

# Evaluation of Emergency Medical Technicians Intermediate Prediction about Their Transported Patients Final Disposition in Emergency Department of Imam Khomeini Hospital

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**Abstract-** This was a prospective cross-sectional study of consecutive transported patients by emergency medical service (EMS) to a referral hospital. The goal of this study was the evaluation of emergency medical technician intermediate prediction about their transported patients disposition in Emergency Department of Imam Khomeini Hospital. 2950 patients were transported to this hospital, Questionnaires were submitted in 300 of consecutive patient transports and completed data were obtained and available upon arrival at hospital for 267 of these cases. Emergency medical technicians intermediate (EMT-I) were asked to predict whether the transported patient would require admission to the hospital, and if so, what will be their prediction of patient actual disposition. Their predictions were compared with emergency specialist physicians. EMT-I predicted that 208 (78%) transports would lead to admission to the hospital, after actual disposition, 232 (%87) patients became admitted. The sensitivity of predicting any admission was 65%, with positive predictive value (PPV) of 39% and specificity of 86% with negative predictive value (NPV) of 94%. The sensitivity of predicting trauma patients (56.2% of total patients) was 55% with PPV of 38%, specificity of 86% and for Non-trauma patients' sensitivity was 80% with PPV of 40% and specificity of 82%. EMT-I in our emergency medical system have very limited ability in prediction of admission and disposition in transported patients and their prediction were better in Non-trauma patients. So in our EMS, the pre-hospital diversion and necessity of transporting policies should not be based on EMS personnel disposition.

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**Key words:** Admission; Disposition; Emergency medical service; Prediction

## Introduction

After activating the emergency medical services (EMS), the first professional medical team is pre-hospital emergency medical technicians that can attend to the victims. With a variety of medical problems and need of the patients and making medical decisions about the necessity of certain medical services such as triage, and review the existing problem and provide the related medical care in scene of accident and also, need for referral and transfer the patients to hospital, so, emergency pre-hospital personnel have the most important roles that is dependent on their determination

and prediction of the severity of the patient's medical problem and clinical condition (1).

This issue will be related to the experience and knowledge of pre-hospital emergency medicine technicians. On the other hand, according to the variety of medical services in hospitals such as emergency departments, intensive care unit, gynecology, pediatric care, psychiatric and etc it is needed to choose the nearest related medical center based on their patients clinical condition (2).

Incorrect and unnecessary decisions making about the need for emergency medical services and transfer or transport patient by ambulances, is one of the important

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## Evaluation of EMT-I prediction in patients disposition

reasons of emergency department overcrowding and patients confusion, dissatisfaction and also, increase dissatisfaction of providing health care quality and increase costs (3,4).

Some studies have shown a limited and poor ability and accuracy of pre-hospital emergency technicians in prediction of actual patients disposition (5-10). There are other studies that support pre-hospital emergency medicine technicians ability to predict the patients' outcome and disposition (11-14). The better understanding of the ability of pre-hospital emergency medical technicians in determining the severity of patients' clinical status and the patients' outcome can decrease emergency departments overcrowding, reduce inducing patients additional costs and improve patient satisfactions. The aim of this study was evaluation the accuracy of the pre-hospital emergency medical technicians predictions for about their transported patients final disposition in the emergency department of Imam Khomeini Hospital (Tehran, Iran).

## Materials and Methods

Imam Khomeini Clinical and Hospital Complex is an urban country hospital, the greatest general and level I trauma center in Tehran-Iran that accepts both medical and trauma EMS transports. The annual emergency department census at this center is approximately 40000. Iran has started its especial academic emergency medical technician training program since 1996. Tehran EMS transported approximately 4000 requests for emergency medical assistance to the Imam Khomeini hospital in 2011. At the time of our study, in addition to other EMS stations in all over the city, there were 10 stations with single tired system that supported the majority of patient transportation to this hospital with 50 EMS technicians and the average 13 number of trips per day. A prospective cross-sectional study was performed in order to evaluating of emergency medical technicians intermediate (EMT-I) Prediction about their transported patients final dispositions in emergency department of Imam Khomeini Hospital from July 2010 up to March 2011. Pre-hospital emergency medical technicians in consecutive patient transfer to Imam Khomeini Hospital voluntarily participated in this study, but based on their trip ID and level of education, the EMT-I trips were just evaluated.

Upon arrival the ambulances and transported sick or injured patients who transported by EMT-I to the triage

unit, a standardized questionnaire including information about the patient (age, sex, initial patient chief complaint according to symptoms' type), number and type of workshops attended by the chief technician, his work experience and finally the prediction of disposition of the patient (admission, discharge) documented by the EMT-I. Admission was defined as a need of additional medical care based on the severity of the patients condition (in emergency department, other wards, ICU or CCU). The questionnaires were stored in a locked box. Finally the prediction were compared with the actual disposition by emergency medicine specialist and the EM chief resident on that duty.

After collecting data, descriptive and inferential analysis were done by SPSS software version 15, and for calculating of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and 95% confidence interval, statistical software Stata (version 8) was used. *P*-value less than 0.05 was considered valuable.

## Results

According to the statistics recorded in the Tehran EMS computer center, from 2952 cases (all patients) of pre-hospital patient transportation by EMS, 300 cases (10% of total transported patients) of consecutive patient transfer by EMT-I had been evaluated during the time of our study from the beginning of July 2010 to March 19, 2011.

Having thirteen consent to participating in the study, 18 cases of incomplete data, 2 patients died during transport, completed research forms were obtained for 267 cases (about 89% of total cases). The majority of patients (68/9%) were male and the average duration of EMT-I experience at the time of study was 8 years. The most common clinical chief complaint was trauma (56/2%) and decrease level of consciousness (13/1%), respectively (Figure 1).

EMT-I predicted that 59 cases would be discharged from emergency department and 208 (78%) would become admitted. In admitting cases, they predicted that they would be managed in these distributions: 141 cases in emergency department, 28 cases in ICU, 17 cases in CCU and 22 cases in wards (Figure 2).

After actual disposition, 35 cases became discharged, 232 (87%) became admitted, in which 117 cases in emergency department, 49 cases in ICU, 13 cases in CCU and 53 cases would become managed.

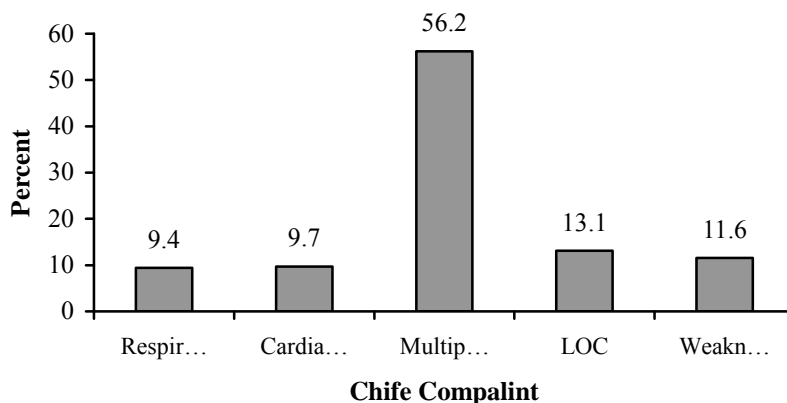


Figure 1. Distribution of patients based-on chief complaints.

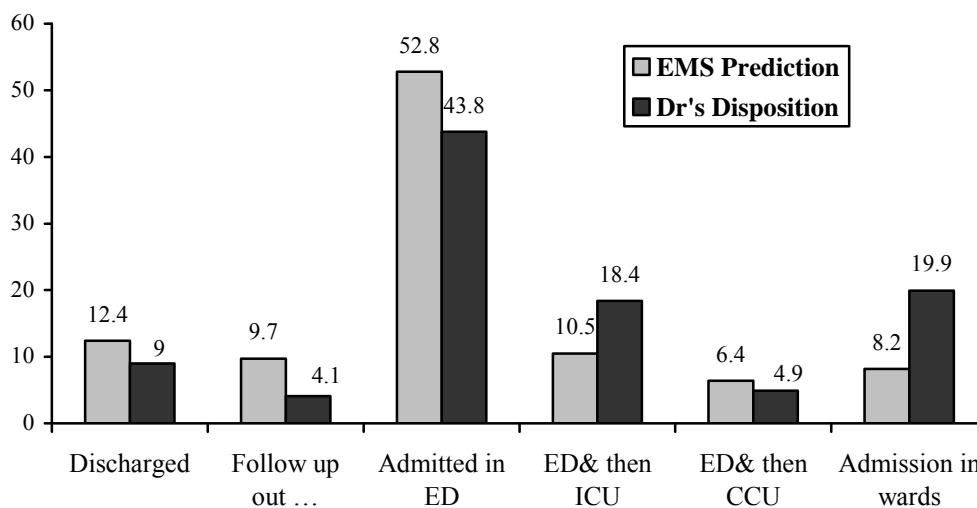


Figure 2. Comparison of EMS prediction and Dr's disposition.

The agreement between EMT-Is prediction and patient actual disposition was poor [ $\kappa=0.387$ ], the sensitivity, specificity, NPV, PPV of EMT-I predicting

any admission are shown in table 1 and prediction and comparison of disposition in trauma and non trauma (medical) patients are shown in table 2.

Table 1. Prediction of EMT-I disposition in all patients.

Pre-hospital emergency personnel prediction	patients' outcome		Total	Parameters	(95%CI)%
	Admitted	Discharge			
Admitted	23	36	59	Sensitivity	65% (48-81)
Discharge	12	196	208	Specificity	84% (79-89)
				Positive predictive value	39% (26-53)
Total	35	232	267	Negative predictive value	94% (90-97)

**Table 2.** Prediction and comparison of disposition in trauma and non trauma (medical) patients.

pre-hospital emergency personnel prediction	Patients' situation	patients' outcome		Total	Parameters	(95%CI)%
		admitted	Discharge			
Traumatic patients	Admitted	11	18	29	Sensitivity	55% (31-77)
	Discharge	9	112	121	Specificity	86% (79-92)
	Total	20	130	150	Positive predictive value	38% (21-58)
Non-traumatic patients	Admitted	12	18	30	Sensitivity	80% (52-96)
					Specificity	82% (74-89)
	Discharge	3	84	87	Positive predictive value	40% (23-59)
					Negative predictive value	97% (90-99)

**Discussion**

Right prediction of EMS about clinical condition and disposition of the patients who are transferred to the emergency departments could help providing medical services based on actual patient disposition. Also, mode of transportation, selection of related hospital and interventions in transferring time to health care centers can be improved and reduced unnecessary traffic and overcrowding in emergency departments.

Over crowded emergency department and its unfavorable effect on the medical system, staff and sources are obvious and well documented (2,15). Evaluating pre-hospital caregivers triage has been difficult, due to different patient’s clinical complaints and lack of objective triage protocols. Some studies showed a limited ability and accuracy of pre-hospital emergency technicians in prediction of actual patient’s disposition (5-10). On the other hand, there are other studies that support pre-hospital emergency personnel ability and accuracy to predict the patients’ outcome and disposition (11-14).

Richards and Ferrall showed that certain patient chief complaints potentially make admission more predictable (14). Although they evaluated paramedics in condition of their “gut feeling”, we also asked EMT-Is to triage patient subjectively.

Saul *et al.* reported a very limited ability in paramedics to predict whether transported patient need admission, but their prediction were better in trauma patients unlike to the our study (2).

Hauswald *et al.* showed that paramedics were unable to predict which patient did not require transporting, they also reported a poor agreement [ $\kappa= 0.32$ ] between predicted and actual disposition (4). The agreement between predicted and actual disposition in our study was also poor [ $\kappa=0.387$ ]

In a similar study, Clesham *et al.* evaluated 396

cases and found that EMS “staff “ had the sensitivity of 71.7%, specificity of 77% in predicting any admission (11). They also evaluated that “EMS staffs” had better prediction accuracy in non-trauma (with medical complaints) patients in comparison with trauma patients with sensitivity of 76% and 57%, respectively.

In our study, a sensitivity of 65% (95% CI, 48-81%) , specificity of 84% (95% CI, 79-89%), PPV of 39% (95%CI, 26-53%) and NPV of 94% (95% CI, 90-97%) was obtained for any hospital admission. We also found that EMT-Is had better prediction accuracy in non-trauma patients in the compared with trauma patients, sensitivity of 80% versus 55%, respectively.

EMT-I in our EMS have very limited ability in prediction of admission and disposition in transported patients. Despite of having most patients with chief complaints of trauma, their prediction was better in non-trauma patients.

Our study had several limitation. Selection bias may have been unavoidable because we had a 10% of incompleted and unavailable data about EMT-I transport to the hospital and we didn’t evaluate EMS transports to other centers. Preventing discussion and consultation of EMTs with physicians, technicians and nurses in the emergency department about the patients, we tried to prevent happening of incorporation bias, although its elimination would’nt be guaranteed. Their observation in starting of quick management or continued care of the emergency department personnel for the patient may also interfered their actual prediction. Having existed discrepancies in the making patient dispositions by different emergency specialist on duties, a bias in the result might have possible. In conclusion, in our EMS, the pre-hospital diversion and necessity of transporting policies should not be based on EMS personnel disposition. Although the majority of our EMS trips 33 were related to trauma patients, EMTs had limited and weaker accuracy of prediction in this field, so despite

the necessity of additional investigation in evaluation of actual EMTs abilities, specific educational programs are inevitable to improving the EMS personnel abilities particularly in trauma patients.

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