Canadian Triage and Acuity Scale (CTAS).

Secondary data sources were comprehensively searched through major academic databases, namely PubMed, Google Scholar, ScienceDirect, and PubMed Central (PMC). Literature searches were conducted using a combination of specific keywords based on the PICO (Population, Intervention, Comparison, Outcome) approach.

Data collection techniques were carried out through a layered screening procedure based on strict clinical inclusion and exclusion criteria. Inclusion criteria included: (1) primary research articles published within the last 10 years (2015-2025); (2) direct comparison or evaluation of time efficiency, clinical sensitivity, and triage error risk parameters between the START and CTAS systems; (3) located or directly implies on the management of hospital emergency departments (EDs); and (4) available in full-text format. Conversely, literature was excluded if it focused solely on field triage (pre-hospital), examined systems other than START and CTAS such as the Emergency Severity Index (ESI), or merely assessed the effectiveness of education for nurses. The literature selection flow is illustrated in detail in Figure 1

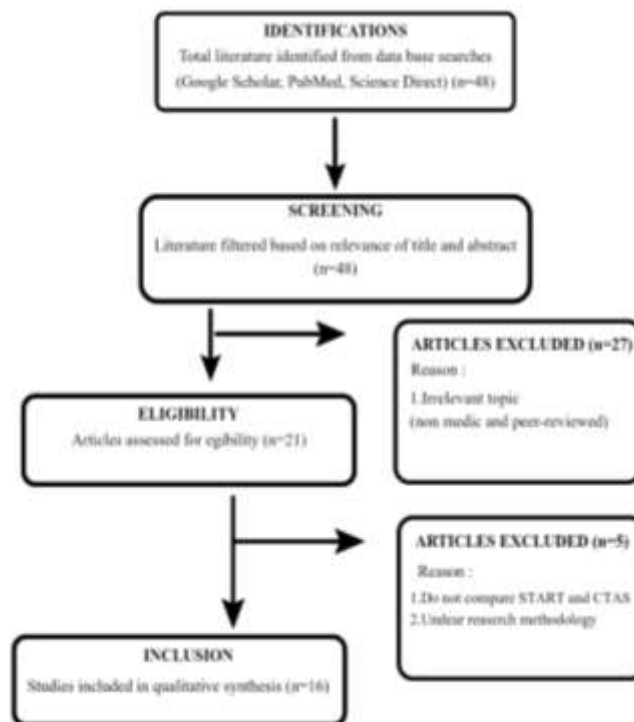


Figure 1. PRISMA 2020 Flow Diagram

The data analysis procedure reduced the literature to 16 articles that were fully assessed for eligibility. The subsequent data extraction process yielded 5 main comparative journals that met the absolute inclusion criteria for synthesis (Table 1). Meanwhile, 11 other journals were designated as supporting literature to strengthen the justification for discussing the level of accuracy and reliability.

RESULTS

Based on the literature search and selection process, 16 articles were evaluated in full. Of these, 5 main articles met the absolute inclusion criteria for direct comparative analysis between the START and CTAS systems in the Emergency Department (ED), as summarized in Table 1. Analysis of the main literature yielded three core findings:



time efficiency of implementation, clinical accuracy, and implications for hospital resource management.

Table 1. Extraction of Key Characteristics and Findings from Journals

No.	Journal Name	Conclusion
1	Curran-Sills & Franc (2017) Prospective Pilot Study – Canada	START was significantly faster than CTAS (average 33 seconds/patient vs. 138 seconds/patient). However, CTAS demonstrated higher cumulative accuracy (77.8%) compared to START (72.2%), indicating that both speed and accuracy must be considered simultaneously when selecting a triage system for mass casualty events.
2	Lee & Franc (2015) Simulation Study – Canada	A two-step triage model combining START at the entrance followed by CTAS in the treatment area proved most effective in optimizing patient flow and preventing emergency department backlogs. The integrated approach outperformed the use of either system alone, suggesting that hybrid triage protocols are superior in high-surge scenarios.
3	Lin et al. (2022) Retrospective Cohort Study – Taiwan	START demonstrated a sensitivity of up to 100% in rapidly identifying critical patients (Immediate/Red category), confirming its high reliability during the early phase of a mass casualty incident. This finding supports START as the preferred tool for rapid initial sorting when time and resources are severely limited.
4	Abdul-Nabi & Hitti (2025) Literature Review – Lebanon	Field-based triage instruments such as START must be integrated with hospital-level clinical parameters to prevent resource depletion caused by initial triage errors. Without adaptation to in-hospital environments, standalone use of START risks both over-triage and under-triage, negatively impacting the quality and equity of emergency care delivery.
5	Bazyar et al. (2022) Systematic Review – Iran	Triage methods such as START exhibit fluctuating accuracy levels that are highly dependent on the disaster scenario. The system frequently requires supplementation by more detailed clinical tools, and is therefore not recommended as a standalone triage instrument in large-scale disaster management without additional validation mechanisms.

The literature selection process was conducted in four main phases: identification, screening, eligibility assessment, and inclusion. The initial search yielded 48 documents. During the initial screening based on titles and abstracts, 27 documents were excluded because they did not discuss clinical emergency topics or were not peer-reviewed manuscripts. The eligibility of 21 full-text articles was assessed in depth. At this stage, 5 articles were excluded because they did not specifically compare START and CATS or

had invalid methodological designs. 16 valid and relevant articles were included for extraction and qualitative synthesis

DISCUSSION

This study highlights the main dilemma in handling mass emergencies in the ED: the speed of initial sorting versus the accuracy of clinical assessment. The speed of the START evaluation, which only takes an average of 33 seconds per patient, is a crucial tactical advantage in the early phase of mass victim arrival (3). In disaster situations

where resources are limited, delays in the triage process can be fatal because the golden hour for trauma patients will be wasted just waiting in line for evaluation. The high sensitivity of the START protocol in identifying immediate victims ensures that patients with life-threatening conditions receive intervention first (4).

However, this time efficiency has consequences in the form of high under-triage rates, especially in patients with moderate conditions who do not yet show explicit symptoms of respiratory or circulatory failure (8). The overly simplified clinical evaluation in the START method is a blind spot that risks worsening patient clinical outcomes if they have to wait a long time in the observation area.

This is where comprehensive hospital-based triage systems such as CTAS play a vital compensatory role. Although CTAS evaluation takes four times longer than START, this system uses comprehensive physiological parameters so that its cumulative triage accuracy exceeds that of START (3). The diagnostic accuracy of CTAS has been shown to have a direct impact on hospital management efficiency. This system minimizes the waste of medical personnel and facilities that often occurs due to the phenomenon of over-triage during the initial panic of a disaster (6)

CONCLUSION

This systematic literature review concludes that no single triage instrument can perfectly meet the needs of speed and clinical accuracy in situations of mass casualties in the Emergency Department (ED). The START method has proven to be superior in terms of efficiency of implementation and has high sensitivity for detecting the most critical patients in the

early phase. The CTAS method demonstrates superiority in clinical accuracy, minimizing the risk of under-triage and accurately predicting the need for medical resource allocation. To optimize service outcomes in crisis situations, it is recommended that ED management implement an integrated dual triage policy. The START method can be used as a very rapid primary screening at the ED entrance, followed in parallel by the use of CTAS guidelines as secondary triage for more precise clinical reassessment in the treatment area.

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