**Title**

Triage systems around the world: A historical evolution

**Abstract**

The process of triaging patients has come a long way. Stemming from the battlefield, it is the ability to sort casualties on the severity of their injuries that has improved the allocation of resources. In modern emergency centres there is a constant struggle to balance limited resources against the ever-growing patient need. Since the late 1980s, when triage became the mainstream standard for sorting patients, many different systems have developed throughout the world. There was a rise in triage system design as emergency centres became more streamlined and resource conscious. Countries around the world sought to develop triage systems that would be most effective in their given setting – giving rise to multiple variations of the triage process. This narrative review will explore the evolution of triage systems around the world by presenting: a historical perspective, how and where modern systems developed, what the main characteristics are of different systems, and discuss the current state of triage system evolution.

**Introduction**

This article serves to present and highlight the history of how triage systems evolved over the years. A narrative review is presented from published literature found on the topic of triage during an unstructured search of medical databases and repositories. The aim was to sift through published research and non-research to piece together an account of how triage systems evolved. The last three decades has seen a marked increase worldwide in triage system development to meet the needs of our growing patient populations. A brief historical overview will be presented, as traced back to the first published works on triage, followed by that of more modern developments and common differentiations between systems. Specific triage systems and their evolution around the world will be presented, as found throughout various regions. Systems that focus on paediatric specific triage will also be identified at the end. Having an appreciation and the knowledge of how triage systems evolved may aid in our understanding of triage systems today, and what the future may hold.

**History of triage systems**

Triage in medical terms, as defined by the Oxford English dictionary, means “the assignment of degrees of urgency to wounds or illnesses to decide the order of treatment of a large number of patients or casualties” (Oxford Dictionary 2014) . The conceptual origins of triage are often traced back to a French physician, Baron Dominique Jean Larrey, who served as Napoleons Chief Surgeon after joining the Army of the Rhine in 1792 (Robertson-Steel 2006). Larrey described in his memoirs how he prioritised the medical needs of military casualties by using a system whereby dangerously wounded soldiers would be treated first, regardless of rank or distinction (Larrey 1932). Those less severely injured could wait for treatment or go to the hospital line if they had transport. He applied the French word ‘trier’ to this process of sorting, which is the origin of the English word ‘triage’ (Kennedy et al. 1996). The concept of triage was refined during subsequent wars and demonstrated that early assessment, prompt resuscitation and early patient transfer reduced mortality (Kennedy et al. 1996). More than a century after the publication of his memoirs in 1832, and following many great world wars, civilian healthcare providers realised that such a system of sorting patients could be applied to the non-combat setting.

During the late 1970s and early 1980s Emergency Centres (ECs) began to develop and implement their own versions of a triage system (Fry and Burr 2002). Medical staff constructed contextually based aims and expectations to improve patient flow and safety through innovative triage coding systems using numbers, colours, ribbons, balloons or the alphabet to indicate patient urgency (Kennedy et al. 1996). In the early days of EC triage, it was performed by a variety of acute care personnel with varying degrees of experience and education (George et al. 1993). The United States of America was the first to assign the responsibility of triaging patients to nurses back in the 1970s (Fry and Burr 2002). This resulted in the formalisation of emergency triage, which became a sub-speciality within nursing. By the 1980s Britain had assigned a dedicated triage nurse to most of its ECs (George et al. 1993). Australia implemented the role in the late 1980s but restricted the position to business hours with clerical staff performing the role after hours (Fry and Burr 2002). During this time, there were no national guidelines for allocating triage codes and nurses learnt the role by adopting their departments’ norms and expectations (Johnson 1996). There has since been a shift in focus, with medical and nursing research concentrating on triage practices and measuring patient outcomes, whilst demonstrating the validity of triage guidelines (Vatnøy et al. 2013). Since the review of triage literature by Fry and Burr in 2002 there has been a substantial rise in the design, development, and validation of triage systems in the 21st century.

**Modern triage**

Current triage systems are mostly based on consensus opinions from expert groups in clinical emergency medicine (Moll 2010). These expert groups design decision trees or algorithms to support clinical risk assessments and predictions based on research evidence; used to define urgency/priority levels (Moll 2010). Most current triage systems follow a categorically measured acuity scale consisting of three-, four-, or five-levels depending on their requirements (Parenti et al. 2010). Although no universal standard for triage exists, various modern triage systems have evolved to favour the five-level acuity scales.

Originally, the concept of three levels was used in warfare situations where casualties could be sorted into either immediate, urgent or non-urgent categories based on how long they could wait to be treated (Robertson-Steel 2006). The introduction of triage within the civilian EC environment saw most triage systems expanding on the three basic levels by introducing new levels between immediate/urgent and urgent/non-urgent (Kennedy et al. 1996). This was the basic principle of how four- and five-level triage systems came into existence. Civilian EC patient populations can be like in-the-field wartime patient populations; in that they also see major trauma. However, civilian EC patient populations also deal with non-traumatic conditions and medical illnesses on a more frequent basis than military populations, depending on the specific environment (Robertson-Steel 2006; Kennedy et al. 1996; Fry and Burr 2002). This led to the current belief that patient acuity and the urgency by which these patients are attended to are best suited to modern five-level triage systems. This extended delineation of the original three-level system was purely based on the requirements of ECs to sort patients and to assign specific resources. However, which five-level triage system to implement is very dependent on the patient population, setting and overall needs of the EC in managing its patients.

Many modern triage systems include the use of vital sign parameters (e.g. level of consciousness, respiratory rate, heart rate, blood pressure, oxygen saturation, and body temperature) with defined cut-off levels to aid in the determination of an acuity level (Göransson and von Rosen 2010). This is accompanied by clinical descriptors; words or expressions used to describe a physiological condition or illness. These two methods are the most predominant techniques used in modern triage systems. Each system has its own application and weighted distribution techniques used to determine acuity. A brief overview of triage system development over the years and across various countries are presented in Table 1.

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| Table 1. Summary of triage systems by year and country |
| **Year \*** | **Triage system** | **Country** |
| 1990 | Emergency Severity Index (ESI) | United States |
| 1993/4 | National Triage Scale (NTS) | Australia |
| 1996 | Manchester Triage System (MTS) | United Kingdom |
| 1997 | Canadian Triage and Acuity Scale (CTAS) | Canada |
| 1998 | Taiwan Triage System (TTS) | Taiwan |
| 2000/1 | Australasian Triage Scale (ATS) | Australasia |
| 2003 | Toowoomba Adult Triage Trauma Tool (TATTT) | Australasia |
| 2004 | Cape Triage Score (CTS) | South Africa |
| 2005 | Medical Emergency Triage and Treatment Systems (METTS) | Sweden |
| 2005 | South African Triage Scale (SATS) | South Africa |
| 2006 | Adaptive Triage (ADAPT) | Sweden |
| 2007 | Supplemented Triage and Rapid Treatment (START) | United States |
| 2010 | Japanese Triage and Acuity Scale (JTAS) | Japan |
| \* Approximate year(s) based on literature sources. |

**Australasian triage systems**

Australia adopted a five-level triage system called the National Triage Scale (NTS) with the aim of promoting a standardised approach to triage in Australian ECs between 1993 and 1994 (Fry and Burr 2002). The NTS used clinical algorithms, rather than diagnoses, to aid urgency in decision-making (Fry and Burr 2002). This approach to triage was thought capable of allocating the same triage category each time to any patient presenting to any triage nurse, in any EC, at any time of the day, with a specific problem (Wollaston et al. 2004). However, their concern regarding the applicability of the system in rural areas and unaccredited ECs was questioned (Fry and Burr 2002). A number of experimental studies, including a study by Doherty in 1996, suggested a lack of standardisation in the application of the system (Eley et al. 2005). Despite this, the NTS formed a benchmark on which other systems (like the British and Canadian) were based (Forsman, Forsgren, and Carlström 2012).

The NTS was revised at the turn of the millennium to include patients’ vital signs and clinical symptoms, and was subsequently renamed the Australasian Triage Scale (ATS), for both Australia and New Zealand (Innes, Plummer, and Considine 2011). To improve national consistency of triage education, the Triage Education Resource Book was introduced in 2002. It contained various recommendations from the Australian Association of Emergency Nurses (Innes, Plummer, and Considine 2011). More recently, an algorithmic decision support tool called the Toowoomba Adult Triage Trauma Tool (TATTT) was developed to address the need for consistency in triage assessment and categorisation; these were found to be lacking when the ATS was applied (Hegney et al. 2003). This supportive tool, although limited to trauma cases, provides a standardised assessment approach to aid in the triage decision process (Hegney et al. 2003).

**European triage systems**

The Manchester Triage System (MTS), a five-level algorithmic scale consisting of 52 flowcharts is used in many European hospitals (Manchester Triage Group 2006). It was introduced within United Kingdom ECs in 1996 by the Manchester Triage Group. It has since been an accepted standard of EC care in Great Britain, Holland and Portugal (Forsman, Forsgren, and Carlström 2012; Olofsson, Gellerstedt, and Carlström 2009; Cronin 2003). The MTS determines urgency levels and links this with time-to-physician assessment in a descending order of priority (Jönsson and Fridlund 2013). The goal of this triage system was to standardise the process and duration of triage within the EC and to show the benefit of nurse triage within the EC when based on consensus opinion (Cooke and Jinks 1999). In Sweden, three different triage methods are used: Adaptive Triage (ADAPT) (Nordberg, Lethvall, and Castrén 2010); Medical Emergency Triage and Treatment Systems (METTS) (Widgren and Jourak 2011); and the MTS (Forsman, Forsgren, and Carlström 2012). The METTS was developed at Sahlgrenska University hospital, Gothenburg, and has been used in Swedish ECs since 2005 (Widgren and Jourak 2011). The METTS and ADAPT are based on subjective interpretation combined with vital parameters also called emergency signs and symptoms (Forsman, Forsgren, and Carlström 2012). These triage systems represent only a few of the major ones used throughout the many European countries, with potentially more being used in local contexts that are less known or published.

**North American triage systems**

Even though triage had been used there for decades, there was no nationally accepted triage system in Canada until the 1990s (Ng et al. 2010). The Canadian Triage and Acuity Scale (CTAS), a five-level triage system, was only introduced in 1997 (Dallaire et al. 2012). Based on the NTS and ATS systems, the Canadian model also adopted the use of vital sign parameters (Beveridge et al. 1998). In addition, CTAS classifies patients in descending order of acuity which has emerged to be a more sensitive, accurate and reliable technique for safe, rapid patient assessment (Beveridge et al. 1998). Currently, hospitals in the United States of America use a variety of triage systems; the most widely used and dispersed triage system being the Emergency Severity Index (ESI), which has been in existence since the end of the 1990s (Rutschmann et al. 2006). This five-level triage system was designed and validated in the EC setting using a variety of patient presentations (Gilboy et al. 2012). The ESI categorises patients, taking into considering both priority and resources, to rapidly assess patients. The Supplemented Triage and Rapid Treatment (START) clinical care program was designed and introduced in 2007 to assist with EC throughput as overcrowding in ECs has become a national crisis in the States (White et al. 2012). However, its effect has not been measurably established (White et al. 2012). The START program complements standard EC triage with a team of clinicians who initiate the diagnostic process and selectively accelerate the time to treatment of a patient subset (White et al. 2012).

**Asian triage systems**

In 2010, the Japanese Society for Emergency Medicine, in conjunction with other Japanese medical societies, developed the Japanese Triage and Acuity Scale (JTAS) (Hamamoto, Yamase H, and Yamase J 2014). Based on the CTAS, the JTAS was the first standardised triage system in Japan with the expectation that it would function similarly to the CTAS in Canada (Hamamoto, Yamase H, and Yamase J 2014). The reason for choosing the CTAS model was due to its demonstrated excellent inter-rater reliability (Hamamoto, Yamase, and Yamase 2014). After implementation of the JTAS, it was found that inter-rater agreement and reliability in Japan improved to similar levels as the CTAS in Canada (Hamamoto, Yamase H, and Yamase J 2014). In Taiwan, the Department of Health and National Health Insurance has been promoting the use of the Taiwan Triage System (TTS) since 1998 (Chi and Huang 2006; Ng et al. 2010). The TTS is a four-level triage system based on concise criteria for major presentations or conditions (Ng et al. 2010). Various studies comparing the TTS to the CTAS and ESI have been conducted (Chi and Huang 2006). These studies however, highlight the various shortcomings and limitations of the TTS to accurately determine patient acuity and resource utilisation (Chi and Huang 2006; Ng et al. 2010).

**African triage systems**

The Cape Triage Score (CTS) was introduced in 2004 in Cape Town, South Africa, and subsequently renamed the South African Triage Scale (SATS) after national roll-out by the creators of the system (Twomey et al. 2012). The SATS was developed “out of a need for an accurate measure of urgency based on physiological parameters and clinical discriminators that is easily adopted in low resource settings” (Rominski et al. 2014). The SATS assigns triage with decreasing priority, using physiological parameters (i.e. vital signs) and clinical presentations within a two-staged approach (Gottschalk et al. 2012). Physiological parameters are evaluated using the Triage Early Warning Score (TEWS), an adapted version of the Modified Early Warning Score (MEWS) (Gottschalk et al. 2012). This adaptation was required after the un-adapted MEWS was found to be unsuitable as a unified triage scoring system for both medical and trauma cases within the South African EC context (Gottschalk et al. 2006). The SATS was the first of its kind to delineate such a prominent focus on vital sign parameters, and resulted in a system that could even be used by entry-level healthcare providers (Twomey et al. 2012).

**Paediatric triage systems**

It is important to realise that paediatric patients’ physiological and clinical presentations may differ widely within paediatric age ranges and from those of adult patients (Wallis and Carley 2006). Most triage systems focus on the evaluation of acuity based on adult findings; however, specific paediatric indicators have been developed in conjunction with well-known triage systems that incorporate their physiology as part of the assessment (Doyle et al. 2012). Various triage systems such as the Paediatric CTAS and the Child and Infant SATS have been developed to address the gap between adult and paediatric triage (Gouin et al. 2005). The MTS, with its 52 flowcharts, was designed with 49 of the 52 charts applicable to paediatrics (van Veen et al. 2012).

**Discussion**

Triage systems have come a long way since the 18th century, however, most of the innovation occurred over a 20-year period between 1990 and 2010. Multiple systems have developed throughout the world as evident by the 13 triage systems presented in this paper. It does appear from the literature that development has reached a plateau. Latest research endeavours focus on refining and improving existing triage systems, instead of formulating bespoke approaches. Using triage to manage EC patient volumes have resulted in countries around the world using different approaches based on their local needs and available resources. Although these systems use different principles of acuity stratification and resource allocation, it is most notable that all of them take in consideration three main aspects: patient presentation, vital sign parameters, and time to treatment. Given that these considerations are the fundamental pillars of a triage system, it was apparent that a plateau of combinations would be reached at some point. In the 21st century there is a push for improved global health and the sharing of literary resources that would aid in healthcare innovation. The availability of a range of triage system approaches makes it easier for countries to adopt and adapt a current system to their needs than to develop one from scratch.

After the literature review on triage systems by Fry and Burr in 2002, at least six more were developed and numerous research studies conducted to evaluate and improve existing systems [5]. The questions are: what is the perfect triage system, and will we ever achieve such a system? It is difficult to determine what the end goal would be, given the changing healthcare environment and the pressures placed on ECs. It appears from a historical perspective that improvement and adaptation of triage systems is an iterative process that continually tries to match patient needs with available resources. We may never see a single best-fit triage system implemented around the world, but more likely have continuously adapted and changed versions of well-defined systems that are locally appropriate.

**Conclusion**

The literature has shown that over the last two centuries much has changed through the evolution of triage systems. It is only in the latter part of the 20th century that saw triage systems become a common standard of sorting patients within an EC. Triage systems have also taken many forms throughout the world, each design being adapted to its healthcare locality, patient population, and resource availability. Each system brings a different approach to a common issue: sorting patients to do the most for the most – a constant balance between patient needs and available resources.

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