

TRAUMA CARE: HIGHLY DEMANDING, TREMENDOUS BENEFITS

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From its beginning, mankind suffered injuries through falling, fire, drowning and human aggression [1]. Although the frequency and the kinetics modify over millennia, trauma continues to represent an important cause of morbidity and mortality even in the modern society [1]. Significant progresses in the trauma surgery were due to military conflicts, which next to social sufferance came with important steps in injuries' management, further applied in civilian hospitals. The foundation of modern trauma systems was started by Dominique Jean Larrey (1766-1842) during the Napoleonic Rin military campaign from 1792. The wounded who remained on the battlefield till the end of the battle to receive medical care, usually more than 24 hours, from that moment were transported during the conflict with flying ambulances to mobile hospitals. Starting with the First World War, through the usage of antiseptics, blood transfusions, and fracture management, the mortality decreased from 39% in the Crimean War (1853–1856) to 10%. One of the most preeminent figures of the Second World War was Michael DeBakey, who created the Mobile Army Surgical Hospitals (MASH), concept very similar to the Larrey's unit. In 1941, in England, Birmingham Accident Hospital was opened, specially designed for injured people, this being the first trauma center worldwide. During the Golf War (1990–1991) the MASH were used for the last time, being replaced by Forward Surgical Teams, very mobile units satisfying the necessities of the nowadays infantry [1].

Nowadays, trauma meets the pandemic criteria, everyday 16,000 people worldwide are dying, injuries representing one of the first five causes of mortality for all the age groups below 60 [2]. A recent 12-month analysis of trauma pattern in the Emergency Hospital of Bucharest revealed 141 patients, 72.3% males, with a mean age of 43.52 ± 19 years, and a mean New Injury Severity Score (NISS) of 27.58 ± 11.32 [3]. The etiology was traffic related in 101 (71.6%), falls in 28 (19.9%) and crushing in 7 (5%) cases. The overall mortality was as high as 30%, for patients with a mean NISS of 37.63 [3].

At the scene, early recognition of severe injuries and a high index of suspicion according to trauma kinetics may allow a correct triage of patients [4]. A functional trauma system should continuously evaluate the rate of over- and under-triage [5]. The over-triage represents the transfer to a very severe patient to a center without necessary resources, while under-triage means a low injured patient referred to a highly specialized center. If under-triage generates preventable deaths, the over-triage comes with a high financial and personal burden for the already overloaded tertiary centers [5]. To maximize the chance for survival, the major trauma patients should be transported as rapid as possible to a trauma center [6]. The initial resuscitation of trauma patients was divided into two time intervals: ten platinum minutes and golden hour [6]. During the ten platinum minutes the airways should be managed, the exsanguinating bleeding should be stopped, and the critical patients should be transported from the scene. During the golden hour all the life-threatening lesions should be addressed, but unfortunately many patients spend this time in the prehospital setting [6]. These time intervals came from Trunkey's concept of trimodal distribution of mortality secondary to trauma, proposed in 1983 [7]. This trimodal distribution of mortality remains a milestone in the trauma education and research, and is still actual for development but inconsistent for efficient trauma systems [8].

The concept of patients' management in the prehospital setting covered a continuous interval, with two extremities: stay and play/treat then transfer or scoop and run/ load and go. Stay and play, usually used in Europe, implies airways securing and endotracheal intubation, pleurostomy tube insertion, and intravenous lines with volemic replacement therapy. During scoop and run, used in the United States, the patient is immediately transported to a trauma center, addressing the immediate life-threatening injuries during transportation.

In the emergency department of the corresponding trauma center, the resuscitation of the injured patients should be done by a trauma team, after an orchestrated protocol based on Advanced Trauma Life Support (ATLS). The modern trauma teams include five to ten specialists: general surgeons trained in trauma care, emergency medicine physicians, intensive care physicians, orthopedic surgeons, neurosurgeons, radiologists, interventional radiologists, and nurses. In the specially designed trauma centers, the leader of the trauma team should be the general surgeon, while in the lower level centers this role may be taken over by the emergency physicians.

The implementation of a trauma system is a very difficult task, and should be tailored to the needs of the local population. For example, in Europe the majority of injuries are by blunt trauma, while in the United States or South Africa they are secondary to penetrating injuries. In an effort to analyse at a national level the performance of trauma care, we have proposed a national registry of major trauma patients [9]. For this registry we have defined major trauma as a New Injury Severity Score higher than 15. The maintenance of such registry requires significant human and financial resources, while only a permanent audit may decrease the rate of preventable deaths in the Romanian trauma care (Figure 1) [10].

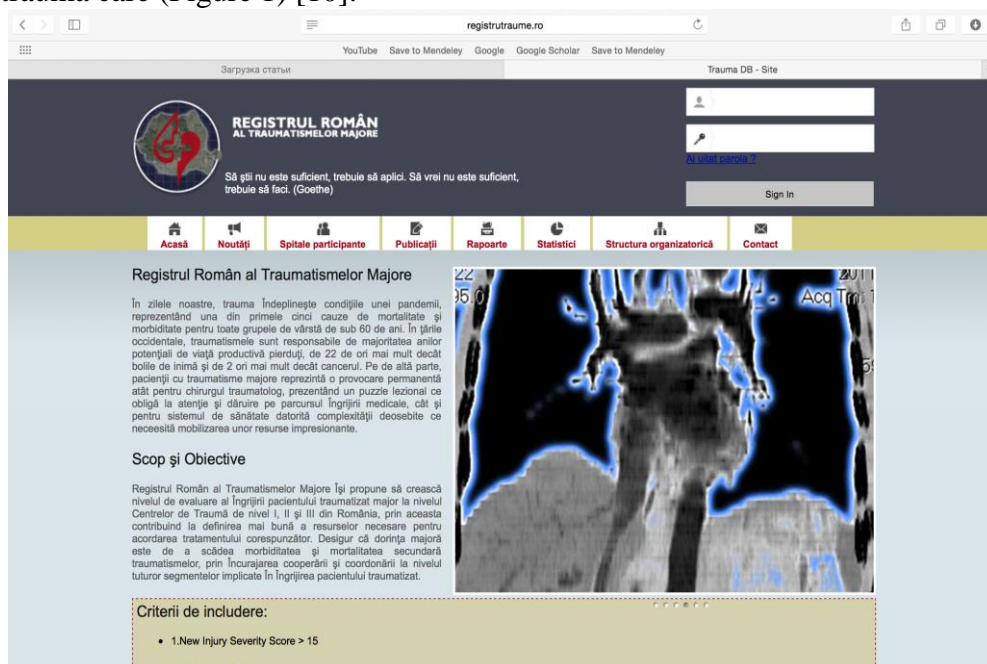


Figure 1 - The website of Romanian Major Trauma Registry (<http://www.registru-traume.ro>).

USA - In the United States of America there are 203 level I centers, 265 level II centers, 205 level III or II centers and only 32 level I or II pediatric centers, according to the 2014 report of National Trauma Databank [11]. USA were the first which recognized trauma as a public health problem, and proceeded to a national strategy for injury prevention, emergency medical care and trauma research. In 1966, the US National Academy of Sciences and the National Research Council noted that "public apathy to the mounting toll from accidents must be transformed into an action program under strong leadership" [12]. Considerable national efforts were made in 1970s, when standards of trauma care were released and in 1990s when "The model trauma care system plan"[13] was generated. The American College of Surgeons introduced the concept of a national trauma registry in 1989. The National Trauma Databank became functional seven years later, in 2006 being registered over 1 million patients from 600 trauma centers [14].

Mortality from unintentional injury in the United States decreased from 55 to 37.7 per 100,000 population, in 1965 and 2004, respectively [15]. Due to this national efforts, 84.1% of all Americans have access within one hour from injury to a dedicated trauma care [16].

Canada - A survey from 2010 revealed that 32 trauma centers across Canada, 16 Level I and 16 Level II, provide definitive trauma care [18]. All these centers have provincial designation, and funding to serve as definitive or referral hospital. Only 18 (56%) centers were accredited by an external agency, such as the Trauma Association of Canada. The three busiest centers in Canada had between 798–1103 admissions with an Injury Severity Score over 12 in 2008 [18].

Australia - Australia is an island continent, the fifth largest country in the world, with over 23 million people distributed on this large area, a little less than the United States. With the majority of these citizens concentrated in large urban areas, access to the medical care for the minority of inhabitants distributed through the territory is quite difficult. The widespread citizens cannot be reached by helicopter, restricted to near-urban regions, but with the fixed wing aircraft of the Royal Flying Doctor Service, within two hours [13]. In urban centers, the trauma care is similar to the most developed countries, while for people sparse on large territories the trauma care is far from being managed in the “golden hour”, often extending to the “Golden day” [19].

Germany - One of the most efficient European trauma system is in Germany. Created in 1975 on the basis of the Austrian trauma care, this system allowed an over 50% decreasing of mortality, despite the increased number of injuries. According to the 2014 annual report of the Trauma Register of German Trauma Society (DGU), there are 614 hospitals submitting data, with 34.878 patients registered in 2013 [20]. The total number of cases documented in the Trauma Register DGU is now 159.449, of which 93% were collected since 2002. In the 2014 report, from 26.444 patients with a mean age of 49.5% and a mean ISS of 16.9, the observed mortality was 10% [20].

The United Kingdom - In 1988, a report of the Royal College of Surgeons of England, analyzing major injuries concluded that one third of deaths were preventable [21]. In 2000, a joint report from the Royal College of Surgeons of England and of the British Orthopedic Association was very suggestive entitled "Better Care for the Severely Injured" [22]. Nowadays the Trauma Audit Research network (TARN) is an independent monitor of trauma care in England and Wales [23]. TARN collects data from hospitals for all major trauma patients, defined as those with a hospital stay longer than 72 hours, those who require intensive care, or in-hospital death. A recent analysis of TARN data, looking at the cost of major trauma patients revealed that the total cost of initial hospital inpatient care was £19.770 per patient, of which 62% was attributable to ventilation, intensive care and wards stays, 16% to surgery, and 12% to blood transfusions [24].

Global health care models	Countries where is applied	Functioning concept	Total healthcare costs from GDP
Bismarck model	Germany	Privatized insurance companies (approx. 180 nonprofit sickness funds). Half of the national trauma beds are publicly funded trauma centers; the remaining are non-profit and for-profit private centers.	11.1%
Beveridge model	United Kingdom	Insurance companies are non-existent. All hospitals are nationalized.	9.3%
National health insurance	Canada, Australia, Taiwan	Fusion of Bismarck and Beveridge models. Hospitals are privatized, but the insurance program is single and government-run.	11.2% for Canada
The out-of-pocket model	India, Pakistan, Cambodia	The poorest countries, with undeveloped health care payment systems. Patients are paying for more than 75% of medical costs.	3.9% for India

GDP – gross domestic product

Table 1 - Global health care models with major consequences on trauma care [17].

Traumas continue to be a major healthcare problem, and no less important than cancer and cardiovascular diseases, and access to dedicated and timely intervention maximizes the patients' chance for survival and minimizes the long-term morbidities. We should remember that one size does not fit in all trauma care. The Romanian National Trauma Program should tailor its resources to the matched demands of the specific Romanian urban and rural areas.

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