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Brief Report

Effect of Field Triage Training on Emergency Medical Technicians in Taipei City

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Injury is a leading cause of death among young adults. An accurately implemented filed triage scheme (FTS) by emergency medical technicians (EMTs) is the first step for delivering right patients to the right hospital. However, the training effect of FTS on EMTs with different levels and backgrounds has scarcely been reported. We evaluated training effects of FTS among EMTs in Taipei. Standard FTS contains physiologic status, anatomical sites of injury, and mechanism of injury criteria. The intervention was a 30-minute lecture and pre-and-post tests, each containing five questions about trauma severity judgment (i.e., mechanism of injury [2 questions], anatomic sites of injury [2 questions], and physiological status [1 question]). The change in EMT accuracy was measured before and after training. Subgroup analyses were performed across EMTs with different levels and seniorities. From September 1, 2015 to March 31, 2016, 821 EMTs were enrolled, including 740 EMT-intermediates and 81 paramedics. Overall, EMT accuracy improved after the intervention in the intermediate (73.2% vs. 85.5%, $p < 0.05$) and paramedic (76.0% vs. 85.7%, $p < 0.01$) groups. All trainees showed improvements in physiology and mechanism criteria, but paramedics showed decreased accuracy in anatomic criteria. The subgroup analysis showed that accuracy positively associated with prehospital care experience for major trauma cases 1 year before the training course, and the anatomical criterion accuracy was adversely associated with paramedic seniority. Field triage training can improve EMT accuracy for FTS. The anatomical aspect is more difficult to improve and should be emphasized in FTS training courses.

Key words: *emergency medical service (EMS), emergency medical technician (EMT), education and training, filed triage scheme (FTS), trauma*

Introduction

Injury is the ninth leading cause of death in the world, and the leading cause of death in young people.[1] Rapid transporting a severely-injured patient to an appropriate trauma center reduces his/her risk of mortality by 25%[2] because prolonged prehospital time is associated with worsen outcome,[3] and that relies on accurate field triage decisions by emergency medical technicians (EMTs). In many countries, emergency medical service (EMS) systems develop field triage scheme (FTS) in reference to the US FTS.[4] Although

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the US FTS guides the destination facility choice by a stepwise evaluation of physiologic status (P), anatomical injury (A), injury mechanism (M), and special consideration of the injured patient, EMTs' responses to P, A, and M criteria may differ.

Currently, no study has investigated field triage training of EMTs. Here, we evaluated whether a single training program improves field triage accuracy and learning outcomes among FTS sub-aspects.

Methods

Study Design and Setting

This is a before-and-after study. We held seven field triage trainings for Taipei EMTs from September 1, 2015 to March 31, 2016 for all intermediate and paramedic EMTs in Taipei City. Taipei City is a metropolitan area with 2.65 million registered individuals over 272 km^2, including about 3.00 million inflow daytime workers. There are 973 intermediates and 89 paramedics in Taipei City and up to 49,000 annual trauma-related missions.

IRB Approval

The study protocol was approved by the Institutional Review Board of the National Taiwan University Hospital.

Exposure Definition

Participants were exposed to a 30-minute lecture and underwent pre- and post-tests. The pre-test and post-test were comprised of five single-choice questions based on a scenario with trauma patient. Each question regard to mechanism of injury (M; 2 questions), anatomic injury sites (A; 2 questions), or physiological status (P; 1 question). A medical director team in Taipei City designed the lecture and test contents. Although the scenarios were different in pre- and post-test, these two scenarios were designed by the medical director team with the consensus of the degree of difficulty to guarantee comparability.

The seniority and major trauma experience among the paramedics were also recorded to test the association with a training effect. The seniority is comprised of "EMT seniority" (i.e., the period from the certificate of EMT basic) and "Paramedic seniority" (i.e., the period from the certification of EMT-P). The reason to divide the seniority is that we think both the occupational years (EMT seniority with multi-tasking duty) and expertise experience (paramedic seniority merely focusing on the ambulance run) might differently affect their learning.

Outcomes

The primary outcome was the test accuracy comparison before and after training. The secondary outcomes included EMT level and seniority.

Statistical Analysis

Data entered in Excel (Microsoft, Redmond, WA, USA) was processed and analyzed by SAS software version 9.3 (SAS Institute, Cary, NC, USA). Descriptive population statistics were given as counts, percentages, or mean ± standard deviation. We used the McNemar and Mann–Whitney rank sum tests for comparisons. A two-tailed p-value < 0.05 was considered significant. We examined the correlation between accuracy and (1) seniority, (2) experience of major trauma mission, and (3) major trauma mission within 1 year using Pearson correlations.

Results

Fig. 1 shows the participant algorithm. In total, 740 intermediates (76.1% of all EMT-intermediates in Taipei) and 81 paramedics (91% of all paramedics in Taipei) were included. Participant characteristics are summarized in revised Table 1.

The baseline field triage accuracy for all EMS providers was 73.51% and rose to 85.6% after training ($p < 0.05$). Overall accuracy improved after intervention in the intermediate (73.2% vs. 85.5%, $p < 0.05$) and paramedic (76.0% vs. 85.7%, $p < 0.01$) groups, which presented higher mechanism and physiological aspect post-test accuracies, but not higher anatomical aspects. The trend of anatomical question performance worsened in the paramedic group, but was not statistically significant (82.0% vs. 80.9%, $p = 0.87$) in revised Table 2.

To determine the impact of seniority, we divided paramedics into subgroups (Table 3). Significant mechanism aspect improvements were observed in all subgroups. Physiological aspect performance was not statistically significant but tended to improve. The anatomical aspect accuracy non-significantly declined after training in the high seniority subgroup.

We analyzed the association between field triage and experience in the paramedic group and found a

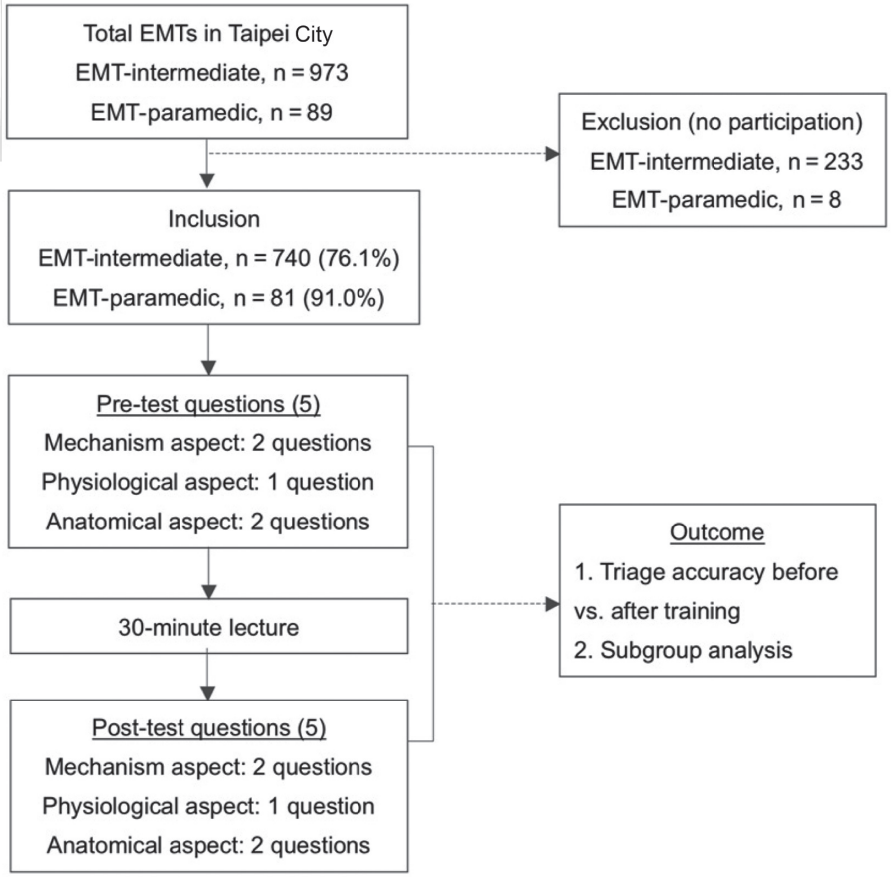

Fig. 1. Algorithm of this study.
EMT: emergency medical technician.

Table 1. Demographic data

	EMT-intermediate	EMT-paramedic
Number	740	81
Age, mean ± SD, y	34.6 ± 7.2	34.7 ± 4.5
Male (%)	702 (94.8)	77 (95.1)
Seniority, mean ± SD, y	5.6 ± 2.4	11.8 ± 5.1
Major trauma mission within 1 year	—	61

EMT: emergency medical technician; SD: standard deviation.

Table 2. Improvement in accuracy after training

	EMT-intermediate			EMT-paramedic		
	Pre-test	Post-test	*p* value	Pre-test	Post-test	*p* value
Overall, %	73.2	85.5	< 0.05*	76.0	85.7	< 0.01*
Mechanism, %	68.4	92.0	< 0.01*	71.6	91.4	< 0.01*
Physiological, %	68.1	81.9	0.01*	72.8	84.0	0.09
Anatomical, %	78.2	83.4	0.20	82.0	80.9	0.87

*Statistically significant.
EMT: emergency medical technician.

Table 3. Effect of experience on accuracy in the paramedic group

Paramedic	n	Pre-test accuracy (%)	Post-test accuracy (%)	McNemar *p* value
Sex				
Male	77	M = 72.7	M = 91.6	M, $p < 0.001^*$
		P = 74.0	P = 84.4	P, $p = 0.115$
		A = 81.8	A = 81.2	A, $p = 0.167$
EMT seniority (year)				
≤ 12	39	M = 65.4	M = 92.3	M, $p < 0.001^*$
		P = 79.5	P = 92.3	P, $p = 0.180$
		A = 80.8	A = 87.2	A, $p = 0.039^*$
> 12	39	M = 76.9	M = 93.6	M, $p < 0.001^*$
		P = 69.2	P = 79.5	P, $p = 0.388$
		A = 83.3	A = 73.1	A, $p = 0.508$
Paramedic seniority (year)				
≤ 5	39	M = 67.9	M = 92.3	M, $p < 0.001^*$
		P = 79.5	P = 92.3	P, $p = 0.180$
		A = 84.6	A = 84.6	A, $p = 0.344$
> 5	38	M = 75.0	M = 93.4	M, $p < 0.001^*$
		P = 68.4	P = 78.9	P, $p = 0.388$
		A = 78.9	A = 75.0	A, $p = 1.000$
Major trauma mission within 1 year				
No	20	M = 62.5	M = 85.0	M, $p < 0.001^*$
		P = 70.0	P = 75.0	P, $p = 1.000$
		A = 80.0	A = 72.5	A, $p = 1.000$
Yes	61	M = 74.6	M = 93.4	M, $p < 0.001^*$
		P = 73.8	P = 86.9	P, $p = 0.057$
		A = 82.8	A = 83.6	A, $p = 0.302$

A: anatomical injury; EMT: emergency medical technician; M: injury mechanism; P: physiologic status.

significant correlation between "major trauma mission within 1 year" and pretest/posttest accuracy (p = 0.037/0.002).

Discussion

The single FTS training program significantly improved overall prehospital field triage decision accuracy. Improvement was achieved mainly in mechanical and physiological criteria. To our knowledge, this is the first study to evaluate different FTS aspects among EMTs, and our results are informative for FTS training courses.

In our study, major trauma within 1 year positively impacted field triage. This was supported by David and Brachet's study, which found that more than 2 years of field experience plus past and recent trauma patient volume associated with prehospital interval reductions.[4] However, the anatomical aspect accuracy decreased in the paramedic group, especially for those with higher seniority, which seems to thwart educational improvement. Most senior paramedics incorrectly answered the post-test question that pictured a javelin penetrating the calf (Fig 2), misleading to over-triage this case to a trauma center, while a penetrating distal limb injury does not meet trauma center transportation criteria. However, there is a proviso, "when in doubt, transport to a trauma center".[3] Even though senior paramedics incorrectly answered this question; this over-triage is acceptable in clinical practice.

The US-FTS evaluates injured patients step by step. However, studies that have discussed the prehospital triage decision-making model revealed

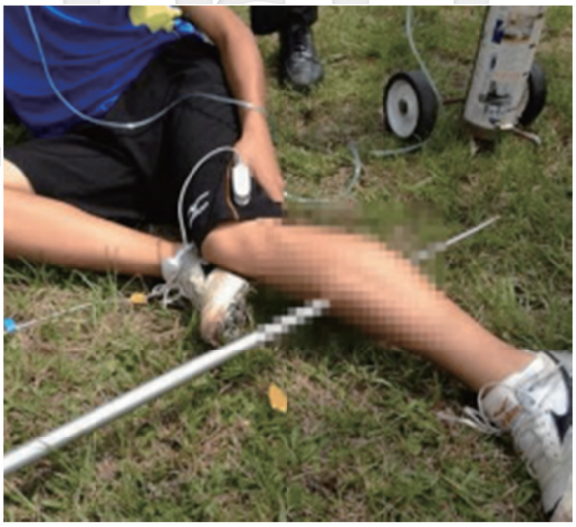

Fig. 2. One of the questions in the post-test that made many senior paramedics overtriage.

that the information obtained before contacting the patient (early visual cues from the scene, mechanism of injury, and patient appearance) play more important roles than further assessment (definite vital signs, non-obvious anatomic injury, and detail history) in decision making.[5,6] "EMT gut feeling" refers to the "EMS provider judgment" criteria that was the last criteria added into the ACS COT (American College of Surgeons Committee on Trauma) decision scheme in 2006 and is the last triage scale step. However, it is also the most commonly cited (40.0%) and sometimes the only used (21.4%) criterion.[5] The value of EMS provider judgement criteria varies between sites, modestly increases overtriage, and plays an important role in identifying high risk patients who are missed by physiologic and anatomic criteria.[5,6] In our study, the post-test penetration question is sanguineous and makes the trainees follow their gut feeling and triage the patient to the trauma center rather than apply the anatomical step. Further training programs should put more emphasis on avoiding EMT judgments that increase overtriage rates and impact emergency care efficacy.

Limitations

Our study has several limitations. First, the number of paramedics was limited. Second, the seniority and major trauma experience among the EMT intermediates were not recorded. Hence, the association between the seniority of EMT intermediates and its training effect cannot be evaluated. Third, training course impact was evaluated based on the tests, not clinical performance. Finally, the cut point of 12 years (in EMT seniority) and 5 years (in paramedic year) was not based on medical evidence but for the middle point of the data distribution to enhance the comparability. Actually, there was scarce evidence about the association between the EMT seniority and their trauma triage performance; therefore, we just choice the median year as the cut point. Further studies should focus on the EMT seniority and their clinical performance.

Conclusions

The training course improves the field triage accuracy in Taipei City. Anatomical FTS aspects are more difficult to improve by a single training program, especially in senior paramedics. Future teaching programs should emphasize FTS anatomy aspects.

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Conflicts of Interest Statement

None.

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