

Review

Trauma systems and early management of severe injuries in Scandinavia: Review of the current state

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ABSTRACT

Introduction: Scandinavian countries face common challenges in trauma care. It has been suggested that Scandinavian trauma system development is immature compared to that of other regions. We wanted to assess the current status of Scandinavian trauma management and system development.

Methods: An extensive search of the Medline/Pubmed, EMBASE and SweMed+ databases was conducted. Wide coverage was prioritised over systematic search strategies. Scandinavian publications from the last decade pertaining to trauma epidemiology, trauma systems and early trauma management were included.

Results: The incidence of severe injury ranged from 30 to 52 per 100,000 inhabitants annually, with about 90% due to blunt trauma. Parts of Scandinavia are sparsely populated with long pre-hospital distances. In accordance with other European countries, pre-hospital physicians are widely employed and studies indicate that this practice imparts a survival benefit to trauma patients. More than 200 Scandinavian hospitals receive injured patients, increasingly via multidisciplinary trauma teams. Challenges remain concerning pre-hospital identification of the severely injured. Improved triage allows for a better match between patient needs and the level of resources available. Trauma management is threatened by the increasing sub-specialisation of professions and institutions. Scandinavian research is leading the development of team- and simulation-based trauma training. Several pan-Scandinavian efforts have facilitated research and provided guidelines for clinical management.

Conclusion: Scandinavian trauma research is characterised by an active collaboration across countries. The current challenges require a focus on the role of traumatology within an increasingly fragmented health care system. Regional networks of predictable and accountable pre- and in-hospital resources are needed for efficient trauma systems. Successful development requires both novel research and scientific assessment of imported principles of trauma care.

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Introduction

The concepts of modern trauma care have developed over the past five decades. Application of lessons learned in warfare, advancements in physiological research, and life-sustaining interventions have led to greater focus on the chain of survival from the pre-hospital setting, with early intervention and rapid transport to the appropriate site of definitive care.^{2,58,89,139}

Since the 1970s the US has occupied a leading role in trauma research and system development,⁴ and the concept of an inclusive trauma system (Fig. 1), was initially described in the early 1990s.¹⁵²

Parallel to increased research in and formalisation of trauma systems, the uniqueness of Scandinavian trauma scenarios have become apparent.^{14,43,79,98,116,125} The Scandinavian countries, based on their commonalities in geography, socio-politics, epidemiology and health-services, would benefit from increased research collaboration and uniformity in the development of their trauma systems.^{78,80,82,116}

Since the initial description, several regions have reported favourable results from introducing trauma systems.^{18,22,85,96,132,157} Such documentation has been scarce in the Scandinavian literature. There are also indications that the Scandinavian trauma system development may be suboptimal compared to central Europe.⁸³ Thus, challenges exist regarding the scientific evaluation of the current trauma systems, the quality of patient care and future directions for trauma management.

In this context, we sought to explore the current status of trauma systems and early trauma management in Scandinavia by performing an extensive collective review of the Scandinavian trauma literature.

Materials and methods

We performed an extensive literature search of the Medline/PubMed, EMBASE and SweMed+ databases, and the Nordic language medical journals (Tidsskrift for Den Norske Lægeforening, Ugeskrift for Læger, and Läkartidningen), including articles related to trauma epidemiology, trauma systems and early trauma management in Scandinavia. References from the included articles were also mined for additional relevant studies. Due to the heterogeneity of the topic, wide coverage was prioritised over uniformity and structured comparison. Emphasis was placed on papers published in the last decade, but papers providing historic context were also included. Original articles were given priority.

Geographical considerations

In this context, “Scandinavia” refers to Denmark, Finland, Iceland, Norway and Sweden.⁸² This gives a total land area of 1.35

million km² and a total population of about 25 million inhabitants. A significant number of Scandinavian citizens live in rural areas; the mean population density is 18 per km², ranging from 2.8 per km² in Iceland to 125 per km² in Denmark.⁷⁸ Pre-hospital medicine and patient transfer is characterised by time-consuming transport.¹²⁶ Seasonal climate changes make long-distance transport and air-medical evacuation weather dependent. In 2005, there were 208 hospitals caring for trauma patients in Scandinavia,¹⁶² most with low trauma admission rates.

Epidemiology

The incidence of major trauma (ISS > 15) in Scandinavia ranges from 30 to 52 per 100 000 inhabitants per year. Blunt trauma predominates (Fig. 2), with only 9–12% of all traumas being penetrating injuries (incidence of 2–3 per 100,000 inhabitants per year).^{15,38,43,51,60,90–92,102–104,117,145,147,163}

Traumatic brain injury (TBI; Fig. 3) is a major cause of trauma morbidity and mortality.^{5,32,35,74,133} Sundström et al.¹³³ analysed TBI mortality during the period from 1987 to 2001, and noticed that Finland had almost two times the TBI mortality rate as the other Scandinavian countries (Fig. 3).¹³³ Accordingly, the Finnish incidence of acute TBI operations was nearly twice that of the other countries.¹³³

The Scandinavian countries have a few centres dedicated to burns.^{1,20,61,68,71,99,123} Burns occur more often in children and young persons; since the 1950s the incidence has decreased and the overall mortality is low.^{61,88,165}

With the increasing percentage of senior citizens, geriatric trauma is recognised as an area of concern. Elderly patients present more co-morbidities, require more prolonged hospital stays, and are more prone to late deaths due to multi-organ failure.⁷⁶

Pre-hospital trauma management

While the organisational structures of emergency medical service (EMS) systems varies between the Scandinavian countries and regions, the paramedic- or nurse-manned ground ambulances constitute the main pre-hospital trauma care provider.⁷⁸ As in several central European countries,^{121,153} the pre-hospital physician-manned EMS are well developed and widely used to supplement paramedic-based EMS.⁷⁸

The level of competency of the pre-hospital trauma care provider and the scope of procedures that should be performed on-scene and during transport continues to be controversial.^{30,31,84,100,135} Several Scandinavian studies emphasise the importance of the specially trained physician when advanced procedures are necessary.^{25,26,54,87,135,136,138} A study from

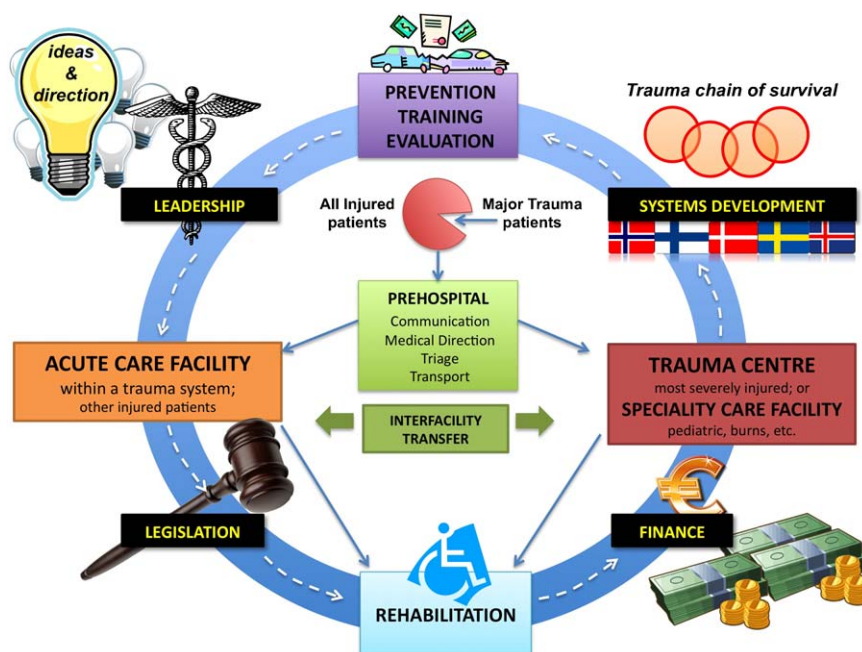


Fig. 1. The inclusive trauma system. The components and their interactions in an inclusive trauma system. The core operational components constitute an organised system from the site of injury to rehabilitation. All levels of resources are employed according to the clinical requirements. The outer administrative framework represents funding, assessment and continual development of the system. Adapted with permission from the Health Resources and Service Administration, US Department of Health and Human Services.¹⁵²

Norway⁸⁷ concluded that for trauma patients, advanced airway management and thoracic drainage performed by a physician increased survival. A Danish series of studies on endotracheal intubation performed on-scene, concluded that while the procedure is widespread it requires skills that are restricted to specially trained physicians.^{25,26,54} The presence of an anaesthesiologist prolonged median on-scene time by 1 min, and in cases in which endotracheal intubation was performed, by 7.5 min.⁶³ A survey of Norwegian pre-hospital anaesthesiologists¹²⁸ also confirmed the need for training to maintain airway management skills. Recently the Scandinavian Society of Anaesthesiology and Intensive Care proposed a flow chart for airway management in the field, stratified by the provider's level of skill.¹²

The northernmost areas of Scandinavia face special challenges.^{126,163} A survey from northern Norway describes the operational and medical characteristics of 147 missions in the Barents Sea,⁴⁶ with one-third of the search and rescue missions

carried out in darkness, transport times of up to 425 min, and patients often severely injured; a scenario not unlike the "tyranny of distance" describing rural trauma management in Australia.²⁹

For decades, pre-hospital fluid therapy has been aimed at the immediate restoration of normovolaemia.¹³⁹ More recent experimental and clinical research has questioned this approach.^{107,139} Scandinavian researchers have contributed to this debate,^{69,70,108–113,130,164} and treatment protocols have been called for.^{107,129} In Stockholm a study of 102 hypotensive trauma patients found that the initiation and form of fluid therapy was irrespective of the type and severity of the injury.¹⁴⁸ Further, they demonstrated a lack of employment of treatment protocol, and that on-scene time exceeded recommendations.¹⁴⁸ Scandinavian guidelines for managing trauma patients with massive bleeding were recently published⁴² based on the existing literature and consensus among the experts in the field. The guidelines include a step-wise framework and differential approach for pre-hospital triage and management of the haemorrhaging trauma patient.⁴²

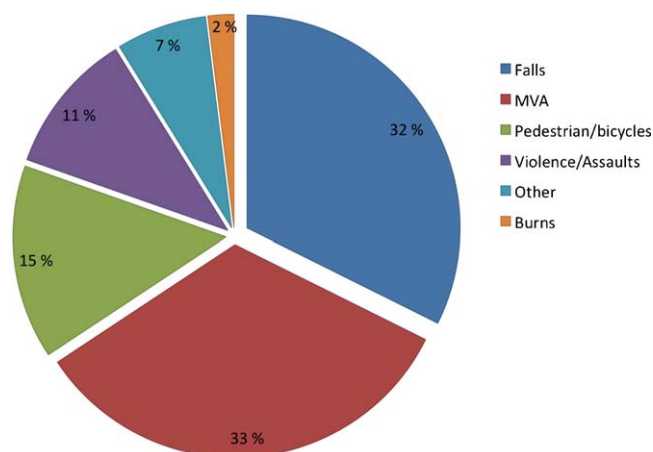


Fig. 2. Mechanism of injury in severe and fatal trauma. Typical distribution of mechanism of injury extrapolated from Søreide et al.¹⁴⁵ and Hansen et al.⁵¹

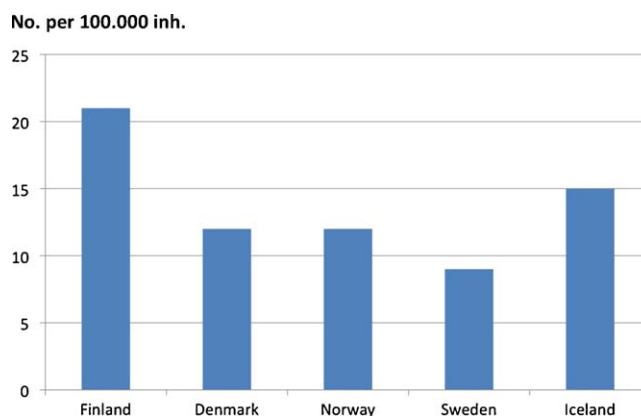


Fig. 3. Distribution of TBI mortality rates in Scandinavia. Data were obtained from references.^{5,32,35,133}

Inter-hospital transfer

Long pre-hospital distances, topography and weather conditions make organised inter-hospital transfer (Fig. 1) of the severely injured essential for efficient regional trauma systems in Scandinavia.^{3,14,27,49,78,126} Patients transferred acutely from other hospitals to trauma centres are less frequently received by a multidisciplinary trauma team, despite being more severely injured and more frequently in need of emergency operative or airway interventions compared to direct admissions.^{75,86,151} In one study of patients with severe head injuries, physicians were more likely than paramedics to directly admit the patients to the neurosurgical department.⁹³ In the directly admitted group, time to definite treatment was shortened by nearly 2 h and was well within the recommended limits.^{93,127}

Sollid et al.¹²⁶ reported that among patients transferred to a university hospital in northern Norway, a median of 8 h was spent from the time of injury to arrival, compared to 3 h for the direct admissions. In a much denser populated area in Denmark, the overall pre-hospital times were shorter.¹³⁴ Both sites reported that transfer times were not related to the distance between the local hospital and the trauma centre. Denmark, having the shortest geographic distances, advocated direct triage to the trauma centre.¹³⁴ However, nine out of ten local hospitals referring patients to the university hospital in northern Norway are outside the range of helicopter transport, necessitating initial local hospital care.¹²⁶ Both studies^{126,134} reported delayed decisions to transfer, highlighting a lack of efficient transfer protocols.

In 2004 less than 10% of Norwegian hospitals had predefined written instructions for transfers.⁶⁷ Regarding transfer strategies as an indicator of system development,^{14,49} these studies indicate room for improvement.

Trauma team triage

The concept of trauma team resuscitation is variably adopted throughout Scandinavia. Handolin et al.⁴⁷ report that only 20% of trauma-receiving hospitals in Finland had trauma teams, compared to 88% in Norway.⁶⁷

Successful trauma systems depend on triage to identify patients with severe injuries that will benefit from trauma team resuscitation.^{3,27,105} The triage should be specific enough to avoid inefficient utilisation of resources (over-triage), yet sensitive enough to minimise failure to prompt the trauma team for severely injured patients (under-triage). Correct trauma team activation (TTA) may improve outcomes while under-triage increases the risk of improper diagnosis and management. In 2004, 66% of Norwegian trauma hospitals had formalised TTA criteria.⁶⁷ Several Scandinavian papers report imprecise recognition of severely injured patients due to excessive over- and under-triage.^{73,75,86,105,151} Rehn et al.¹⁰⁵ found that patients brought to a Norwegian trauma centre were subject to an under-triage of 10% and over-triage of 55%. They also reported that patients subject to under-triage had an ISS-adjusted Odds Ratio for 30-day mortality of 2.34 (95% CI 1.6–3.4, $p < 0.001$) compared to those correctly triaged according to TTA.

The systematic evaluation of trauma victims for physiological derangement, obvious anatomical injury, mechanism of injury (MOI), and pre-injury health status have been recommended.^{101,105} Several papers have found that signs of deranged physiology or obvious anatomical injury may suggest considerable haemorrhage that warrants trauma team resuscitation.^{73,105,151} In general, physiological criteria are considered highly specific (i.e., when positive, the patient is truly severely injured), but not very sensitive (i.e., if negative, the patient may still be severely injured). Therefore, physiology can never be utilised as a single field triage

criterion. However, several papers report a general tendency of failure to document physiological variables.^{62,105,125} Other Scandinavian reports confirm the link between MOI as the single criteria for TTA and excessive over-triage.^{28,73,105,151} The tendency towards imprecise triage may be considered as an incitement to design two-tiered trauma triage protocols.¹⁰⁵

In-hospital early trauma management

Modern trauma care in Scandinavia comprises a multidisciplinary approach. Anaesthesiology has an important role in both pre- and in-hospital trauma care.⁷⁸ Iceland is the only Scandinavian country with emergency medicine as a separate specialty.⁷⁸ In 2006 Sweden accredited emergency medicine as a sub-specialty.²¹ Surgeons most commonly act as the “leader” of the trauma team and as the consultants in charge of definitive care.⁴² Trauma surgery is not a separate specialty in Scandinavia, and most general surgeons infrequently manage severe injuries.⁴³ The low volume is only in part compensated for by educational rotations in trauma centres and surgical courses.^{40,43,53} In addition, the general surgeon as the universal trauma caretaker is becoming obsolete as sub-specialisation takes precedence and fewer of the surgical specialties provide training in managing critical injuries.^{43,142,143} However, surgeons on call in every Scandinavian hospital should be specifically trained in basic life-saving, damage control, surgical procedures for the chest and abdomen.⁴² A current lack of surgical interest by residents and students is of concern¹⁴⁶ as this will likely hamper the recruitment of trauma competence as well. These issues need to be addressed in developing new approaches to trauma care for the future.^{140,142}

The concept of extraperitoneal packing for severe pelvic haemorrhage has in part been developed and demonstrated by Scandinavian orthopaedic surgeons.¹⁵⁰ These techniques are taught as part of trauma surgery courses, and several hospitals have implemented training on cadavers at the institutional level.⁸ Moreover, angiographic embolisation has been implemented as an adjunct in the treatment of these severe injuries.^{42,149}

Non-operative management

Angioembolisation and endovascular stenting by interventional radiologists is increasingly supplementing the operative repertoire.^{39,41,131,149} Haemodynamically stable patients and patients who are stabilised after initial resuscitation are evaluated by CT-scanning.⁴² The majority of these patients can be treated non-operatively, and successful angioembolisation of splenic and liver injuries are reported in more than 85% of the patients.^{39,41} However, patients that remain unstable despite resuscitation are directed to the operating room.⁴² Multidisciplinary management is now the rule rather than the exception.⁴² Treatment algorithms need to account for the availability of interventional radiologists.

Special considerations in early trauma management

Head injuries

The Scandinavian countries face common challenges in the management of patients with head injuries. The majority of these patients are initially admitted to hospitals without neurosurgical facilities; thus, the need for correct assessment and triage by non-specialists in both the pre- and in-hospital setting is critical.^{66,126,127} There have been indications that decentralised operative treatment results in low volume and unfavourable outcome.^{155,156}

Several authors have called for evidence-based guidelines adapted to local requirements,^{10,11,34,64} and in 2000 the

Scandinavian Neurotrauma Committee (SNC) published guidelines for the initial management of minimal, mild, and moderate head injuries.⁶⁶

For patients suffering from severe head injuries (Glasgow Coma Scale [GCS] score ≤ 8), studies have highlighted the importance of initial resuscitation and pre-hospital efforts.^{87,122,126} The SNC also recently published guidelines for the pre-hospital management of severe traumatic brain injuries.^{9,72,127} Recommendations include direct transport or early transfer to a hospital with 24 h neurosurgical facilities; thus optimising monitoring and avoiding decentralised operative management.^{9,72,127}

In spite of documented requests for guidelines,^{10,11,34,64} parallel publishing in the Scandinavian medical association journals,^{65,118,119} implementation efforts by national task forces,⁶⁶ and acceptance by clinical leaders,⁹⁴ implementation of and compliance with the SNC guidelines still remain a challenge.⁵⁶

Paediatric trauma management

Trauma is the leading cause of mortality and morbidity in children after infancy.^{37,38,137,144} The major culprit is traumatic brain injury resulting from traffic accidents and falls.^{33,37,38,136,137,158} Deaths from severe injuries in children tend to occur immediately or within a few days of incidence.^{137,144}

A Finnish study¹³⁸ suggested that helicopter emergency medical services (HEMS) play an important role in the pre-hospital paediatric emergency treatment. During an 18-month period, 8% of the patients studied were younger than 17 years of age. Among this age-group trauma was the most common emergency (31%). Cardiopulmonary resuscitation, tracheal intubation, and administration of intravenous medication were among the procedures performed.¹³⁸ Studies from southern Finland indicate that advanced life support and field intubation performed by EMS physicians improves survival among children with serious head injuries.^{135,136}

A lack of uniform management of head injuries in children has been reported.^{34,120} Despite the fact that the SNC guidelines⁶⁶ do address the paediatric population, a survey of Swedish hospitals indicated that the guidelines are underutilised for this age group.⁶ Falk et al.³⁷ estimated that the Scandinavian Head Injury Classification⁶⁶ is generally clinically useful in the paediatric age-group, but that there may be limitations to its use in children younger than 1 year of age.

An additional consideration in the paediatric age group is abuse and deliberately inflicted traumas. A publication from Norway⁹⁵ supports previous findings that subdural haemorrhages in infants presenting with seizures in the absence of documented major trauma, should raise clinical suspicion of abuse. Children with inflicted trauma were more often previously hospitalised, of a younger age, had younger fathers and presented later in comparison to children with accidental injuries.⁹⁵

Pregnancy

Traumatic injury is one of the principal causes of maternal death during pregnancy, with foetal deaths being more common than maternal.⁷⁷ In a recently published population-based study from Sweden,⁷⁷ motor vehicle collisions were the leading cause of maternal deaths during pregnancy, constituting almost 1/3 of maternal deaths and close to three times as many foetal or neonatal deaths. Uterine rupture as a cause of foetal death was associated with fatal injuries to the mother, while placental abruption, causing 40% of foetal or neonatal deaths, occurred despite only minor injuries to the mother.⁷⁷ This study concluded that the incidence and mortality of traffic accidents are equal among pregnant and non-pregnant women; pregnancy was found

to be protective against death due to external causes in a Finnish study.⁴⁴

Swedish authors⁵⁵ have advocated a heightened clinical suspicion of domestic violence during pregnancy. Their study of 207 consecutively selected women from three antenatal clinics in Gothenburg detected exposure to serious violence in 4.3% of the participants.⁵⁵

Trauma education and training

The majority of Scandinavian hospitals rarely manage severely injured patients.¹⁶² Trauma training using simulators or simulated patients is an important factor in overcoming lack of practical training.^{67,160,162} The traditional trauma education offered in Scandinavia include damage control surgery courses, e.g. the Definitive Surgical Trauma Care (DSTCTM), and the trauma life support courses (ATLS[®], PHTLS[®], TNCC[®]).^{40,67,106,142,148}

Scandinavian publications on traditional trauma education and training is scarce, and assessment of the educational benefits and clinical relevance of this training is also in short supply.¹⁴¹ Training on porcine models shows special educational benefits for rarely performed procedures, such as suturing a on a beating heart.⁴⁰ In Aarhus University Hospital in Denmark the entire surgical staff was effectively taught retroperitoneal packing on cadavers.⁸ In the pre-hospital setting, Talving et al.¹⁴⁸ reports a lack of implementation of the PHTLS principles of fluid therapy.

Team-based training

Team-based training serves as an adjunct to the traditional trauma training.¹⁴¹ Experience gained in other high-risk domains (i.e., aviation industry) suggests that training in communication, leadership, and decision-making is imperative for increased safety and overall improvements. This has led to a paradigm shift with respect to team training in trauma management.^{16,17,52,53,159–162}

Attending the BEST (Better & Systematic Trauma Care) courses,¹⁶⁰ improved self-reported confidence and knowledge of trauma resuscitation across different profession and hospitals of different sizes.¹⁶¹ Similar results are shown for team training in operative trauma management.⁵² A paper¹⁶² reviewing the literature on training with simulation and the use of team training in Scandinavia, concluded that simple training activities, with an emphasis on debriefing improve performance. Variations of trauma team training within and between the Scandinavian countries have been reported, and more widespread training, coupled with scientific evaluation is recommended.¹⁶² Recently, the BEST concept has successfully expanded to include pre-hospital trauma management and primary health care.¹⁵⁴

Trauma registries in Scandinavia

Trauma registries form the basis for research and quality assessment of trauma management and inform policy makers about strategies for optimal care of injured patients.^{19,116} In Scandinavia, many trauma centres have established individual trauma registries, but no nation wide or pan-Scandinavian trauma registry currently exists.

In Sweden, there have been several calls for a national trauma registry.^{59,97,98} The trauma registry KVITTRA (Kvalitet i Trauma-vården),⁹⁷ with the intention of becoming a national standard, offers local databases to participating trauma centres, but has not yet been nationally implemented.

In Norway, some hospitals have used the common network-based trauma registry provided by the BEST system, while some of the larger trauma centres have developed their own databases.⁵⁷ A governmental decision exists regarding the establishment of a

nationwide trauma registry; this is yet to be implemented. The trauma centres in Denmark also lack a uniform database,^{24,79} although efforts towards developing a national registry have been initiated.

Studies have highlighted the lack of a national trauma registry in Finland.^{47,48} The trauma registries at Helsinki University Hospital (Töölö and Meilahti Hospital) have previously submitted data to the British Trauma Audit & Research Network (TARN), but they have recently developed a trauma registry based on a local data dictionary.¹¹⁶

Applied registry studies

Despite the lack of national trauma registries, several studies evaluating the performance of Scandinavian trauma centres have been published in the recent years.

Larsen et al.⁷⁹ compared the trauma deaths in Odense to the North American Major Trauma Outcome Study (US MTOS)²³ and the TARN reference databases, demonstrating that the actual number of trauma deaths was significantly lower than expected.

Oslo University Hospital Ullevål (OUH) data were compared with a subset of the original US MTOS database,¹²⁵ finding a lower frequency of penetrating injuries than in the North American database (9.8% vs. 31.8%), with significantly more patients displaying a higher ISS and lower probability of survival (Ps). Importantly, 6.6% of the patients at US MTOS controlled sites (with a mortality rate of 26.7%) were found to have been excluded before actual estimation of the Trauma and Injury Severity Score (TRISS) coefficients due to a lack of data for calculating Ps. If this convention had been used for the OUH database, a high proportion of patients who were intubated prior to hospital admission (17.4%) would have been excluded.¹²⁵ The same research group showed that if the endpoint of the TRISS model (“end of acute care”) was applied to OUH data, a substantial number of blunt trauma deaths would occur after discharge from the primary institution and would invalidate the performance estimate.¹²⁴

In a study from Bergen, the performance of a Norwegian trauma centre was compared to both the US MTOS and the TARN databases; the results were favourable with respect to observed versus expected survival.⁵⁰

Data from the Helsinki University Hospital were assessed by the TARN prediction model using the TARN database as a reference.⁴⁸ The Helsinki patients were older, demonstrated a higher mean ISS (14 vs. 11), and a larger proportion of them were referred from other hospitals (26.9% vs. 7.8%). Survival (adjusted for case-mix) was found to be greater than expected.

Future developments

Until recently, no recognised Scandinavian standard set of data dictionaries have been available. A study initiated by the Scandinavian Networking Group for Trauma and Emergency Management (SCANTEM), demonstrated variability between the registries at Scandinavian trauma centres when comparing content, data variables, data variable definitions, and inclusion criteria.¹¹⁶ Based on this, SCANTEM called for a uniform core data set with the aim of initiating a prospective Scandinavian Major Trauma Outcome Study in the future (Fig. 4).¹¹⁶

Efforts have been made to establish a European standard for trauma registries. Based on the TARN UK, a EuroTARN project was initiated, and a first report published.³⁶ As a continuation of the Euro TARN project, SCANTEM, TARN UK, the Trauma Registry of the German Society of Trauma Surgery and the Italian National Registry of Major Injuries carried out a consensus process to create an Utstein Trauma Template for documenting and reporting data following major trauma.^{114,115} The Utstein Trauma Template focuses on a small set of core data variables to describe patient, process and system characteristics, and aims to facilitate research collaboration and trauma system audit.

Discussion and future directions

In Scandinavia, injured patients are managed in a challenging environment. The majority of Scandinavians live in urban environments, but large distances in rural areas and a harsh winter climate necessitate efficient utilisation of resources. Studies indicate that the larger hospitals perform according to US MTOS and TARN UK standards,^{48,50,79,124,125} but the current state of trauma system development is immature. In further developing trauma systems in Scandinavia, experiences made in regions facing similar challenges are valuable.

There is a high level of activity and Scandinavian collaboration within many fields of trauma research. Scandinavian authors have been in the forefront of developing efficient team and simulation based trauma training^{52,161}; still, more widespread use and scientific evaluation of these principles are needed.¹⁶² Pan-Scandinavian efforts have resulted in guidelines for pre-hospital airway management,¹² neurotrauma patients^{66,127} and critically bleeding patients.⁴² Implementation is a potential Achilles' heel of these guidelines, and both monitoring their application and developing effective implementation strategies deserve future attention.

Regional trauma systems should optimally utilise the available resources to match the clinical requirements of injured patients

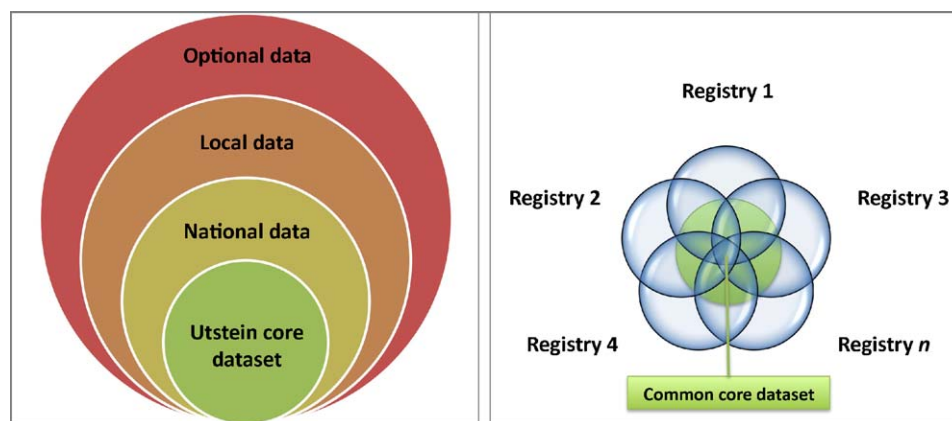


Fig. 4. Principles for a common core dataset in trauma registries. Depicted in (A) the principle of having common core data set, while any database may be expanded by data of local and/or regional interest, or optional data, e.g. for study purposes (clinical studies, inclusion/exclusion criteria, etc.); and (B) how core data across several registries may ensure extraction for a common dataset for comparison.

within an area. Employment of protocols for efficient pre-hospital triage and inter-hospital transfer are needed. Such protocols require predictable resources both pre- and in-hospital. Defining the requirements of trauma centres and stratifying these by level of resources have been among the initial steps seen in other trauma systems.^{7,58,85,132,157} These key elements, having stood the test of time and rigorous assessment elsewhere, can still stir controversy and resistance when brought to ones doorsteps. Scandinavia has a large amount of smaller hospitals receiving injured patients; as seen in the UK,¹³ local political agendas for keeping decentralised services can be strong. Further, elective specialties, subject to, e.g. randomised experiments, may have evidential advantages in political negotiations.

With increasing sub-specialisation, traumatology appears to be neglected. The resulting level of competency of professions and institutions in managing the severely injured has thus far received little scrutiny. There is a need to re-evaluate the current super-specialisation of health care and add traumatology to the equation.

Challenges remain before regional and national trauma systems are fully implemented in Scandinavia. Denmark may compare to the more developed systems in continental Europe,⁸¹ and positive results from the Danish system developments have been published.²⁷ For the large rural areas of Scandinavia, models developed in highly urbanised areas may not be applicable. Adopting elements from well documented systems with similar population and geographical characteristics, such as the state of Victoria, Australia⁷ and Quebec, Canada,⁸⁵ may be more appropriate.

It is important that the development of protocols for formalised trauma networks is evidence based. Trauma registries have been identified as crucial for quality assessment and research. National registries have yet to be implemented in Scandinavia; however, measures are taken to further implement and standardise registries within Scandinavia and beyond.^{114,115}

A paradox exists for European, including Scandinavian, trauma research. In recent decades, American institutions and authors have led the developments in trauma and acute care medical research. Consequently, the journals of highest impact are located accordingly. There appears to be a “brain drain” of European research, whereby the papers of highest significance and quality are published in high impact American journals.⁴⁵

Discontinuation of these trends in the Scandinavian setting will require further funding for trauma research, further Scandinavian research collaborations, and a commitment by the scientific community to publish high quality studies also in the journals closer to home.

Conflict of interest

There are no conflicts of interest declared.

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