## Development of Emergency Medical Services (EMS) in Iran: Components of Access

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#### Abstract

**Introduction:** One of the most important components of emergency medical services (EMS) which plays a major role in reducing mortality and disability of victims is access to healthcare services. Equitable access to healthcare services requires providing essential and accessible services for all people without imposing any financial burden on them. The aim of this study was to determine and prioritize the components of access to EMS in Iran.

**Methods:** This study is a descriptive and cross-sectional study that has done in the first half of 2010 in Iran using DEMATEL method. The data about the access components of EMS in different systems was collected using researcher-made questionnaire. Afterwards, a sample of 30 Iranian experts in EMS who were selected using purposive sampling method were asked to evaluate the suggestions and revise the collected components using their scientific, practical and visionary experience. Then, the components were identified using Delphi method. The priority of components was depicted using MATLAB and Edraw Max 5 softwares.

**Results:** Capitation, third party insurance, insurance for non-traffics cases, the budget of some especial organizations such as the tobacco companies, etc., distribution of facilities based on the characteristics of each region and distribution of facilities in urban areas based on the population density were determined as access components. Also, The components of third party insurance and capitation were determined as the most affecting and affected access components with the coordinates (1.44 and 1.44) and (0.09 and -0.09) respectively, on the pre-hospital emergency access components graph.

**Conclusion:** Given the limited resources to access EMS, alternatives should be taken into consideration. Considering the high number of deaths from traffic accidents in Iran, part of car insurance premiums should be allocated to provide emergency services for people injured. Some Iranian organizations such as tobacco companies, oil manufacturing companies, etc. have a major role in cardio-vascular diseases outbreaks. Given that cardiovascular diseases are the most common cause of deaths in Iran, such organizations should pay costs of these diseases spreads and outbreaks.

Keywords: EMS, access, components, healthcare services

#### Introduction

Equitable access to healthcare services requires providing essential and accessible services for all people without imposing any financial burden on them (1). Emergency Medical Services (EMS) is a part of these healthcare services and as an integrated system, including access to healthcare, care in community and during transportation to a hospital and providing care in the hospital (2).

Unintentional accidents after Cardio-vascular diseases are the second cause of mortality in Iran to the extent that the mortality rate is more than world average (3). Given that over 50% of deaths occur at the first hour of an event, access to healthcare should have the high priority for development of EMS (4).

Most of the world's populations (over 50 to 75%) live in the areas that don't have any formal access to EMS (5-6). In the most of developing countries especially in Iran, due to inadequate access to emergency medical services, accident injuries are transported by vehicles other than ambulances (7) so that based on a study findings, only 14% of the injured have been transported by ambulances. The findings of some studies show that the access to EMS plays an important role in reducing deaths from traffic accidents (8-10). Reducing the outcomes of accidents is possible through providing effective emergency medical services (11). Reducing the response time can, also, result in decreasing in the severity of injuries and the number of preventable deaths so that the risk of deaths and the severity of injuries increase after the golden hour (12).

A key factor in emergency medical services is transferring patients from the scene because the lack of emergency transportation vehicles could slow down the EMS. Therefore, access to EMS in the shortest possible time should be pursued (7).

The findings of a study conducted in Arizona showed that the insurance component was a predictor of access to medical care (13). Also, the findings of a study conducted in Brazil showed that the development of ambulance services was a major factor that led to reduced deaths from 7.1% to 5.9% (14).

During recent years, human and physical resources in EMS have been developed in Iran, but this development has not been balanced and has had little effects on reducing deaths from accidents (15). Haghparast in a research has studied the access to EMS and related factors (including ambulance and telecommunications bases and their staff) in Iran using the indicators of inequality, Lorenz curve and Gini coefficient and has concluded that resources and facilities have been distributed unevenly and unequally among the provinces (16). The findings of another study, also, conducted in Iran showed that in a province the response time in city locations and interurban locations were 5 minutes and 10.6 minutes, respectively (17).

The findings of a study showed that improper and inadequate distribution of resources in Iran had been a major barrier for providing EMS. Mismatch between the number of ambulances, the number of bases, and the size and density of population was associated with poor and improper distribution of resources in emergency medical services (18).

Emergency medical services have grown rapidly and are constantly evolving. This evolution and development is required in our country, too. Access to EMS is an important factor for reducing deaths from accidents. However, considering the resource constraints, priorities for greater access to resources and the development of emergency medical services should be identified. This study aimed to prioritize the components of access to EMS in Iran.

#### **Materials and Methods**

The current study is a descriptive and cross-sectional study that has done in the first half of 2010 in Iran using DEMATEL method (a group decision-making technique). The data about the transportation components of EMS in different systems was collected using a researchermade questionnaire. Afterwards, a sample of 30 Iranian experts in pre-hospital emergency who were selected using purposive sampling method were asked to evaluate the suggestions and revise the collected components using their scientific, practical and visionary experience. The choice criteria of these selected experts were being academic and having experience or administrative responsibilities in emergency medical services. The components were identified using Delphi method. Then, the components were determined using SPSS 17.0 software One-Sample T-Test and the experts were asked to indicate the priority of components and, finally, the related graph was depicted using MATLAB and Edraw Max 5 softwares.

The DEMATEL technique is based on oriented graphs diagrams which can divide effective components into the groups, cause and effect. These diagraphs depict the dependency relationship between the components of a system. Causal diagraphs are obtained through regular pairs ( $D_K+R_K, D_K-R_K$ ) in which the horizontal (D+R) and vertical (D-R) axes called, respectively, the "prominence" which can be made by adding  $D_K$  to  $R_K$ , and the "relation" which can be made by subtracting  $R_K$  from  $D_K$ . If the quantity of ( $D_K-R_K$ ) is positive, that criterion will relate to the cause group and if it is negative, the criterion will relate to the effect group. Therefore, the causal diagraphs can convert complex causal relationships among components into a visible structural model and provide an accurate insight for resolving the considered issues. Furthermore, the right decisions can be made using causal diagrams and recognizing the differences between cause and effect criteria (19-20).

#### Results

According to the initial findings of this research, capitation, third party insurance, insurance for non-traffics cases, the budget of some especial organizations such as the tobacco companies, etc, distribution of facilities based on the characteristics of each region and distribution of facilities in urban areas based on the population density, were suggested. (P=0.001) (Table1).

Also, the results of this study showed that the third party insurance (P1) and insurance for non-traffics cases (P2) certainly penetrated into the system, which were placed in the cause group as the first and second priorities. While the components of the budget of some especial organizations such as the tobacco companies, etc. (P3), distribution of facilities based on characteristics of each region (P4), distribution of facilities in urban areas based on the population density (P5) and capitation (P6) were partially influenced, and were in the effect group as third to sixth priorities (Table 2 and Figure 1).

Third party insurance and capitation were determined as the most affecting and affected access components with the coordinates (1.44 and 1.44) and (0.09 and -0.09), respectively, on the pre-hospital emergency accessibility components graph.

### Discussion

This study was conducted to determine and prioritize the components of access to EMS in Iran using one of the operations research methods. In the pre-hospital emergency care, basic strategies should be considered and lack of resources should not be viewed as a barrier to effective care (21). Access levels to pre-hospital emergency resources are different among various countries and this has led to a wide range of differences in care provided in these countries (22) .Also, there is little knowledge about increasing pre-hospital emergency interventions, as well as, decreasing their costs (23).

Based on the findings of this study, capitation, third party insurance, insurance for non-traffic cases, the budget of some especial organizations such as the tobacco companies, etc., the distribution of resources and facilities based on the characteristics of each region, and the distribution of resources and facilities in urban areas based on population density have been identified as the components of access to Iran pre-hospital emergency care among which third party insurance is the most influential one.

The findings of studies show that one of the most basic components of access to EMS is the health insurance which has an important role in the decisions to use EMS. Therefore, this component is now a high priority. Also, based on the comprehensive coverage of pre-hospital emergency medicine regulations in Iran, the Ministry of Health and Medical Education in coordination with the President Deputy Strategic Planning and Control was required to submit a plan on how to use insurance industry for providing EMS to the Cabinet for approval within six months (13, 24).

One of the high priority components in this study is the insurance for non-traffic cases. Based on the findings of Symons' study, access to EMS was one of the important components whose one of factors was that access to these services depended on the willingness of municipalities to pay for them and these services were provided publicly and privately. Also, all insured citizens in the region should be under coverage of the equal health insurance services in terms of conditions and period of validity. According to Canada regulations, using healthcare should not be delayed due to financial or any other obstacles, although patients themselves undertake to pay most costs in the limited subsidy system (25).

According to the findings of Pozner's study, EMS is provided based on different models in the US and financial factors partly make a difference to the services based on the way they act. EMS system can operate directly by the people or through third party providers such as private companies. In the UK, patient transportation services for non-traffic cases are funded on the basis of commercial agreements with local hospital authorities or boards of health or, in some cases, directly by government contracts (26).

Major differences in population density, geography and other conditions may require different types of EMS systems. Therefore, there can be significant differences between the medical services provided in a state with those of other states. In a country like Norway, considering its population density, the existence of small towns and villages that are far from hospitals and medical centers has resulted in distributing resources and facilities based on the characteristics of each region and the population density which confirms current study findings (27).

### Conclusion

Given the limited resources to access emergency medical services, alternatives should be taken into consideration. Considering the high number of deaths from traffic accidents in Iran, part of car insurance premiums should be allocated to provide emergency services for people injured. Some Iranian organizations such as tobacco companies, oil manufacturing companies, etc. have a major role in cardio-vascular diseases outbreaks. Given that cardiovascular diseases are the most common cause of deaths in Iran, such organizations should pay costs of these diseases spreads and outbreaks.

In order to have the suitable and proper access to EMS Iran, the distribution of resources and facilities should be based on the specific characteristics of each region. For example, establishing pre-hospital emergency bases in impassable regions neither help timely access nor is economical. Instead, it is better to use the helicopter. Also, little attention has been paid to the population density in urban areas in order to follow the principle of public access to services, and special attention is needed on this principle.

Modeling to determine the proper positions of the road and urban bases, designing the required strategies to participate the private sector in delivering EMS and creating assessment models for allocating resources to different areas using simulation are very important for future research works in the field of access to EMS.

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	Expert Responses							
Components	Completely agreed	agreed	Without any Responses	Opponent	Completely Opponent	Mean	SD	P-Value
Capitation	22	8	0	0	0	4.73	0.43	
Third party insurance	12	18	0	0	0	4.26	0.49	_
Insurance for non-traffics cases	10	18	2	0	0	4.26	0.58	
The budget of some especial organizations such as the tobacco companies, etc.	20	9	1	0	0	4.63	0.55	0.0001
Distribution of facilities based on the characteristics of each region	6	24	0	0	0	4.80	0.40	_
Distribution of facilities in urban areas based on the population density	27	3	0	0	0	4.90	0.30	-

# Table1: The results of the expert opinions about access components to pre-hospital emergency services in Iran

# Table 2: The hierarchy of affecting and affected components of access to pre- hospital emergency services in Iran

Components	D	R	D+R	D-R
Capitation	0	0.09	0.09	-0.09
Third party insurance	1.44	0	1.44	1.44
Insurance for non-traffics cases	1.02	0.24	1.26	0.78
the budget of some especial organizations such as		0.82	1.36	-0.28
the tobacco companies, etc.				
Distribution of facilities based on the characteristics of	0.24	0.72	0.96	-0.48
each region				
Distribution of facilities in urban areas based on the	0.16	0.72	0.88	-0.56
population density				



Figure 1: The prioritization of access components to pre-hospital emergency in Iran