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Innovation in the use of motor ambulance for prehospital emergency care

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Abstract:

BACKGROUND: Prehospital emergency care system is one of the important parts of the health system. Heavy traffic, increasing urban population, and growing demands for prehospital emergency services are challenges faced by this section of the health system. One of the approaches to deal with this issue is using motor ambulances.

AIMS: This study aims to investigate the missions of motor ambulances, ambulances, and the effects of motor ambulance services on response time and ambulance missions.

MATERIALS AND METHODS: This applied research has been designed as a descriptive and cross-sectional study. Overall, 267,836 missions carried out by ambulances and motor ambulances of Tehran emergency medical service (EMS) Center in the years 2014 and 2015 were investigated. The data were gathered personally by visiting Tehran EMS Center. The data were analyzed by Excel (2013) software.

RESULTS: The average response time for ambulances and motor ambulances were 16 min and 14 min and 13 s, respectively. Most of the ambulance and motor ambulance missions were reportedly due to weakness (20%) and heart problems (16%). In 57% of ambulance missions and 71.5% of motor ambulance missions, the patients refused to being transferred to the hospital. Most of the transport missions to hospital (24%) were caused by traffic accidents.

CONCLUSIONS: According to the results, the response time was higher than the national standards. Locating motor ambulances on the streets and outside emergency stations during peak traffic times decreased the response time by 2 min and by providing the necessary services in the scene and transferring fewer patients to the hospital, it is possible to provide further services by assigning ambulances to more urgent missions. Thus, it is recommended to employ more seasoned staff, multiply motor ambulances, and locate motor ambulances precisely to decrease response time and also at a lower cost more citizens are provided with prehospital care.

Keywords:

Ambulance, emergency medical services, motor ambulance, prehospital emergency care

Introduction

The emergency medical services (EMSs) system is at the forefront of health-care provision and is now considered as one of the most important functions of the health system.^[1] This system consists of a network of coordinated services; it aims to save the injured and patients' lives and prevent further injuries using experienced

staff. They try to deliver basic medical services in triage and emergency situations and transport patients and the injured to the nearest equipped medical centers.^[2] Prehospital emergency services can play a significant role in enhancing survival rate and preventing serious injuries to patients and the injured.^[3] The need to transport patients to medical centers has been increasing significantly since the last decade.^[4-6] For instance, the emergency centers' yearly phone call rates in the

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Asian Pacific ocean countries were 5%–10% and it was on the rise from 2002 to 2012.^[7] But for all of these calls and transfers, there is no need for EMS, and it has been shown that a large percentage of these have been nonemergent.^[8] There were numerous reports in the United Kingdom and the US regarding unnecessary emergency phone calls for ambulance missions.^[9,10] A study conducted in the US showed that 30%–50% of answers to EMS phone calls were not of emergency or life-threatening cases.^[11] A study in the UK showed that 50% of the patients transported by EMS ambulances to hospitals or referred to clinics were released without any significant clinical procedure.^[12] A study in Iran also showed that 28.9% of patients with internal diseases dispatched by prehospital emergency services did not need urgent transmissions.^[13] Unnecessary emergency missions and misuse of prehospital emergency services consume the limited resources at present, making the patients with real emergency to wait for proper services, and this consequently leads to increased death rates and disease side effects among patients needing emergency services. Misuse or overuse of EMS is one of the major complaints voiced by prehospital emergency service staff that affects their performance and job satisfaction negatively.^[14] The average annual growth rate of prehospital emergency missions is over 16%. Thus, the number of prehospital emergency missions is doubled every 6 years. It is necessary to double the staff for prehospital emergency services every 6 years in Iran. The depreciation of ambulances, equipment, and the occupational burnout of staff impose considerable costs on the Iranian health-care system.^[13] Thus, the attempt is to perform these duties by spending less, but without reducing service quality and incurring injury to people. Several approaches have been suggested to overcome this issue; one of these approaches is the use of motor ambulances. In Iran, the EMS system is responsible for the free transportation of patients suffering from internal diseases or trauma. Tehran, the Iranian capital, is highly crowded and a city, with heavy traffic. The Tehran EMSs center receives around 7000 phone calls daily. After phone triage, 1300 cases lead to technician dispatch.^[15] There are 140 emergency stations in Tehran. The city has one dispatch center that receives all emergency phone calls through the number 115. Regarding the large number of calls, the need to organize ambulance dispatch, prevention of radio jamming, and confusing missions at the dispatch center, Tehran is divided into four geographical areas, namely, Northern, Southern, Eastern, and Western. The missions in each area are announced to their stations by separate operators at the dispatch center using separate radio frequencies. On an average, each area has 30 emergency stations; based on the location and the number of available staff, each station has two ambulances, two ambulances and one motor ambulance, one ambulance and one motor

ambulance, or just one ambulance. Tehran emergency centers have been running motor ambulances for several years now, but their capabilities were not used systematically. In order to respond to the problems mentioned above, such as long response time, personnel and equipment burnout, shortages of human and financial resources, and use of all capabilities of motor ambulances, a new plan was introduced. It was proposed to use motor ambulances round the clock (24/8) in 2015. According to this proposal, motor ambulances will be located at designated areas in the city and on the streets outside the stations, and they will be dispatched at traffic and emergency phone call peak time, namely, from 10 am to 2 pm and 6 pm to 10 am. The on-street location of the motor ambulances removes the time for mission announcement to the station and ambulance dispatch. By implementing this proposal, motor ambulances were on call for 4 h; then, they would have a 4-h break, and this cycle continued. In addition, the dispatch unit was obligated to assign all emergency phone calls and missions first to motor ambulances, except for cases of psychiatric disorders, or calls from clinics. This proposal has been implemented for a year. The aim of the present study was to investigate missions of motor ambulances, ambulances, and the effects of motor ambulance services on response time and ambulance missions.

Materials and Methods

This applied study was conducted using a descriptive and cross-sectional design in Iran's capital city of Tehran. This study was approved by the emergency department of the country and emergency center of Tehran. Eastern Tehran region with the most number of motor ambulances (17 vehicles) was chosen as the study area. This region has 31 stations; two of these stations are located outside the city and are not equipped with motor ambulances, and they were crossed out of the study. Thus, the data on missions were gathered from 29 stations (40 ambulances) and 17 motor ambulances using census procedure. The data were obtained by studying mission computerized forms that are kept at the dispatch center. Excel 2013 was used to analyze the data. We used descriptive statistics including frequency, mean, and standard deviation. Overall, 267,836 mission files were investigated carefully. Due to the failure to register the time interval in some missions by the dispatch computer system, in order to compare the "response time," the data were analyzed as to the registered time of dispatch and the time of arrival at the scene. In order to reduce the effects of interventional factors, the response time was calculated for both ambulances and motor ambulances within the same intervals, from 10 am to 2 pm and 6 pm to 10 pm. The interval between the time of an emergency phone call and the arrival time of an ambulance or motor ambulance at the scene is called the response time. Data

on missions without registered dispatch and arrival time were crossed out of the temporal analysis; consequently, 101,140 mission files were investigated. All files were studied for investigating dispatch reasons and missions results.

Study conduct period

The study on motor ambulances was conducted from August 23, 2015 to August 22, 2016. The study on ambulances was conducted from August 23, 2014 to August 22, 2015 (before) as the interval before using motor ambulances and from August 23, 2015 to August 22, 2016 (concurrency) as parallel to using motor ambulances.

Results

The missions fulfilled by ambulances and motor ambulances were investigated within the above-mentioned time periods. Number of missions and the average response time are shown in Table 1. The data under study included missions whose dispatch and arrival time of ambulances and motor ambulances were registered.

The reasons for dispatching ambulances and motor ambulances were investigated within the above-mentioned periods as well. Among the 32 dispatch reasons recorded in the dispatch center forms, five dispatch priorities are presented in Table 2. Weakness was the top dispatch reason in the 1st year (20%).

The results of ambulance and motor ambulance missions within the study periods are presented in Table 3. As shown, most of the ambulance and motor ambulance missions led to lack of cooperation and refusal for hospital transfer.

Table 4 shows the five priorities reasons for patients' transfer to hospitals by ambulances. Traffic accident injuries accounted for the top reason (23%) for dispatches.

Top five reasons for requesting ambulances by motor ambulances are shown in Table 5. Traffic accidents were the top reason (26.9%) for requesting ambulances.

Discussion

Improving EMS performance is one of the goals of the health-care system. There are numerous indices to investigate this performance; response time is one of these indices. Studies showed that delay in response time is one of the most important causes of violence against EMS staffs.^[16,17] The present study showed that the average response time by ambulances at peak traffic hours in Tehran increased from 15 min (2014) to 16 min (2015); however, no discrepancy was observed within the 24-h period. Based on the regulation for the organization of comprehensive coverage of EMSs in the country as approved by the Iranian Cabinet of Ministers in 2007, the response time for prehospital emergency services in the cities was determined to be <8 min (in 80% of cases) and <15 min on roads (in 80% of cases).^[18]

Table 1: Number of missions and average response time by ambulances and motor ambulances

Time period	Vehicle	Total number of missions	Investigated missions		Investigated missions from 10 AM to 2 PM and 6 PM to 10 PM	
			n (%)	Average response time	n (%)	Average response time
Before*	Ambulance	128,241	53,888 (42)	14 min 41 s	22,461 (17)	15 min 8 s
Concurrency**	Ambulance	118,879	44,110 (37)	14 min 48 s	14,408 (12)	16 min
Concurrency**	Motor ambulance	20,709			3142 (15)	14 min 13 s

*Before: August 23, 2014 - August 22, 2015 (absence of motor ambulance), **Concurrency: August 23, 2015 - August 22, 2016 (presence of motor ambulance)

Table 2: Reasons for dispatching ambulance and motor ambulance based on the main complaint

Time period	Vehicle	Total number of missions	Weakness, n (%)	Heart problem, n (%)	Traffic accident, n (%)	Respiratory problem, n (%)	Trauma, n (%)	Cardiac arrest, n (%)	Etc., n (%)
Before*	Ambulance	128,248	25,505 (20)	19,789 (16)	15,594 (12)	13,362 (11)	8790 (9)	1895 (1.5)	43,313 (30.5)
Concurrency**	Ambulance	118,879	18,391 (16)	20,254 (17)	16,408 (14)	13,946 (12)	9512 (8)	2005 (1.7)	38,363 (31.3)
Concurrency**	Motor ambulance	20,709	3618 (17.5)	3662 (18)	2283 (11)	2354 (11.3)	1949 (10)	263 (1.2)	6580 (31)

*Before: August 23, 2014 - August 22, 2015 (absence of motor ambulance), **Concurrency: August 23, 2015 - August 22, 2016 (presence of motor ambulance)

Table 3: Results of the dispatch of ambulances and motor ambulance

Time period	Vehicle	Total number of missions	Transport to hospital, n (%)	Hospital transfer refusal, n (%)	Outpatient visit, n (%)	Death, n (%)	Etc., n (%)
Before*	Ambulance	128,248	35,997 (28)	74,975 (58.4)	2262 (1.7)	2569 (2)	12,445 (10)
Concurrency**	Ambulance	118,879	34,292 (28.8)	61,932 (52)	3688 (3)	2511 (2.2)	16,456 (13.8)
Concurrency**	Motor ambulance	20,709	Delivery to ambulance	14,817 (71.5)	665 (3.2)	35 (0.16)	1652 (7)

*Before: August 23, 2014 - August 22, 2015 (absence of motor ambulance), **Concurrency: August 23, 2015 - August 22, 2016 (presence of motor ambulance)

Table 4: Reasons for transport patients to hospital by ambulance based on the chief complaint

Time period	Total number of patient transport	Traffic accident, n (%)	Heart problem, n (%)	Weakness, n (%)	Trauma, n (%)	Respiratory problem, n (%)
Before*	35,997	8004 (23)	5169 (14.3)	5054 (13.9)	4215 (11.5)	3184 (8.7)
Concurrence**	34,292	9044 (24.3)	4868 (14.1)	3509 (10.1)	9044 (11.1)	3125 (9.1)

*Before: August 23, 2014 - August 22, 2015 (absence of motor ambulance), **Concurrence: August 23, 2015 - August 22, 2016 (presence of motor ambulance)

Table 5: Reasons for requesting ambulances by motor ambulances on the basis of the chief complaint

Time period	Total number	Traffic accident, n (%)	Trauma, n (%)	Weakness, n (%)	Heart problem, n (%)	Respiratory problem, n (%)
Concurrence**	3540	952 (26.9)	520 (14.6)	396 (11.1)	373 (10.5)	369 (10.4)

**Concurrence: August 23, 2015 - August 22, 2016

The average response time in Mashhad, another crowded Iranian city with heavy traffic, was between 8 and 9 min in 2012 and 2013.^[19] According to reports by the Norwegian Ministry of Health and Social affairs, the average response time should be 8 min in cities and 25 min in rural areas for 90% of emergency phone calls.^[20] In the present study, the use of motor ambulances reduced response time significantly to 14 min and 13 s. Nonetheless, it is not up to national or international standards. It was expected that motor ambulances would reduce the response time more significantly, but it was not observed in the present study. This could be due to the lack or improper registration of temporal indices at the dispatch center because only 15% of motor ambulances and 37%–42% of ambulance missions have had registered temporal indices. Another reason is the nature of motor ambulance service; the technician has to manage the event by himself and maybe the situation does not allow him to establish communication with the dispatch center and announce the arrival time. There are also some other reasons such as inadequate number of motor ambulances compared to ambulances, improper location, and uneven distribution of motor ambulances in the target area. It was also expected that the use of motor ambulances in the 2nd year would reduce the response time of the ambulances, but it did not happen. This could probably be due to the reduced number of registered temporal indices in the 2nd year (compared to the previous year), increased number of patients being transported to hospitals (compared to the previous year), and the normal speed of ambulances on a limited number of missions due to the presence of motor ambulance technicians providing services at the scene. A study conducted by Peyravi *et al.* in Shiraz reported that the use of motor ambulances for prehospital emergency services reduced the time of arrival at the scene.^[21] Another study conducted by van der Pols *et al.* in the Netherlands showed that motor ambulances reduced response time down to 54 s.^[22] The results of a study in India by Patel and Ekkiswala showed that 63% of missions performed by motor ambulances had less response time than other rescue vehicles.^[23] Nakstad *et al.* reported that the average response time was reduced by motor ambulances (compared to ambulances).^[24] Fink

and Andoljšek conducted a study in the city of Ljubljana (Slovenia), they concluded that motor ambulances reduced the average response time by 50%.^[25] Soares-Oliveira *et al.* conducted a study in Portugal and reported that the response time by motor ambulances was less than that of other rescue vehicles in 63% cases.^[26] A study by Lin *et al.* in Taipei (Taiwan) also showed that the arrival time of motor ambulances was less than that of ambulances both at traffic and nontraffic peak hours.^[27] Our study found that time registration within these 2 years was done in less than half of the missions by ambulances; this number had decreased significantly in the 2nd year compared to the previous year. Thus, it is necessary to register the time more carefully and use other equipment such as Global Positioning System (GPS); the quality control center should pay more attention to these issues. In terms of the number of missions in 2015 compared to the previous year, a 7% growth (11,000 missions) was observed; this is consistent with the reports of previous studies.^[7] Maybe this growth is reason for increased average response time of the 2nd year compared to the 1st year, despite the increase in the number of stations, motor ambulances, and ambulances. The presence of motor ambulances just for 8 h in the 2nd year led to the performance of 20,000 missions and a decrease of 10,000 ambulance missions in comparison to the previous year. Consequently, it was possible to answer more emergency phone calls by spending less cost, on the one hand; and on the other hand, by decreasing the number of ambulance missions, it was possible for the ambulance technicians to rest and recover. In addition, more ambulances were available for other missions that required transporting patients to hospitals. The reasons for emergency phone calls are registered in a standard form that consists of 32 main complaints, and it is filled by the dispatch nurses. The study's findings showed that most of the emergency phone calls (20%) leading to ambulance dispatch pertained to weakness. This complaint also comprises some other complaints such as urinary system problems that are not included in the 32-complaint form of the dispatch center. In addition, each complaint not diagnosed by the dispatcher through a patient's verbal account is included in this complaint

form. This could be due to a lack of mutual understanding between the patients and the dispatchers, novice dispatchers, or inexperienced dispatchers due to the usual rotation of personnel at the dispatch center. A careful study should be conducted in order to reject or confirm the effects of a dispatcher's competence and skills. According to the results, 16% of the complaints pertained to heart diseases, thereby indicating the high incidence of cardiovascular diseases in the country; thus, it is necessary to take proper measures such as using motor ambulances to answer all emergency phone calls related to cardiovascular diseases. Regarding the cause of death in Iran, traffic accidents rank third after cardiovascular diseases and cancer.^[28] Since 12% of ambulance missions are due to traffic accidents, it is necessary to take preventive measures as well as train citizens to decrease these traffic-related injuries. It is also necessary to equip ambulances with immobilization and bandage devices. Emergency service personnel should be updated in terms of their knowledge and skills to deal with trauma and perform immediate medical response to reduce side effects and mortality. Shakeri *et al.* reported that the personnel of Tehran emergency service center are satisfactorily skillful at taking care of trauma patients.^[29] The different prioritization of the first five reasons for dispatching ambulances and motor ambulances could be because dispatchers used motor ambulances for cases of weakness and cardiac and pulmonary problems because these cases need immediate services compared to other cases. Thus, dispatchers prefer to prioritize motor ambulances for cases that need less transportation to hospitals. The present study further revealed that in 2015 (compared to the previous year), more ambulances were dispatched for traffic accidents. This could be the result of increased traffic accidents or increased awareness of citizens regarding prehospital emergency services as well as the fact that the transport and treatment of traffic accident injury victims are done free of charge. Özata *et al.* conducted a study in Turkey in this regard and reported that trauma and cardiovascular disease were the main reasons for emergency service phone calls.^[30] A Norwegian annual report (2001) showed trauma (41%) and cardiovascular diseases (27%) were the main causes of EMS missions.^[31] According to a report by the Turkish Ministry of Health (2006), trauma (25.7%) and heart diseases (19.5%) were the two major reasons for dispatching ambulances.^[5] As shown in Table 3, patients refused hospital transportation in more than half of the cases of ambulance dispatches (58%) in two consecutive years. Peyravi *et al.* reported that transport refusal was 36.2% in Shiraz.^[32] Transport refusal in cases of motor ambulances has increased in comparison to those related to ambulances (71.5% against an average of 57%). This could be due to more motor ambulance dispatches for cases of weakness and fewer dispatches for trauma and accidents because most of the people

involved in such cases are transported to hospitals. In contrast, a study by Soares-Oliveira *et al.* (2007) reported that in 18% of cases related to motor ambulances, there was no need for transport.^[26] The findings have shown that just 28% of patients are transported to hospitals by ambulances, whereas hospital transport by ambulances was between 54% and 74% in Turkey (2007–2009).^[30] In the US, 70% of emergency phone calls led to hospital transportation.^[33] According to Table 4, traffic accident injuries accounted for the most cases of hospital transportations in the 2 consecutive years; it increased in 2015 compared to the previous year. According to Table 2, traffic accidents ranked third in terms of the reason for an ambulance dispatch to a scene. However, such traffic accidents were the cause of most hospital transportations (roughly 25%). This could be due to the severity of injuries or the treatment of traffic accident injuries free of charge. Weakness was the top reason for ambulance dispatches, but it ranked third as the reason for hospital transportations. It is interesting to note that fewer cases of weakness accounted for hospital transportations in the 2nd year (10% as against 13.9% in the previous year); it could be concluded that hospital transport refusal occurred more in cases of weakness. The number of hospital transportations decreased in the 2nd year (68.7% as against 71.4 in the previous year), this could be due to the presence of motor ambulances and dispatches for weakness cases and consequently transporting fewer patients to hospitals. Since motor ambulances are not able to transport patients, the motor ambulance technician will request the dispatch center for transportation. An investigation of the reasons for requesting ambulance dispatches by motor ambulances showed that traffic accidents (26.9%) ranked among the five top reasons, followed by traumatic injuries. On the one hand, this is caused by the severity of the injuries and the free of charge emergency services; and on the other hand, this is because the patient's family members or friends were not present at the scene, and it was not possible to transport him/her to hospital for minor injuries. Inevitably, this transportation should be performed by ambulances, whereas other cases occur at home or the workplace in the presence of relatives, family members or colleagues; thus, it is possible to transport the patients to clinics or hospitals by them. This finding confirms the previous results that traffic accident injuries are the main reason for the transportation of patients to hospitals. From limitations of this study can be noted to the few registered time intervals in ambulances and motor ambulances particularly. It is recommended to compare the response time with more registered cases.

Conclusions

According to the results of the present study, it could be concluded that motor ambulances are effective

rescue vehicles to reduce response time for emergency service missions in crowded cities with heavy traffic, especially round the clock at peak traffic hours. The presence of motor ambulances in the 2nd year led to decreased number of patient transportations to hospitals (in comparison to the previous year). This could be an advantage in terms of reducing costs imposed on emergency centers, ambulances readiness to go for more necessary missions, and preventing crowded emergency department in hospitals; however, in term of patients refusing hospital transport, nothing has been reported yet, and its causes and outcomes should be investigated further in the future studies. It should be highlighted that the advantages of motor ambulances are not only restricted to reducing response time and costs but also can manage events better before the arrival of ambulances. Thus, they provide the ambulance technicians with the opportunity to take some rest and recover. Since most of the emergency phone calls are due to weakness and hospital transport cases are few, it is necessary for dispatch nurses to acquire more knowledge about phone triages or the dispatch triage protocol should be revised. Regarding the large number of refusals for hospital transport, it is recommended that motor ambulances should be enhanced both qualitatively and quantitatively. It is also suggested that citizen should learn how to perform first-aid procedures and distinguish necessary situations requiring ambulance requests. It is also suggested that ambulances should be used more often for traffic accidents and motor ambulances for other cases, including weakness.

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Conflicts of interest

There are no conflicts of interest.

References

- Ebarhimian A, Saedin H, Jamshidi-Orak R. Exploration of Internal Emergency Predictors to Determine the Instrument in Pre-Hospital Environments: Iran University of Medical Sciences. School of Health Management and Information Sciences; 2014.
- Khankeh H-R, Saberiniya A, Nakhaei M, Khorasani -Zavareh D, Ardalan A, akbari Y, *et al.* National Health Assessment Tools in Emergencies and Disasters, 2nd ed. Tehran, University of Welfare and Rehabilitation Sciences, Arshia publishers; 2016.p 24.
- Abolghasem Gorji HA, Shahidi Sadeghi N. Relationship between pre-hospital services to patients with acute myocardial infarction and their hospital length of stay in Hazrat Rasool Hospital: 2009. *J Health Adm* 2013;15:7-17.
- Lee LL, Yeung KL, Lo WY, Lau YS, Tang SY, Chan JT, *et al.* Evaluation of a simplified therapeutic intervention scoring system (TISS-28) and the modified early warning score (MEWS) in predicting physiological deterioration during inter-facility transport. *Resuscitation* 2008;76:47-51.
- Keskinoglu P, Sofuoglu T, Ozmen O, Gündüz M, Ozkan M. Older people's use of pre-hospital emergency medical services in Izmir, Turkey. *Arch Gerontol Geriatr* 2010;50:356-60.
- Thang ND, Karlson BW, Bergman B, Santos M, Karlsson T, Bengtson A, *et al.* Characteristics of and outcome for patients with chest pain in relation to transport by the emergency medical services in a 20-year perspective. *Am J Emerg Med* 2012;30:1788-95.
- Ong ME, Cho J, Ma MH, Tanaka H, Nishiuchi T, Alsakaf O, *et al.* Comparison of EMS systems in the pan - Asian resuscitation outcomes study countries: Report from a literature review and survey. *Resuscitation* 2012;83 Suppl 1:e29.
- Karlsten R, Elowsson P. Who calls for the ambulance: Implications for decision support. A descriptive study from a Swedish dispatch Centre. *Eur J Emerg Med* 2004;11:125-9.
- Kamper M, Mahoney BD, Nelson S, Peterson J. Feasibility of paramedic treatment and referral of minor illnesses and injuries. *Prehosp Emerg Care* 2001;5:371-8.
- Mann C, Guly H. Is the emergency (999) service being misused? Retrospective analysis. *BMJ* 1998;316:437-8.
- Key CB, Pepe PE, Persse DE, Calderon D. Can first responders be sent to selected 9-1-1 emergency medical services calls without an ambulance? *Acad Emerg Med* 2003;10:339-46.
- Al-Shaqsi S. Models of international emergency medical service (EMS) systems. *Oman Med J* 2010;25:320-3.
- Ebrahimian AA, Khalesi N, Mohamadi G, Tordeh M, Naghipour M. Transportation management in pre-hospital emergency whitt physiological early warning scores. *J Health Adm* 2012;15:7-13.
- Knapp BJ, Kerns BL, Riley I, Powers J. EMS-initiated refusal of transport: The current state of affairs. *J Emerg Med* 2009;36:157-61.
- Tehran Emergency Center.[cited 2017 Feb 19] Available from: <http://www.umsha.ac.ir/includes/plink.aspx?linkid=62>.
- Pourshaikhian M, Khorasani-Zavareh D, Gorji HA, Aryankhesal A, Barati A. Workplace violence process against emergency medical services staffs: A grounded theory. *Globl J Health Sci* 2016;8:213.
- Pourshaikhian M, Abolghasem Gorji H, Aryankhesal A, Khorasani-Zavareh D, Barati A. A systematic literature review: Workplace violence against emergency medical services personnel. *Arch Trauma Res* 2016;5:e28734.
- Bahadori M, Nasiripur A, Tofighi S, Gohari M. Emergency medical services in Iran: An overview. *Australas Med J* 2010;3:335-9.
- Ebrahimipour H, Vafae Nazhad R, Vafae Najar A, Yousefi M, Houshmand E, Hosseini S. Pre-hospital Emergency services with emphasis on traffic accidents: A case study in Mashhad, Iran. *Health Emerg Disasters Q* 2017;2:145-54.
- Shah Che Hamzah MS, Ahmad R, Nik Abdul Rahman NH, Pardi KW, Jaafar N, Wan Adnan WA, *et al.* Ambulance services at hospital universiti Sains Malaysia and hospital Kota Bharu: A retrospective study of calls. *Malays J Med Sci* 2005;12:34-42.
- Peyravi M, Tubaei F, Pourmohammadi K. The efficiency of motorlance in comparison with ambulance in Shiraz, Southern Iran. *Iran Red Crescent Med J* 2009;11:330-33.
- van der Pols H, Mencl F, de Vos R. The impact of an emergency motorcycle response vehicle on prehospital care in an urban area. *Eur J Emerg Med* 2011;18:328-33.
- Patel FN, Ekkiswala MM. Motorcycle ambulance: A cheaper and faster alternative. *Indian J Appl Basic Med Sci* 2010;12:50-4
- Nakstad AR, Bjelland B, Sandberg M. Medical emergency motorcycle – Is it useful in a scandinavian emergency medical service? *Scand J Trauma Resusc Emerg Med* 2009;17:1-4.
- Fink A, Andoljšek D. 143: Cost-benefit of medical emergency motorcycle system. *Ann Emerg Med* 2008;51:514-5.

26. Soares-Oliveira M, Egipto P, Costa I, Cunha-Ribeiro LM. Emergency motorcycle: Has it a place in a medical emergency system? *Am J Emerg Med* 2007;25:620-2.
27. Lin CS, Chang H, Shyu KG, Liu CY, Lin CC, Hung CR, *et al.* A method to reduce response times in prehospital care: The motorcycle experience. *Am J Emerg Med* 1998;16:711-3.
28. Bhalla K, Naghavi M, Shahrzad S, Bartels D, Murray CJ. Building national estimates of the burden of road traffic injuries in developing countries from all available data sources: Iran. *Inj Prev* 2009;15:150-6.
29. Shakeri K, Fallahi-Khoshknab M, Khankeh H, Hosseini M, Hosseinzadeh S, Haghi-Monie N. Evaluation of clinical skills of medical emergency personnel in Tehran emergency center confronting the trauma. *Health Promot Manage* 2012;1:16-24.
30. Özata M, Toygar S, Yorulmaz M, Cihangiroğlu N. Comparative analysis of using 112 emergency ambulance services in Turkey and the province of Konya. *Eur J Gen Med* 2011;8:262-7.
31. Langhelle A, Lossius HM, Silfvast T, Björnsson HM, Lippert FK, Ersson A, *et al.* International EMS systems: The Nordic countries. *Resuscitation* 2004;61:9-21.
32. Peyravi M, Ortenwal P, Djalali A, Khorram-Manesh A. An overview of Shiraz emergency medical services, dispatch to treatment. *Iran Red Crescent Med J* 2013;15:823-8.
33. Burt CW, McCaig LF. Staffing, capacity, and ambulance diversion in emergency departments: United States, 2003-2004. *Adv Data* 2006;47:317-26.