

## An Applicable Model for Trauma First Aid and Transport: A Mini Review

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### Abstract

The nature of trauma triage and transportation services is along with limited opportunities, chaos and irregularities. In such conditions, a model is required to prevent a problem through anticipating the future and appropriate decision making. This study tried to suggest an applicable model through surveying weak and strong points of the available models in trauma triage and transportation. In this study by using a mini review method in purposive form and by focusing on the research question that is; “what are the available models for transport and first aid?”, necessary information was searched, retrieved, evaluated and integrated in the related information databases based on the key words and inclusion criteria. Five articles had the inclusion criteria. These articles were narrative ordered, summarized and categorized according to the research question and finally findings were reported based on the achieved themes. The theme of “responsible model in trauma transport and first aid” was achieved through data analysis and integration; this theme includes: three main categories; “recognition and decision making in trauma transport and first aid”, “trauma transport and first aid in remote areas” and “crisis management of trauma transport and first aid”. We propose that trauma transport and triage models are actual images of first aid measures which lead to performance increase and successful results in first aid system in different conditions. Responsive model in trauma first aid and triage is an applicable model that improves first aid speed, transportation and pre-hospital care in terms of motivation, skill and promotion of management ability through human sources empowerment.

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### Introduction

Worldwide, trauma constitutes a massive public health problem. Approximately 5.8 million people die annually as a result of injury, representing 10% of the world's deaths [1]. Those who die as a result of trauma represent only a fraction of those injured. Every year, approximately 50 million people suffer moderate or severe disability, resulting in the loss of 180 million disability-adjusted life years [2]. These economic and treatment costs in the U.S (2009) have been estimated 693.5 billion dollars [3]. A short review of the history of transportation methods of trauma casualties shows that there has been a remarkable decrease in the death rate by considering progressed methods of transportation, so that during world war II, transportation time was four hours and the death rate was 4.5% and in Vietnam war, transportation time was reached to 27 minutes and the death rate was reached to 1.9% [4]. Although some factors such as frontlines hospitals and blood bank availability were effective in this regard, development and progress of trauma care organization and rapid evacuation of casualties are among the main causes of death decrease [5]. In the study about trauma care model in pre-hospital environment, it is shown that trauma pre-hospital care system has developed and progressed in many countries during the last decade and this progress was due to military medicine experiences modeling [6]. Among the studies in this regard, it can be pointed out to military medicine

experiences modeling in Korea war. In this war, using modern methods such as helicopter, field hospital, blood bank and bulletproof vest caused saving lives of thousand soldiers and it has been suggested to use medical experiences as a model [7]. Studies show that trauma transport and first aid with appropriate quality is encountered with many challenges; to overcome these challenges, thoughtful design of the system and care processes models are required [8]. Currently, this issue is in discussion in trauma transport and first aid model that whether the presence of a physician is necessary in the team or not? [9]. In some European countries, trauma transport and first aid model is in this way that pre-hospital care is started from the scene of the event and in crisis moments by the presence of a physician [10]. First aid interventions for saving casualties' lives are started from the event scene and after stabilizing the clinical situation, the casualties are transported to the trauma centers rapidly. Interventions are based on necessary transport and triage protocols [11]. In the stated models, considering injuries etiology particularly in thoracic injuries is very important. The study about thoracic injuries shows that in penetrating injuries of the chest, rapid transportation is more important than measurements for stabilizing casualty's conditions in the event scene [12]. According to the above studies, it is necessary to have a model for transport and first aid with the aim of overcoming transport and first aid challenges and



correct decision making. This study tried to present an applicable model in this regard through analyzing the available models in transport and first aid and diagnosing their common and effective features

**Methods**

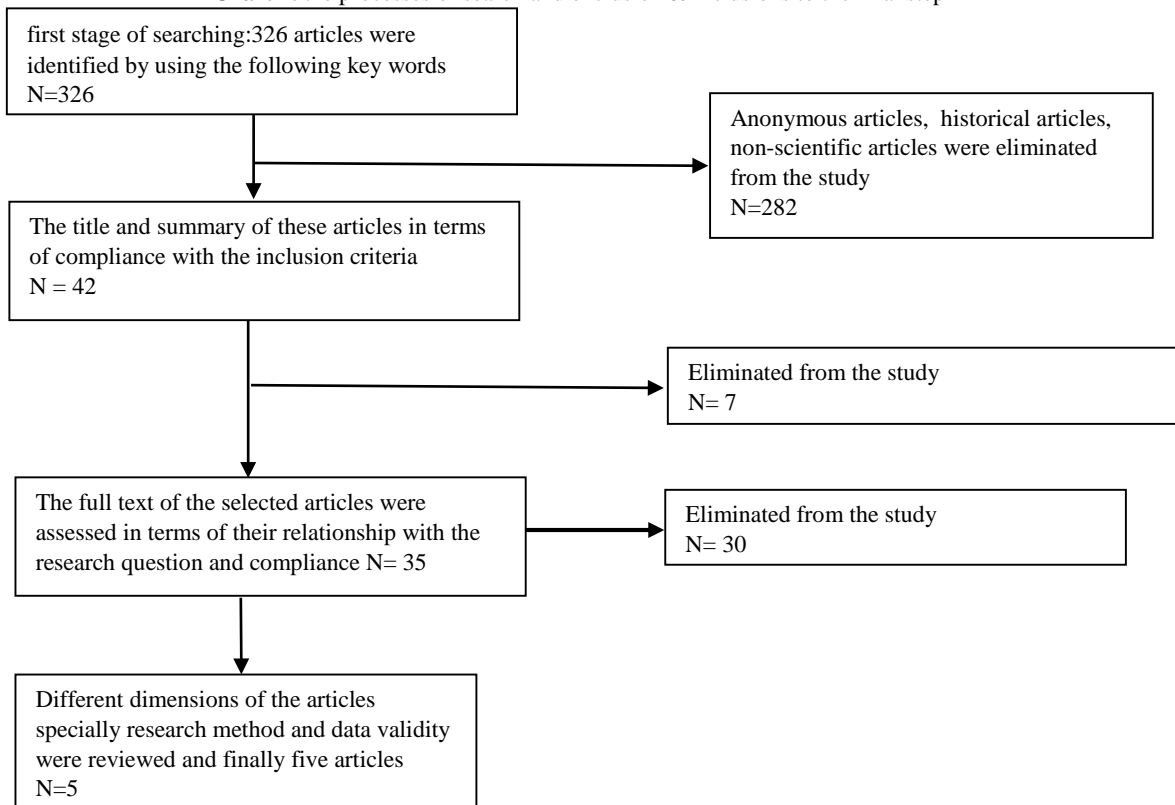
The present study is done for explaining the available transport and first aid methods, since the review can manage a large volume of evidences achieved from different studies and can decrease a large amount of the results of other studies to important findings [13]. Searching the required information was retrieved, evaluated and integrated purposefully and by focusing on the research question. The question of the study was that; “what are the available methods in trauma transport and first aid?” in this regard, electronic research was started in two English and Persian languages by using the following key words; “trauma transport and first aid”, “models for trauma transport and first aid” in the following English information banks: Pubmed, Cochran, Medline, Science Direct and Persian databases; Iranmedex and SID. Inclusion criteria included all the original articles with qualitative, quantitative and reviewing approaches that were published from 2003 to 2013 in English and Persian languages. Also anonymous articles, a reviewing part of the book, recommendations, letter to the editor, historical articles, non-scientific articles, theses and articles written in a language other than Persian and English were eliminated from the study. In the first stage of searching, 326 articles were identified; after surveying the title and summary of these articles in terms of compliance with the inclusion criteria, 282 articles were eliminated. In the next stage, the full text of the selected

articles were assessed in terms of their relationship with the research question and compliance with the inclusion and exclusion criteria of the studies and according to that some articles were eliminated in this stage too. For assessing quality of the gathered articles by two researchers; different dimensions of the articles specially research method and data validity were reviewed and finally five articles had the inclusion criteria (chart1). Then for extracting and synthesizing data, articles were exactly read by one of the writers, the most important points of the articles were normatively ordered, summarized and categorized in line with the research question (table1). The sheet code was used for recording information related to every one of the articles. Finally findings were reported according to the achieved themes. For increasing accuracy of the study, achieved data were controlled and reviewed by three other researchers in the research team through re-assessing the process and for design and propose the model expert trauma transport and first aid professional in military domain has been used.

**Results**

In this study, results achieved from content analysis was seventy codes that categorized and integrating one them in five categories including “recognition and decision making in trauma transport and first aid”, “trauma transport and first aid in rural areas” and “managing trauma in transport and first aid”, “Transition team for trauma casualties with rapid treatment and critical car”, “Pre hospital trauma care is an important component of all trauma care systems” was extracted in the theme of “the responsive model for trauma transport and first aid”.

**Chart 1.** the processes of search and exclusion & inclusions to the final step



**Table 1.** the data of the five studies reviewed

	<b>The paper name</b>	<b>Author(s)</b>	<b>Year</b>		<b>Ex tract model</b>
1	Emergency Medical Responders and Physicians: Diagnostics, Decision Making and Medical Management in High Stakes Situations	Moin Rahman	2012	Symposium on Human Factors and Ergonomics in Health Care	The first responder's mental model based on recognition and decision making process(
2	A model for rural trauma care	N McSwain M Rotondo P Meade J Duchesne	2012	British Journal of Surgery	Right patient is treated at the right hospital at the right time for the benefit of the patient.
3	A hierarchical Model For Emergency Management systems	R ALBTOUSH R DOBRESCU Florin IONESCOU	2011	University" Politehnica" of Bucharest Scientific Bulletin	Complex multilayered emergency management system a comprehensive model that includes risk assessment and preparedness
4	Advances in pre hospital trauma care	<i>K Williamson</i> <i>Ramesh</i> <i>Grabinsky</i>	<i>R</i> <i>A</i>	2011 Int J Crit Illn Inj Sci.	Pre hospital trauma care is an important component of all trauma care systems in the field
5	Long range transport of war-related burn casualties	EM Renz LC Cancio J David CE White SE Wolf MC lbrecht and et al	2008	<i>Journal of Trauma-Injury Infection &amp; Critical Care.</i>	Transition team for trauma casualties with rapid treatment and critical car

### 1. Recognition and decision making in trauma transport and first aid (mental model).

In the category of recognition and decision making in trauma transport and first aid, three subcategories including; correct diagnosis, correct decision, formation of care mental model and providing measurements by the respondent were emerged. In this category, transport and first aid decision making is by considering limitation of time, confusion, uncertainty and incomplete information influenced by internal factors (experience, expertise and skill, mental conditions such as robustness in stressful situations) and external factors (environment: heat, dust, light, etc. organizational procedures and protocols, complexity, workload and technology). Therefore emergency personnel imagine a model of required measurements in the event scene in their mind in facing with disaster. Structural components of this mental model are started by considering information achievement (dispatch center or present emergency personnel at the scene and other resources) and recognition of the scene. Provisional mental model formation & plan for initial course of action upon arrival - In situ Mental model formation and selecting and executing a course of action (either due to starting afresh with no preconceived plan or by modifying the previous step). During the process, the main aim of the emergency personnel and first responder is determining nature and severity of injury, pre-hospital medical cares and decision making (triage at the scene) about dispatch to the most appropriate health center (hospital or trauma center).

According to this model, the levels of trauma transport and prehospital trauma care are unknowns. The first responder determined nature and severity of injury, therefore in events with high causality not matching.

### 2. A model for rural trauma care

In this study, trauma transport and first aid model is the rural areas is another category that is achieved from other studies and they are explained in two subcategories of "principles

and priorities" and "the levels of trauma transport and first aid" (table 1). Trauma care standards in these areas include; correct principles for patient's transportation to a correct hospital at an appropriate time. It means that the casualty should be transported to a health center that provides the best health services in the right time; for this purpose, emergency personnel should transport the patient to the right center.

According to this model, number of the casualties, status and mechanism of injury, triage national protocol and first aid measurements that patients achieve at the scene and also hospital sources and equipment that are going to be dispatched should be considered. Totally, in this model, emergency personnel transport the casualty to the closest center after evaluating the level of injury (the initial transportation). The second stage of transportation to other centers is going to be done for the casualties who need more specialized services. Therefore, the first step of triage for the first aid personnel is choosing the correct hospital. The second step is providing care in the hospital and the third step is inter-hospital transportation.

This model doesn't consider the external or internal factors related to the hazard trauma. Therefore, this model is not applicable for different cases of trauma transport and first aid. Also cost, time, technology, infrastructure, supply chains are not taken into consideration.

### 3. Managing trauma in transport and first aid (hierarchical models).

Trauma transport and first aid crisis management is among other categories of the study. Three common elements in crisis include; organization thereat, surprising and decision making in a short time. So there are three stages in crisis management that include; 1. detecting imminent problem or warning signs. 2. Choosing the most appropriate strategy. 3. Implementation of changing process and observing that and preventing dangers. According to these stages, principles of trauma transport and first aid management in crisis include

three stages; before the event (preparation, decrease and prevention), during the event (improvement and development response) and after event (reconstruction Trauma transport and first aid System that relies on a thorough integration of the trauma transport and first aid plans at all levels of the organization, and an understanding that the lowest levels of the organization are responsible for managing the trauma transport and first aid and getting additional resources and assistance from the upper levels. This model is considered a dynamic model that is able to maintain multi-interdependency

Between events, actions, actors, context and the other factors involved in the process. The main limitation of this model can be used for certain and limited area of crisis.

**4. Prehospital trauma care is an important component of all trauma care systems.**

In this category, definite care of trauma patients needs to start early prehospital trauma care in the field. The training of prehospital care providers ranges from minimally trained first responders to others emergency member in trauma center. The prehospital system needs to carefully review and new technologies, techniques and tools to improve patient care of trauma patients in the field. Besides the use of modern techniques and tools, it has become important to introduce scoring systems in prehospital trauma care. The prehospital trauma care needs to training personal as international trauma Life Support (ITLS) for all-comers, advanced trauma Life Support (ATLS) for physicians, and Trauma Nurses Core Courses (TNCC) for nurses.

**5. Transition team for trauma casualties with rapid treatment and critical car**

In these category priorities of care in transport of trauma casualty is forming team. The same as those used in the modern intensive care trauma unit, regardless of the team providing the care. Burn casualties represent a group of patients with severe traumatic injuries. Rapid treatment and critical care transport remain vital to the survival of the burn casualty injured thousands of Miles away from definitive

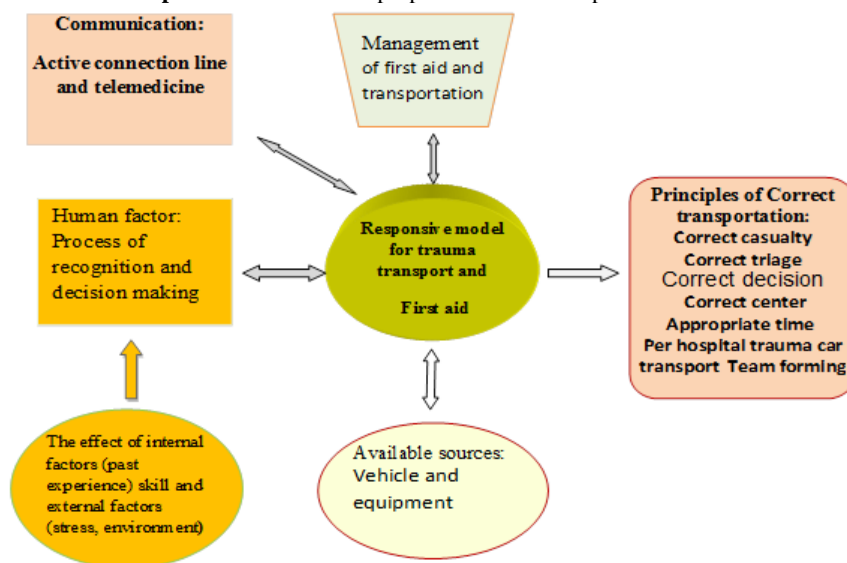
care. Long-range air transport is affected by the isolated nature and austere environment of the aircraft, which allows for finite staffing and limited supplies and equipment. Frequently multiple patients sustain thermal injuries in the same explosion is ideally suited to transport multiple burn casualties, as well as trauma patients without thermal injuries. The challenge is even greater as patients are transferred Concerns regarding long-range flight and prolonged bed rest and immobility heightened concern for deep vein thrombosis among evacuated patients

**The responsive model for trauma transport and first aid (proposed model).**

The theme of the responsive model for trauma transport and first aid, After this analysis the authors has developed a applicable model; the responsive model for trauma transport and first aid that introduces an improvement over existing models. Structure of this model is in a way that is responsive in different trauma situations, among these situations, it can be pointed out to; development of recognition and decision making, empowering human sources in terms of motivation and skill, considering the level of transportation, appropriate triage, correct transportation and promotion of management ability in three stages of preparation, rapid response and reconstruction in transport and first aid.

The model presents in nine main components: -First aid actions: determining the nature and severity of the triage damage in the scene, basic CPR, progressed CPR of transport- The first cycle in the transport and first aid chain, in time care- Recognition and decision making process.- Correct recognition and presenting correct decision.- Cognitive processes and using human force.- The effect of internal factors such as skill.- The effect of external factors (stress, environment).- Conditions: active connection line, telemedicine, information saving and transport.- Medical management, risk management, monitoring and evaluation. This model has the ability to handle different situation by supporting different stages and phases of trauma transport and first aid.

**Graph 1.** Model structure propose in truma transport and first aid



This graph shows a responsive model structure in trauma transport and first aid

It solved the difficulties related to others model that review in this study. This model based on determining the set of resources and a plan required by the first responder in order to handle an incident that has just occurred. This requires a set of information resources, resilient communication to get information from the main source to the first responder and plan implementation. The main limitation is that it can be implemented only to by the first responder and can be considered an effective model so the degree of success can not be guaranteed.. The model is shown in Graph1

### Discussion

The review identified an applicable model for trauma relate to improvement in training and experience, recognition and decision making and rapid evacuation. Also findings providing model of trauma transport and first aid regarding promotion of managerial abilities and decision making by considering organizational procedures and protocols and technology .This finding are in consistent with the study of Marla et.al (2010) about transport and first aid to discover new experience-based clinical and care delivery knowledge learned in combat zones, eight areas of experiential knowledge were identified in the new care delivery system that featured rapid transport, early trauma and surgical care, and expeditious aero medical evacuation ‘organizing for mass casualties, uncertainty about incoming casualties, resource utilization, ripple effects of a mass casualty event, operating medical facilities under attack, and emotions related to mass casualties. Therefore a good support system should be readily available to all providers. [15].

Base of results in this study prehospital trauma care is an important component of all trauma care systems and definite care of trauma patients needs to start early in the field, therefore human sources issues are important for initial management of the trauma casualty in the field and required a strategy of rapid assessment, airway protection, and appropriate resuscitation in addition to a thorough examination for associated injuries common to the trauma casualty. This finding are in consistent with the study by Renz et.al about the necessity of establishing and applying transition team for trauma casualties with rapid treatment and critical care .Also our current system of selectively using specialty medical transport teams for the long-range transport of burn casualties is safe and effective. In response to the question of whether equipment or personnel provide a unique advantage to the team, the answer is both. [16].

In the category of recognition and decision making in this review related to responder interventions to treat the victim either in the form of first aid, basic or advanced life support that in consistent with the study by Moyeen Rahman (2012) so analyze the human factors challenges inherent to an emergency care system, by applying three important constructs (mental models, situated actions and distributed cognition), from human factors psychology and cognitive anthropology. The findings from this research provide a cognitive foundation for empirical research in the EMS domain to inform the design of a robust emergency care and delivery system to minimize error, maximize successful outcomes and reduce costs by considering the role of human source provides a mental model for recognition and decision

making regarding first aid and transport, communication and operational protocols [17].

Other finding of the correct triage principles and the prehospital transport, system needs to carefully review and, if appropriate, adopt new technologies, techniques and tools to improve patient care of trauma patients in the field. Many of these techniques were developed by the military, while other technologies were first established in the operating room or the intensive care units are in consistent with the study of Mcswain (2012) regarding trauma care model in rural areas inappropriate use of air EMS vehicles thus circumventing families having to travel long distances to see patients, incurring expense and inconvenience, and avoiding loss of revenue to the local hospitals and the overload of urban trauma centers. Rather triage criteria can be taught as per the EMS systems, training given to rural hospital personnel, hospital administrators instructed as to the benefit of such a system, citizens educated as to the advantage of keeping their loved ones closer to home and trauma system registries used to enhance the correct use of the trauma system. Thus considering correct casualty principles at the appropriate time and transportation to the appropriate center [18].

Balance between preparation and flexibility is a main center in this model. Considering the above the issues regarding trauma transport and first aid, the most important stage which is in high conformity with crisis management models is before the event stage (preparation) and during the event stage (in time presence at the scene and appropriate first aid interventions) rehabilitation stage (equipment replacement) that is in consistent with the study of Albtouch (2011) with the title of Hierarchical pattern in emergency management. As result of a critical analysis of some crises and disaster management systems models from the classical and recent literature, according to different criteria such as: applicability, advantages, limitations, cost, time, geographical area, that offer suggestions of how to implement intelligent systems for crisis and disaster management and on this basis to define the architecture of a complex multilayered emergency management system whose comprehensive model includes risk assessment, disaster prevention, mitigation and preparedness. [19]. after reviewing this model we conclude the:

This model can be considered a virtual model and can be used for certain and limited area of the events and disasters and specifically in dangerous environments.

### Conclusion

Extracted model from this study are encapsulates all the required activities of trauma transport and first aid. This model has the ability to handle different conditions .It solved the difficulties related to others models and actual images of first aid measures that can lead to good performance of the system and successful achievements. This is responsive to trauma triage and transportation through empowering the human sources, recognition and decision making, risk management, trauma management, monitoring and evaluation and using correct principles. This model can be used in the events and specifically in dangerous environments.

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