Designing a Model for Trauma System Management Using Public Health Approach: The Case of Iran

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Received: 30 Jul. 2011 ; Received in revised form: 7 Aug. 2011; Accepted: 17 Aug. 2011

Abstract- Trauma is a leading cause of death and disability around the world. Injuries are responsible for about six million deaths annually, of which ninety percent occur in developing countries. In Iran, injuries are the most common cause of death among age groups below fifty. Trauma system development is a systematic and comprehensive approach to injury prevention and treatment whose effectiveness has been proved. The present study aims at designing a trauma system management model as the first step toward trauma system establishment in Iran. In this qualitative research, a conceptual framework was developed based on the public health approach and three well-known trauma system models. We used Benchmarks, Indicators and Scoring (BIS) to analyze the current situation of Iran trauma care system. Then the trauma system management was designed using the policy development phase of public health approach The trauma system management model, validated by a panel of experts, describes lead agency, trauma system plan, policy-making councils, and data-based control according to the four main functions of management: leading, planning, organizing and controlling. This model may be implemented in two phases: the exclusive phase, focusing on resource integration and the inclusive phase, which concentrates on system development. The model could facilitate the development of trauma system in Iran through pilot studies as the assurance phase of public health approach. Furthermore, the model can provide a practical framework for trauma system management at the international level.

Acta Medica Iranica, 2012; 50(1): 9-17.

Keywords: Injuries; Trauma; Trauma System; Lead Agency; Trauma Regionalization; Iran

Introduction

Trauma is a leading cause of death and disability for the first four decades of life around the world. Ninety percent of the injury burden including death, disability and economic loss occurs in low-middle income countries (1-5). In Iran, injuries are the most common cause of death among age groups below fifty (6). Road accidents alone are responsible for more than 24,000 deaths in the country every year (7-9). Iran is the third country for disability adjusted life years (DALY) due to road traffic injuries according to the Global Burden of Disease study for the year 2002 as reported by World Health Organization (WHO) (10). The first National Burden of Disease study for Iran's status in 2003 shows that road traffic injuries caused the highest mortality, years of life lost due to premature mortality (YLL), years lived with disability (YLD), and DALY rates for all ages and both sexes (11).

It has been proven worldwide that a systematic approach is needed for reducing mortality and disability due to injuries (12,13). This systematic approach has been developed as an organized trauma system that delivers a full range of care, including pre-hospital, hospital and post-hospital care to all injured people in a defined region (14). The regionalized trauma care system is integrated with local health care systems and has an active role in injury prevention programs (14).

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Despite the strong emphasis in the Third Socio-Economic and Cultural Development Plan of Iran on trauma system implementation as part of government duties and other similar legislators supporting the concept of organized approach to trauma control (15,16), no serious action has been taken to establish such system in the country. Besides, Iranian researchers have reiterated the necessity of the trauma system approach repeatedly (7,17-21). Part of this lag between belief and action may be related to absence of a conceptual model for managing and integrating such complicated system.

By using Public health approach in a three-step cycle, a problem is determined based on the data in the assessment phase. An intervention is designed and implemented in the policy development phase, and finally the outcome is evaluated in the assurance phase (22). In this study, we used the public health approach for trauma system development recommended in "Model Trauma System Planning and Evaluation" document (22). The objective of this paper was to design a model for trauma system management in Iran in order to prepare a practical management infrastructure for implementing trauma system.

Materials and Methods

Conceptual framework

The conceptual framework developed in the study is based on the four core functions of management: leading, organizing, planning and controlling. In trauma system management, leading is manifested by a lead agency. Organizing presents itself in building advisory committees or policy-making councils. Planning includes trauma system plan, and finally controlling is integrated with trauma data banks providing data-driven control for trauma system. This conceptual framework has been illustrated in Figure 1. The framework was achieved by a content analysis of three different well-known trauma system models. The United States trauma system model is characterized by concentration on trauma centers with less emphasis on pre-hospital trauma care in the definitive care. France trauma system model emphasizes the pre-hospital trauma care as a definitive care coordinated in Service d'Aide Medical Urgente (SAMU) (23,24). The WHO model, designed by combining the trauma system approach and the essential services concept, accentuates low cost and high yield interventions in the chain of trauma care for injured patients as essential trauma care for the developing countries(25,26).

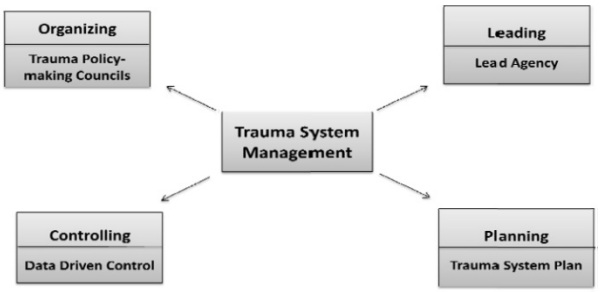


Figure 1. Conceptual framework.

Public health system provides another conceptual framework for development, management and continuous performance improvement.

Using public health model for trauma system is based on the concept that the injury problem in society, like any other disease, can be prevented and its negative impacts mitigated by the help of primary, secondary and tertiary preventive efforts (22). The policy development core function in trauma system involves these steps: designating a lead agency and defining its role in policy development, enabling legislation, preparing the trauma system plan for a specified geographic region, and establishing management information system (22). In this article, the policy development phase has been described in detail in the designed model.

Research process

Following the development of the conceptual framework, Iran's trauma care system was assessed by Benchmarks, Indicators, Scoring (BIS) assessment tool (22). Then, based on a comparative study of different trauma system models world-wide and the components of policy development phase of public health approach, a model for trauma system management was designed. In the final step, the model was validated by a national expert panel. The schematic model of the research process is demonstrated in Figure 2.

Expert panel

For assessing the current status of the trauma care system and the model validating steps, nineteen experts participated in the expert panel hosted by Emergency Medical Services (EMS) organization, in the Ministry of Health and Medical Education (MOHME). All the participating experts met three or more of these criteria:
1) Knowledge and experience in trauma system, 2) A related academic degree, 3) Executive background in trauma care system, 4) Published articles in the field 5) Trauma research background, and 6) Membership in trauma research centers.

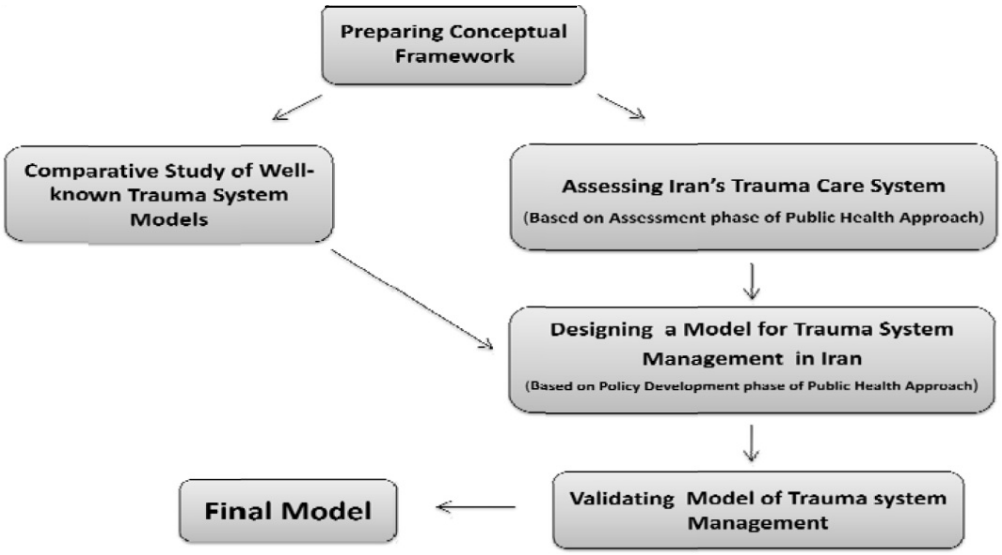
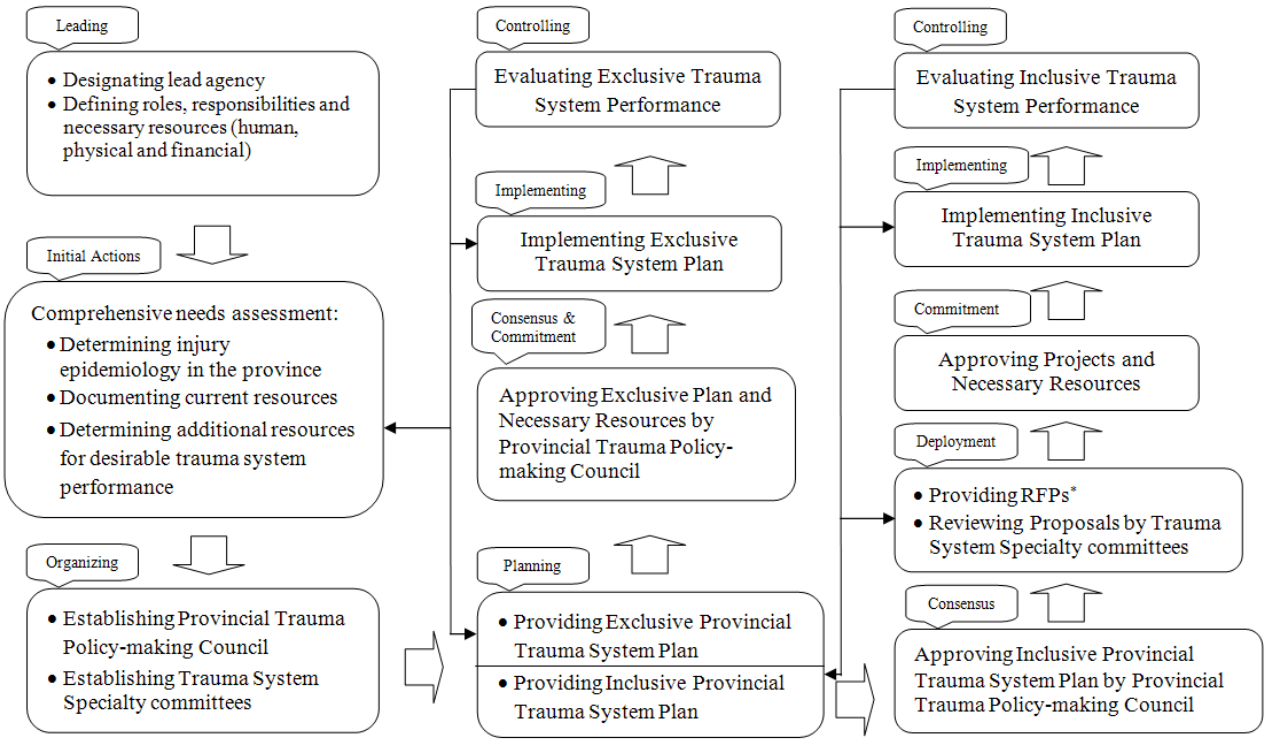


Figure 2. Schematic model of the research process.



*RFP: Request for proposals

Figure 3. Trauma system management model.

Table 1. Components of exclusive and inclusive trauma system plans.

Components of Trauma System Plan	Exclusive	Inclusive
Emergency Medical Services	✓	✓
Transportation Resources	✓	✓
Triage	✓	✓
Communication	✓	✓
Trauma Center Designation	✓	✓
Roles and Responsibilities of Trauma Centers and Specialty Care Centers (Burn, Pediatrics, Spinal Cord Injuries)		✓
Trauma Information System	Limited	Comprehensive
Integrated with Comprehensive Disaster Management Plan		✓
Additional Resources for all-hazards events		✓
Injury Prevention and Control plan	Unwritten	Written
Legislative Rules and Regulations		✓
Legal Authority for Planning, Implementing, Managing and Evaluating Trauma System		✓
Training of Professionals	✓	✓
Rehabilitation Services		✓
Medical Direction	✓	✓
Public Education	✓	✓

Results

Validated by the expert panel, the final model for trauma system management in Iran describes lead agency, trauma system plan, policy-making councils and data-based control in accordance with the four main functions of management. This model may be implemented in two phases. The main concentration is on resource integration in the exclusive phase and on system development in the inclusive phase. The model is shown in Figure 3. In the exclusive phase, the model identifies five major processes, consisting of establishing the lead agency at the provincial level, establishing provincial trauma policy-making council, providing exclusive provincial trauma system plan, implementing and evaluating as a final step (Figure 4). The provincial level is an operational defined geographic region supervised by a medical university responsible for all health care services. The region is governed by the Office of Governor-General as a branch of the Interior Ministry. In the inclusive phase, the model focuses on six major processes including stabilizing the lead agency and trauma policy making council, providing the inclusive trauma system plan, approving the projects for system development, and finally controlling system performance (Figure 5).

The components of the exclusive and inclusive trauma system plans are shown in table 1.

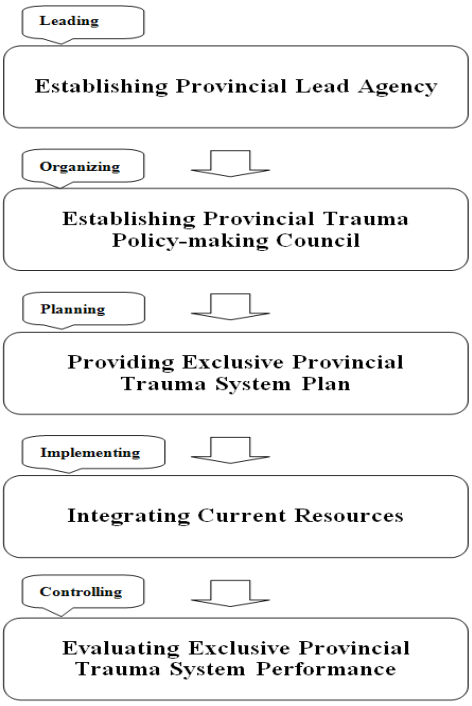
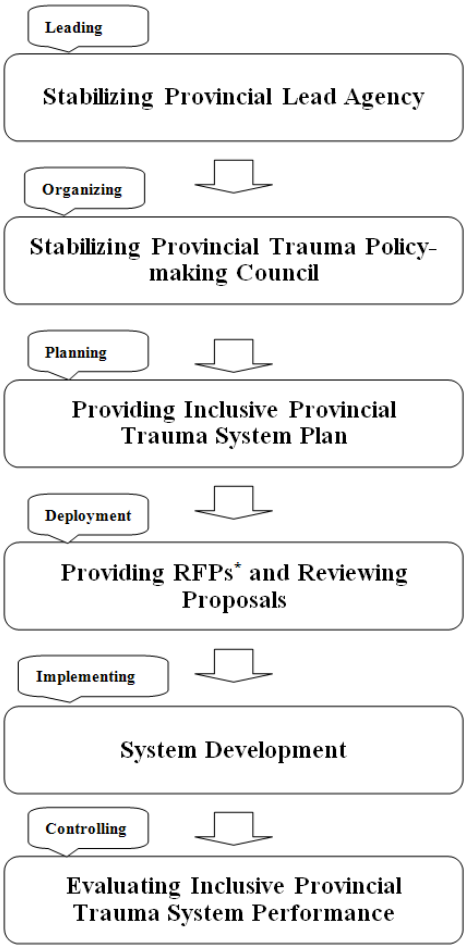


Figure 4. Simplified model of provincial trauma system management: phase I.



*RFP: Request for proposals

Figure 5. Simplified model of provincial trauma system management: phase II.

Discussion

The main objective of this study was to design a model for trauma system management, a multidisciplinary issue and the result of a multidisciplinary approach. It is a multidisciplinary issue, for it has to incorporate the modern knowledge of management in development, maintenance and evaluation of a system that is devoted to one of the greatest challenges of the health system. It needs a multidisciplinary approach, because the trauma system management is responsible for one of the most complicated social systems which is fully integrated with all modern society components form the policy- making bodies to media and human networks and sciences in the field of medicine, engineering and humanities. The logic for regionalizing trauma care or developing a trauma system is connecting all trauma care aspects in a network in order to maximize efficiency, pool resources and improve trauma patients' outcome. Needs assessment in a defined region is necessary for effective trauma system planning and regional needs covering (27-29).

In our model, the first step is doing comprehensive needs assessment including a description of the provincial injury epidemiology, documentation of accessible resources and identification of resources needed for optimum system performance. American College of Surgeons-Committee of Trauma (ACS-COT) believes that needs assessment study for determining a region's or state's available resources is the first step to enable planners to locate deficiencies and find solutions (30).

National leadership

Legal authority is another critical step necessary for establishing a lead agency which is responsible for running system development. West points out that the presence of a lead agency with legal authority to designate trauma centers as the first rank in his eight essential elements for an inclusive trauma system (31). Bazzoli emphasizes on the vital importance of strong and consistent leadership as one the facilitating factors for trauma system development and progress (32). In addition to the presence of lead agency at the regional level, the leadership organization at national level in each country seems to be crucial in coordinating local trauma systems. In our model, we proposed the EMS organization under the supervision of the MOHME as a responsible body for trauma system leadership at national level. A number of studies conducted in Iran support this assertion (17,33). The EMS organization provides prehospital care for emergencies including injured patients.. In the United States, there is no single organization in charge of national leadership, while several agencies within the Department of Health and Human Services (DHHS), Department of Transportation (DOT) and Department of Homeland Security (DHS) are responsible for emergency and trauma care system at national level (34,35). The absence of a single transparent federal organization to play a role in trauma system leadership has resulted in the fragmentation of federal programs (36). In France, Ministry of Health plays the nation's trauma system leadership role (24,37). Germany, Canada and Australia follow the same policy (38-41). Trauma Association of Canada cooperates with

The Ministry of Health and in Australia, Royal Australian College of Surgeons-Committee of Trauma plays the same role (42,43). WHO recommends that, the ministry of health or a related organization lead Essential Trauma Care (EsTC) Project at national level in the collaborated countries (26). In the United Kingdom, Ambulance Service Network (ASN) and National Health System (NHS) Confederation play the leadership role in implementing trauma system in the country (44,45).

Regional leadership

The importance of a regional lead agency is its direct role in planning, implementing, maintaining and evaluating the regional trauma system serving in a defined geographic area. Any trauma system needs a lead agency with authority, responsibility and adequate resources for planning, establishing, operating and evaluating trauma system (46). In our model, a provincial medical sciences university in cooperation with its subsystem, the provincial EMS center, by the help of its health network, will be responsible for implementing the regional trauma system. In the U.S., the EMS office in the health department of each state plays this role (34,35). In France, ninety five regional SAMU services lead the trauma care system in each region (37). In Germany, each regional trauma center plays the same role in all ten regions throughout the country (41,47). In Australia and Canada, state health departments are the regional lead agencies for the state trauma systems(48-50). In the U.K., subsets of NHS in each region are responsible for trauma systems (44,45). WHO recommends that, the local health organizations be responsible for the establishment of EsTC Project (25,26).

Advisory committees or policy-making councils

The role of the advisory committees or policy making councils, the thinking focal points for approving plans and increasing the degree of consensus among trauma stakeholders, is indispensable. The ability of bringing multidisciplinary multi-agency advisory groups together as a committee is essential for achieving trauma system goals in the establishment and maintenance of trauma system. In fact, this committee is a part of the leadership needed for creation and development of trauma systems (46,51). Bazzoli points out that widespread participations of all service providers and community representatives in decision makings is another facilitating factor for trauma system implementation (32). In our model, National Trauma Policy-making Council at national level and Provincial Trauma Policy-making Council at the provincial level have been assigned to play the role of policy-making councils at different geographic levels throughout the country. Considering the existing structures in governmental executive bodies, Health High Council and Provincial Health Working Group are to assume responsibility at each level following reorganization and authority delegation.

In the U.S., trauma-specific statewide multidisciplinary and multi-agency advisory committee provides a comprehensive guidance for the design and implementation strategies. Approving trauma system plan in each state is one of the committee's responsibilities (46). There is no similar structure with this extensive involvement in France, Canada, the U.K. and Germany. On the other hand, the role of the National Road Trauma Advisory Council in Australia at national level is completely different from that of trauma-specific statewide multidisciplinary and multi-agency advisory committee in the U.S (52). WHO encourages building various committees of stakeholders critical to increasing community partnership and facilitating EsTC Project in each region (25).

Trauma system plan

The trauma system leaders should define the process of trauma system planning precisely and clearly. The result will be a trauma system plan document that includes a comprehensive list of trauma system resources and determines the gaps in services, resources and their distributions (53). The trauma system plan is provided by a lead agency based on needs assessment and reviewing the other accessible data (46).

The plan should be based on stakeholders' consensus as far as possible. This plan is used as a guideline for developing, implementing and managing the trauma system as it defines each component of trauma system in detail. In Iran's trauma system management model, trauma system plan will be provided in two phases. In the initial step, the main objective is to integrate current resources and the exclusive plan includes ten components. However, in the final step, the system development is the ultimate destination and the inclusive plan covers sixteen components (Table 1).

In 1992, Health Resources and Services Administration in the U.S. Department of Health and Human Services released "Model Trauma Care System Plan" that provided a framework for implementing trauma care systems in the states (54). In 2006, this administration `published "Model Trauma System Planning and Evaluation" document that introduced a new framework for developing trauma systems in the U.S. by using public health approach (22). In France, SAMU plan serves as a model for trauma system development (37). There is no common plan within the ten regional trauma systems in Germany; so each region has designed its own specific trauma system plan according to ACS-COT guidelines and the rescue system model in the country (35,41). There is no precisely defined framework as trauma system plan at national level for guiding states or provinces in Canada, the U.K. and Australia. However, Trauma System Accreditation Guidelines document will be useful for provincial trauma system designing in Canada (43). Similarly, the report of "National Road Trauma Advisory Council" in Australia and the reports of "National Audit Office", "The National Confidential Enquiry into Patient Outcomes and Death (NCEPOD)", and Intercollegiate Group in the U.K. will be helpful in regional trauma system designing (45,55). WHO has introduced "Guidelines for Essential Trauma Care" as a model in implementing EsTC Project in developing countries (25).

Control

Trauma system evaluation and continuous improvement will not be achievable unless there are trauma patients' data bases. In our model, limited and comprehensive trauma information systems have been predicted for trauma system control in the exclusive and the inclusive phases, respectively. In the U.S., National Trauma Data Bank (NTDB) provides essential data (56). In France, SAMU services data are integrated in a data bank. Province trauma registry in Canada, state trauma registry in Australia, regional trauma registry in Germany and Trauma and Audit Research Network (TARN) in the U.K. provide crucial data for trauma system control (41,45,52,57). WHO recommends collecting minimal data sets for evaluating actions taken in EsTC Project (25).

General perspective

Modern management knowledge is based on the premise that the solution for controlling the burden of trauma and decreasing trauma mortality and morbidity is a systematic approach to trauma. This approach has emerged as the trauma system over the past four decades. Based on environmental conditions, demographic information and accessible resources, every defined geographic region could have its own specific trauma system. In our country, the key chain in integrating resources and establishing trauma systems is management. Trauma system management is led by a legally authorized lead agency. Organizing is bringing all trauma stakeholders together as policy-making councils. Planning identifies desirable future in the trauma system plan as a road map and consensus program. Commitment of top executive governmental decision-makers in providing necessary resources will be the next determining step. Trauma system evaluation and improvement, as the final part of the four main functions of the management, needs a comprehensive trauma information system.

In conclusion**,** the trauma system management model could facilitate the development of trauma system in Iran through pilot studies in a selected province as the assurance phase of the public health approach. Every country designs and implements its own specific model of trauma system. Nevertheless, the model introduced in this article can provide a practical framework in trauma system management for developing countries, especially at the initial steps of their trauma system development.

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