Research

The influence of successfully completed triage courses and work experience of advanced emergency medical technicians on their perception of patient disposition

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Abstract

Introduction

This study assessed the impact of various one-day workshops and the work experience of advanced emergency medical technicians (AEMTs) on their prediction of patient disposition.

Methods

We conducted a prospective study on 267 patient transport missions to the emergency department. During the study, convenience sampling was used in all the clinical shifts of the lead author. The AEMTs completed the questionnaires, which comprised of the number of successfully completed workshops; other training courses; work experience and their perception of the patient's disposition. The latter was compared to the ultimate disposition of patients determined by emergency medicine specialists.

Results

The respective figures for sensitivity, specificity, positive predictive value and negative predictive value were 86%, 80%, 33% and 66% on predicting patient disposition for AEMTs who passed fewer workshops; and 79%, 76%, 34% and 96% for the participants with less than 4 years' work experience. The Kappa coefficient for the agreement between AEMTs' prediction and ultimate patient disposition was 0.387.

Conclusion

The number of triage courses was not positively effective in the prediction of patient disposition by AEMTs; the number of years of work experience did not make a difference either. The AEMTs were fair in their prediction of patient disposition in comparison with the emergency medicine specialists.

Keywords:

advanced emergency medical technician; education; triage

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Introduction

Emergency medical technicians (EMTs) are usually the first responders after the activation of the emergency medical service (EMS). One of the important tasks of the advanced emergency medical technician (AEMT) is to make the right decision on the necessity of medical service delivery, which mandates accurate triage and thorough assessment of the scene (1,2).

The exact disposition of patients to the nearest related medical facility also depends on available hospital departments such as emergency or gynaecology, intensive care unit (ICU), cardiac unit, paediatric ICU, neonatal ICU, and trauma or burn centre (2). Redundant or inappropriate patient transport can lead to emergency department (ED) overcrowding, ambulance overuse, turfing or overspending budgets; or it might deprive patients of emergency care. Accurate perception of AEMTs on how to disposition patients can improve transportation processes and medical procedures applied in the course of transportation (2). Some researchers suggest a significant correlation exists between EMT prediction and a patient's final disposition (3-5).

According to the educational curriculum of the Ministry of Health and Education in Iran, EMTs are destined to become AEMTs. The majority of EMS personnel in Iran are young men (6). As with many countries, nearly all EMS missions lead to free transport to hospital (7). EMS missions are usually single-tiered and not oriented to specific complaints or certain care. AEMTs undertake an initial 200 hours training, which includes didactic lectures, clinical and field experience, and learn skills such as endotracheal intubation, defibrillation and intravenous line placement and to apply limited pharmacologic treatments. AEMT training includes basic life support (BLS), advanced cardiac life support (ACLS), primary trauma care (PTC), pre-hospital trauma life support (PHTLS), and how to approach common chief complaints such as body and limb weakness, decreased level of consciousness, syncope and chest pain. The decision about which appropriate health facility to transfer a patient to and field triage are mainly based on the AEMT's experience, as well as consultations made with the dispatch physicians. Several triage systems exist, with one of the most applicable systems being the hospital emergency severity index-IV (ESI-IV) (8). AEMTs have successfully completed workshops and determined triage levels based on the ESI-IV triage system (9).

The purpose of this study was to determine the influence of successfully completed training workshops and previous work experience of AEMTs in the final disposition of patients transported to the hospital emergency department.

Methods

Study design

In this observational prospective study, emergency pre-hospital transport was analysed in all the clinical shifts of the author (JM) throughout each day of the week (days, evenings and nights) by

convenience sampling.

Setting

The study was performed in a university hospital: a 1,300-bed medical, educational and research centre in which trauma and non-trauma patients are transferred to the emergency department by AEMTs, or by their own car. It is a level II trauma centre with 65,000 annual visits, including critical patients referred from other centres, especially cardiac and trauma patients via air or vehicle transport. The ambulance missions were mostly covered by 10 stations near the hospital in addition to EMS stations located in different areas of the city. All missions were single tiered, which represents the same level of personnel expertise and resources specified to patients regardless of the call type.

Each transport mission of AEMTs was readily distinguishable via a four-digit code in the pre-hospital emergency medical system. In this study, we targeted the performance of advanced EMTs while other certification levels such as basic EMTs or paramedics were not assessed.

Study protocol

At the entrance of the ambulance triage unit, information was obtained from the AEMTs to see if the inclusion criteria were met, ie. patients 18 years of age or more, and the AEMT personnel who gave informed consent to participate in the study. Questionnaire number one was given to AEMTs after the patients entered the triage unit. It comprised of patient information such as age, gender, chief complaint; and AEMT information including type and number of educational workshops attended, years of work experience and AEMT prediction of the patients' disposition. The completed workshops consisted of various one-day (mainly 6 hours) triage workshops, trauma workshops (PTC and PHTLS) and other workshops (on how to approach common chief complaints) as well as BLS and ACLS. Patients are mainly dispositioned into these six categories in the emergency department by emergency medicine specialists. Therefore, the same categories were used in the questionnaire and were selected by AEMTs including discharged, outpatient follow-up, ED admission, ED and then ICU admission, ED and then CCU admission, and ordinary ward admission. The 'discharged' group consisted of patients who were discharged from the ED and did not need any further care or follow-up, and 'outpatient follow-up' included patients who were discharged from the ED but needed further care or follow-up. The 'ED admission' group refers to patients with a short stay in the ED with probable discharge after some hours of observation. The questionnaires were completed in a separate room and were not influenced by the physician's disposition. Critical patients entered the resuscitation room immediately and were treated by emergency medicine residents; therefore, patient stabilisation and medical emergency management of the transferred patients took precedence. The questionnaires were completed only by the AEMTs who had given informed consent to enter the study. This was indicated in the study forms, which were anonymous.

The questionnaires were stored after they were answered, and no revision or modification was possible. Finally, the final disposition of patients by board-certified emergency physicians was documented in another questionnaire and these two were compared.

Outcome measures

We designed this study to determine the impact of successfully completed workshops and previous work experience of AEMTs in the ultimate disposition of patients.

Data analysis

Data derived from the questionnaires was analysed using SPSS 15.0. Sensitivity, specificity, positive and negative predictive values, and 95% confidence intervals (CI) were calculated by Stata version 8.0. The agreement between AEMTs' prediction and ultimate patient disposition was determined by the Kappa coefficient.

Ethics

The Research and Moral Committee of the University of Medical Sciences approved the study protocol (approval code 89/140/859). This study was in accordance with the Helsinki Declaration Protocol. The Deputy of Research of the University of Medical Sciences supported the study financially for data gathering. Informed consent was obtained from the participants.

Results

Of the eligible participants, 267 AEMTs were included in the study. Of the patients, 68.9% were men and the most common complaint was traumatic injury (56.2%) followed by decreased level of consciousness (13.1%). Other documented complaints included body/limb weakness (11.6%), cardiac symptoms (9.7%) and respiratory symptoms (9.4%). There were 20 incomplete questionnaires, which were excluded. Of the study patients, 55% were rated to have the triage level of 3 or 4 and 24% were determined to have a level 1 or 2, as determined by the registered nurse in the triage unit (in line with the ESI-IV

triage criteria). If the patient did not need to be seen in the ED, an emergency medicine resident who assessed the patient with a triage level of 4 or 5 referred them to the primary care physicians.

Most of the AEMTs had less than 8 years' work experience. To address the influence of AEMT work experience (years) on final patient disposition, the sensitivity, specificity, positive and negative predictive values were compared with the results obtained by EMTs with less than 4 years' experience (Table 1).

The number of triage workshops addended by the AEMTs and the ability to predict the ultimate disposition (admission or discharge) showed that AEMTs who successfully attended three or fewer workshops had more accurate predictions than those AEMTs who attended more. The sensitivity, specificity, positive predictive value and negative predictive value in this group were 86%, 80%, 33% and 98%, respectively.

The sensitivity, specificity and positive predictive value of admission prediction were estimated to be 65%, 84% and 39% with the values for trauma and non-trauma patients being 55%, 86% and 38% and 80%, 82% and 40%, respectively.

The Kappa coefficient of 0.387 demonstrates a fair agreement between the AEMTs' prediction and the actual patient disposition. The precision of AEMTs to predict the disposition of patients are shown in Tables 1 and 2, which is based on their years of work experience and the successfully completed workshops.

Discussion

Overcrowding and ambulance diversions are crucial situations in the emergency setting. One of the solutions for this problem may be the AEMT's ability to properly identify the clinical severity and prediction of a patient's disposition (2). This can also decrease the number of ambulance transport missions. It is prudent to assume that 'discharge from the ED' does not mean that EMS transport to the ED was not needed, as certain AEMTs

Table 1. The precision of AEMTs to predict the admission/discharge of patients regarding their training background

AEMT training background		Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)
Work experience (years)	≤4	79 (50-95)	76 (65-84)	34 (19-53)	96 (88-99)
	4-8	50 (12-88)	88 (80-94)	20 (4-48)	97 (91-99)
	8-12	60 (32-84)	97 (85-99)	90 (55-99)	85 (71-94)
Number of workshops successfully completed	≤50	73 (45-92)	77 (68-85)	33 (18-52)	95 (87-98)
	50-100	43 (10-82)	89 (81-94)	21 (5-51)	96 (90-99)
	100-150	69 (39-91)	96 (80-99)	90 (55-99)	86 (68-96)
Number of triage workshops	≤3	86 (42-99)	80 (67-89)	33 (13-59)	98 (89-99)
	3-6	54 (25-81)	87 (80-92)	29 (13-51)	95 (90-98)
	≥6	67 (38-88)	82 (66-92)	59 (33-82)	86 (71-95)

PPV = positive predictive value; NPV = negative predicative value

transported the patients to selected medical facilities in their missions according to geographical categories defined by the EMS dispatch. The AEMTs ability to predict discharge from the ED can affect further transportations and also may influence the level of hospital to which they transport the patient.

It appears that limited research has been undertaken in recent years about the impact of training workshops and work experience of AEMTs in estimation of final patient disposition. On one hand, our results suggest that younger technicians with lesser work-related experience can more efficiently predict dispositions. This may result from a more up-to-date educational system which they have benefited from. On the other hand, the work experience of AEMTs may not be a crucial factor in determining the capability to predict ultimate patient disposition. It is a standard of care that technicians would be trained for and the work they are assigned to. In addition, a better understanding of the patient status may be helpful in avoiding ambulance overuse. Handel et al conducted a study in which the orientation of pre-hospital technicians and their close relationship with the emergency physicians might decrease the input of non-urgent patients and length of stay (10). A few studies addressed the safety measures associated with the pre-hospital setting in which several factors may influence a safe climate for technicians and patients. The work experience and years of work did not bring up a significant difference in working conditions and job satisfaction (11). However, that study was performed in agencies that only provided advanced life support care (11). Another study mentioned the competency and experience of EMTs as influential factors in patient safety (12).

The influence of training on transport missions and the practice of EMTs is more prominent in special populations. In paediatric settings, a lack of specialised training was reported a factor for missed EMT cases (13). In pregnant patients, a case series assessed the impact of the knowledge of EMTs on foetal ultrasound in air medical transports which showed promising results (14).

Several studies have assessed the decision making of EMTs and their prediction of patient disposition. Some researchers evaluated the validity and reliability of the trauma team

activation in paediatric patients (15). Levin et al analysed 952 patient transports by paramedic EMTs in California (US) and reported the sensitivity and specificity of 62% and 89% for admission need, respectively (2). In a systematic review and meta-analysis by Brown et al, the need for ambulance transport and hospital admission according to the American EMTs' disposition was estimated to be inappropriate (16). Hauswald et al assessed 183 paramedic patient transports in which a Kappa of 0.47 (0.34–0.60, 95% CI) was identified for the means of transport (ambulance or a substitute-like taxi) and a Kappa of 0.32 (0.17–0.46, 95% CI) was identified for the need of care in the ED (17). However, other studies indicated an appropriate potential of EMTs in the patient's final disposition (3,4,18,19). The need for admission of non-trauma patients was better predicted by AEMTs compared to trauma patients, and this was similar to the Clesham study findings with AEMTs sensitivity of 76% compared to 57% in their study for non-trauma patients and sensitivity of 80% compared to 55% in this study for trauma patients (3).

Interdisciplinary research in pre-hospital care is an important issue to be evaluated and upgraded to maximise the quality of patient care. It is crucial to consider that the emergency care commences from the scene. In this context, the co-operative and supportive working from pre-hospital to hospital aim is to improve patient safety. Certain guidelines for the treatment, triage and transport of patients have been developed and the ability to predict disposition can be an important step to scrutinising a patient's status by AEMTs (20).

Limitations

In this study there was a selection bias due to the limited dispatch and EMT personnel involved for patient transport to hospital. We tried to minimise the incorporation bias in the triage unit, although it may have been inevitable. Moreover, the comparison of AEMTs' prediction and ultimate patient disposition was performed in various clinical shifts with different emergency physician attitudes. Although patients mostly were dispositioned based on the determination of the emergency medicine specialists, the 'prediction of disposition' given by the attending physician might not be always comparable to

Table 2. The precision of AEMTs to predict the admission/discharge of patients regarding their workshops successfully attended

Number of workshops	Sensitivity	Sensitivity % (95% CI)	Specificity % (95% CI)	PPV % (95% CI)	NPV % (95% CI)
Trauma workshops	≤5	90 (55-99)	84 (73-92)	45 (23-68)	93 (91-100)
	5-9	40 (5-85)	60 (42-76)	12 (2-38)	87 (68-97)
	10-15	37 (8-75)	92 (85-97)	30 (7-65)	94 (87-98)
	≥15	75 (43-94)	89 (75-97)	69 (39-91)	92 (77-98)
Other workshops*	≤5	92 (61-99)	80 (69-88)	42 (23-63)	98 (91-100)
	5-9	17 (0.4-64)	84 (74-91)	7 (0.2-34)	93 (84-98)
	10-15	65 (38-86)	91 (80-97)	69 (41-90)	89 (78-96)

*workshops addressing the approach to the common chief complaints and BLS and ALS

the actual disposition of patients as the disease process may be unpredictable in some patients. Gender and the EMT certification did not differ between the participants, therefore, the demographic variabilities were limited between EMTs. Further studies may address this issue. In addition, previous studies were conducted on various levels of EMT certification. Thus, it is difficult to compare different qualifications of these levels.

Conclusion

The AEMTs had a fair capacity to predict final patient disposition, which was more efficiently accomplished in non-trauma patients. The AEMTs with less work experience and fewer training workshops successfully completed and performed more accurate predictions. According to the fair agreement of predictions between the AEMTs and emergency medicine specialists, the AEMTs' decisions were reasonable in selecting the right means of transport, to judge transfer necessity and to transport a patient to a specific hospital.

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Competing interests

The authors declare no competing interests. Each author of this paper have completed the ICMJE conflict of interest statement.

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