A Review and Emphasis on Emergency Healthcare Systems of Turkey

By Görkem Sarıyer & Mustafa Gökalp Ataman

Yasar University, Turkey

Abstract- Emergency health care systems are vitally important. The effective planning of these systems clearly reduces the response time, which is the main factor in saving lives. Thus, it is important to develop this an interactive area of research.

The main goal of this study is to review the state of research on emergency health care systems of Turkey. Furthermore, by highlighting the deficiencies in the Turkish literature in the area, this study aims to stimulate the, interest of researchers.

This study reviews the literature, classifying studies into three areas: evaluation of 112 emergency ambulance services use, determining on optimal ambulance locations, and predictions of call volume.

Although there are some studies related with first two areas subjects, it is important to draw attention to the last of these.

Keywords: ambulance, deployment, emergency medicine, health care, local health, prediction.

GJMR-K Classification: NLMC Code: W 74.1

AREVIEWANDEMPHASISONEMERGENCYHEALTHCARESYSTEMSOFTURKEY

Strictly as per the compliance and regulations of:

A Review and Emphasis on Emergency Healthcare Systems of Turkey

Görkem Sarıyer [α] & Mustafa Gökalp Ataman [σ]

Abstract- Emergency health care systems are vitally important. The effective planning of these systems clearly reduces the response time, which is the main factor in saving lives. Thus, it is important to develop this an interactive area of research.

The main goal of this study is to review the state of research on emergency health care systems of Turkey. Furthermore, by highlighting the deficiencies in the Turkish literature in the area, this study aims to stimulate the, interest of researchers.

This study reviews the literature, classifying studies into three areas: evaluation of 112 emergency ambulance services use, determining on optimal ambulance locations, and predictions of call volume.

Although there are some studies related with first two areas subjects, it is important to draw attention to the last of these.

Keywords: ambulance, deployment, emergency medicine, health care, local health, prediction.

I. Introduction

Emergency health-care systems is a chain of different tasks, which start with emergency help and rescue, and are followed by with ambulance transportation, emergency services of hospitals, and rehabilitation services (1). Ambulance transportation plays a key role in this chain. Ambulance transportation of emergency health-care systems exists in all developed and developing countries. In the United States, the emergency call number is 911, while in in European countries and Turkey the number 112 is used (2).

The importance of emergency health-care systems is unquestioned in a society since appropriate and efficient first aid intervention saves lives. Time is the most vital factor which affects the efficiency of first aid intervention; minutes, even seconds can save lives. Therefore, this is an interactive area of research which needs further attention.

In recent years, there has been an increased awareness of emergency health-care systems, especially 112 ambulance systems in Turkey. There are, however, only a limited number of published articles in this area. The main goal of this study is to review this literature, in an attempt to highlight the need for further research which improves the local health.

In following parts of this study, literature is reviewed based on different sub-topics. The categorization of these sub-topics is as follows: evaluation of 112 emergency ambulance services use, determining on optimal ambulance locations, predictions of call volume.

II. Subject Related Topics

a) Evaluation of 112 emergency ambulance services use

In emergency health-care systems, this sub-topic is widely researched in Turkey. In a retrospective study, calls to the number112 received at Bursa State Hospital Emergency Service within the period of January 1993-May 1995 are analyzed. The analysis showed that call frequencies increase according to the age of the patient; almost 50% of the cases involve older people. The analysis also summarized the frequent reasons of calling as: 78.3% cerebrovascular disease, 13% cardiovascular disease, and 7.4% traffic accident (3). Another study was designed to determine the clinical characteristics of patients who applied to 112 services with dermatological disorders in Kayseri in 2011. This study showed that in 112 service calls for dermatological disorders were relatively common (4). The use of 112 emergency ambulance services in Konya and Turkey in general between the years 2007 and 2009 was compared in (5). According to this study, approximately 70% of the ambulance calls were carried out for medical purposes, while the following most frequent reason was traffic accidents. Konya was found to have results that are close to or above the country average for each evaluated criteria, such as timely intervention, transfer to hospital, ex-left onside, ex-transfer to morgue, mission aborted, transfer by another vehicle, wrong calls, transfer from hospital to another (5).A study contucted by Yıldız and Durukan has analyzed patients transported to emergency departments of hospitals via ambulances. Due to the continuous need for ambulances to transport patients to emergency departments, this study aimed to determine the appropriateness of transportation via ambulances. For this aim, a prospective study was prepared, which surveyed 524 patients transported to Fırat University Faculty of Medicine Emergency Department between 26th May of 2004 and 5th September of 2004. The mean

Author α : PhD- Yasar University Business Administration.
e-mail: gorkem.ataman@yasar.edu.tr
Author σ: MD: Bayburt State Hospital Department of Emergency Medicine.

arrival time in this study, was 32.17 minutes. Patients were classified as trauma, medical emergencies, or cardiopulmonary arrest. This study concluded that, during ambulance transportation, transportation rules, airway safety, and cervical immobilization were not taken into consideration appropriately (6). Another study was performed to evaluate 112 call services in another province of Turkey, Tekirdağ. The observations of this retrospective study covering the years 2001, 2002, and 2003 suggested that use of 112 services increased by 33% between 2001 and 2002, and 27% between 2002 and 2003. Most frequent reasons for using these services were determined as trauma and cardiovascular orders (7). In their study, Zenginolet. al. examined ambulance orders between the years 2006-2008 in Gaziantep city. According to this study, the maximum number of calls was observed from 6-25 years old for males and above 65 years old for females, call numbers increased every year, and most frequent reasons were classified as medical reasons and traffic accidents (8). In order to evaluate the level of awareness of the emergency call number and utilization of emergency services, Ekşi and Torlakpiloted studies in two Turkish cities, İzmir and Antalya.616 respondents from İzmir and 291 respondents from Antalya were surveyed using face-to-face interviews.In this study, the level of awareness of the availability of the ambulance emergency service was observed as 89.4%, where it was only 13.5% for the coast guard. Additionally, males, the young and educated were found to use these services more frequently compared to the other sections of the population (9).

Use of 112 services by an older people is specifically analyzed in literature. Among these, the aim of (10) wasto evaluate the ambulance use in İzmir between 2004 and 2005. According to this paper, the use of ambulance services by older people is 5 times higher than younger people, and the most frequent reasons are medical conditions and traffic accidents. Furthermore, ambulance use in Turkey, even in İzmir (1.48%), is much lower compared to developed countries, and therefore it is important to develop pre-hospital emergency services.Another study has mentioned that during the first 50 years of 21st century, the world population aged 65 and older is expected to increase three-fold. Thus, caring for old people is one of the most important goals of health-care systems. This descriptive study surveyed patients 65 years and older, who used the 112 services in a province of Turkey, Samsun. This study has shown that cardiovascular, neurologic, and respiratory problems were the most frequent reasons of 112 ambulances use, and highlighted the importance of monitoring and reporting the use of this service (11). In a final descriptive study, patients of 65 years of age and over who used 112 services in Sivas in 2006 were surveyed. This study has shown that the highest level of requests occurred in

January between 10:00 and 12:00 am, and the most common reasons for calls were cardiovascular, neurological, and respiratory problems (12).

b) Determining on optimal ambulance locations

Considerable attention has been paid to the problem of how to best deploy ambulances within a municipality to minimize the response times to emergency calls.In determining the optimal location for ambulances, some optimization models and geographic information systems (GIS) have been proposed in the literature. In their study, Selim and Özkarahan (13) mentioned the need to either increase the number of vehicles or to improve the deployment of existing vehicles in order to decrease the response time of ambulances, which is an important performance measure for emergency service systems. Sinceincreasing the number of vehicles is not always feasible, due to budget constraints, the more efficient deployment of ambulances is more feasible. In their paper, Selim and Özkarahan have proposed a linear deterministic covering-based location model based on two models, the Maximal Backup Coverage Model (14) and the Capacitated Maximal Covering Model (15), respectively created by Hogan and Revelle, and Pirkul and Schilling. Selim and Özkarahan finally tested their model through the sequential solution technique of multiple objective decision making. This model can be used to determine ambulance locations or deployment (13). Another study mentioned that especially for the crowded cities with heavy traffic such as İstanbul, the planning of ambulance location is crucially important. The Backup Double Covering Model, which depends on Set Covering and Maximal Covering location problems, was proposed in the study. It was only possible to obtain the optimal solution for the single period model, whereas for large scale problems with a large number of decision variables and constraints, this model failed to obtain optimal solutions. Thus, a further three heuristic methods have been applied to find the optimal ambulance locations of İstanbul (16).

Geographic Information Systems is also widely used in ambulance deployment. GIS was used in analyses to determine the optimum route for ambulances to reach the incident scene in Isparta. Network topology map of Isparta urban center was constructed to determine optimum routes for ambulances according to various scenarios through ArcGIS 9.0 software. These analyses suggested the creation of new 112 ambulance station points in the required locations (17). In a similar study, a database was developed for traffic accident records of Isparta-Antalya-Burdur national road between 1996-1999, using MS Excel software. Since special coordinates were required, rather than GIS, GPS measurements were made for each traffic accident site. The observations of this study can be summarized as follows: traffic

accidents generally occurred in tangent sections of roads, there was an increase in traffic accidents in day-time and clear weather conditions, , and fatal accidents generally occurred on the periphery of the city of Antalya (18). In their study, Erden and Coşkun determined optimal locations of fire stations, and have conducted a multi-criteria site analysis, based on mentioned criteria weights in GIS environment. Sensitivity and robustness analyses were also given in the study. They concluded that, using these models, decision-makers can find optimal locations of fire stations (19).

c) Predictions on Call Volume

This issue is important in planning of Emergency Health Care Systems. In order to plan ambulances effectively, it is important to know not only the optimal locations of the ambulances, but also demand for a specific time interval. To estimate demand for ambulances for a specific time interval, the total number of emergency calls in this interval needs to be estimated. In addition,accurate predictions on call volume allows effective 112 Call Center planning. Combining these benefits, the conclusion is that accurate call volume predictions considerably reduces the response time of ambulances.

Studies have been developed to predict emergency calls or arrival rate. A benchmark study documented an emergency service, using a simple moving average to twenty previous observations: the previous four weeks, from the previous five years (20). Matteson et. al. introduced a more complex method which combines integer-valued time series models with dynamic latent factor structure, to forecast emergency call arrival rates. In order to quantify the impact of reduced forecast errors, they designed a queueing model simulation. This simulation model performed better when the call volume predictions used were more accurate (21). Another study developed time series models of call volume to the emergency medical service in a Canadian city with the objective of offering simple and effective models which can be used in simulating the emergency services (22). Trudeau et. al. classified four main areas of ambulance service operations planning : demand forecasting, scheduling, optimal locations of ambulance points, and simulation as an evaluation tool (23) .

Although prediction on call volume of emergency services is an important subject, it has not received any attention in Turkey so far. One of the main goals of this paper is to highlight this deficiency in the literature, in order to stimulate research interest.

III. Conclusions

Studies on Emergency Health Care Systems of Turkey are reviewed in this article. Since the awareness of people on these systems has just been started to increase, there are only a few of published studies in

this area which are gathered around the two categories of evaluation of 112 emergency ambulance services use, and determining on optimal ambulance locations. However, planning the Emergency Health Care Systems in an effective manner, which sharply decreases the response time of ambulances, considerably depends on demand forecasting or the 112 call volume prediction. Thus, this study aims to draw attention of researchers on this deficiency while reviewing the literature.

a) Conflict of interest

No conflict of interest was declared by the authors.

References

1. Aksoy, F;Ergün, A. Ambulance in emergency medicine. *Turkish Journal of Trauma and Emergency Surgery* 2002; **8** :160-163
2. Çakır, Z;Bayramoğlu, A;Aköz, A;Türkyılmaz, Ş;Emet, M;Uzkeser, M. Analysis of patient forms of pre-hospital emergency medical services. *Journal of Academic Emergency Medicine* 2012;**16** : 23-26.
3. Yurteri, H; Saran, A;Özgün, İ. Evaluation of the patients transported with the emergency service ambulances. *Turkish Journal of Trauma and Emergency Surgery* 1996; **2** (2):204-207.
4. Özyurt, K; Bozkurt, S; Öztürk, P;Baykan, H;Okumuş, M. Evaluation of dermatological disorders among admittances to a 112 emergency services in a year. *Journal of Clinical and Experimental Investigations* 2013; **4** (1):47-50.
5. Özata, M;Toygar, Ş;Yorulmaz, M;Cihangiroğlu, N. Comparative analysis of using 112 emergency ambulance services in Turkey and the province of Konya. European *Journal of General Medicine* 2011; **8** (4):262-267.
6. Yıldız, M;Durukan, P. Analysis of patients transported to emergency department via ambulance. *Turkish Journal of Emergency Medicine* 2004; **4** (4):144-148.
7. Oktay, İ;Kayışoğlu, N. The assessment of emergency health services in Tekirdağ province. *STED* 2005; **14** (2):35-37.
8. Zenginol, M; Al, B;Genç, S;Deveci, İ;Yarbil, P; Yılmaz, D;Sarcan, E; Yıldırım, C. 3 yearly study results of 112 emergency ambulances in the city of Gaziantep. *Journal of Academic Emergency Medicine* 2011; **10** : 27-32.
9. Ekşi, A;Torlak, SE. Utilization of emergency services during the single European emergency call number pilot. *Turkish Journal of Emergency Medicine* 2011; **11**(4):149-154.
10. Kıdak, L;Keskinoğlu, P;Sofuoğlu, T;Ölmezoğlu, Z. The evaluation of 112 emergency ambulance services in İzmir. *Journal of General Medicine* 2009; **19**(3):113-120.

11. Dündar, C;Sunter, AT;Cambaz, S;Çetinoğlu, E. Emergency service use by older people in Samsun, Turkey. *Advances in Therapy* 2006; **23**(1):47-53.

12. Nur, N; Demir, ÖF;Çetinkaya, S;Tirek, N. Evaluation of the 112 emergency service use by older people. *Turkish Journal of Geriatrics* 2008; **11**(1):7-11.

13. Selim, H; Özkarahan, İ. Acilservisaraçlarıyerleşimi-ninbelirlenmesindeyenibir model. *EndüstriMühendis-liğiDergisi* **14**(1):18-27.

14. Hogan, K;Revelle, C. Concepts and applications of backup coverage. *Management Science* 1986; **32**:1434-1444.

15. Pirkul, H; Schilling, DA. The maximal covering location problem with capacities on total workload. *Management Science* 1991; **37**:233-248.

16. Çatay, B; Başar, A;Ünlüyurt, T. Planning the locations of the emergency medical service stations in İstanbul. *EndüstriMühendisliğiDergisi* 2008; **19**(4):20-35.

17. Morova, N;Şener, E; Terzi, S. Detremining the optimum routes and querying service areas of 112 ambulance stations of Isparta using Geographic Information Systems. *SDU International Techno-logical Science* 2011; **3**(3):1-13.

18. Karaşahin, M; Terzi, S. Determination of hazarodus locations on Isparta-Antalya-Burdurhigways through GIS. *Journal of Engineering Sciences* 2003;**9**(3):305-311

19. Erden, T;Coşkun, MZ. Acil durum servislerininy-erseçimi: Analitikhiyerarşiyöntemi ve CBS entegrasyonu. *İTÜ Dergisi/Mühendislik* 2010; **9**(6):37-50.

20. Setzler, H;Saydam, C; Park, S. EMS call volume predictions: A comparative study. *ComputOper. Res* 2009; **36**:1843-1851.

21. Matteson, DS; Mathew, W; Dawn, BW; Shane, GH. Forecasting emergency medical service call arrival rates. *The Annals of Applied Statistics* 2011;**5**:1379-1406.

22. Channouf, N;L'Ecuyer, P;Ingolfsson, A;Avramidis, AN. The application of forecasting techniques to modeling emergency medical system calls in Calgary, Alberta. *Health Care Manage Sci* 2007; **10**:25-45.

23. Trudeau, P; Rousseau, JM; Jacques,AF;Choquette, J. An operations research approach for the planning and operation of an ambulance service. *INFORMS* 1989; **27**(1):95-113.