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Original Article

Comparison of Medical Students and Paramedics Using Simple Triage and Rapid Treatment and Sacco Triage Method in Mass Casualty Incident: A Simulated Cohort Study

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Abstract

Background: In a Mass Casualty Incident (MCI), when medical resources are overwhelmed by the number and severity of casualties, victims' triage plays a crucial role in disaster management. This study aimed to assess the difference between two triage methods, Simple Triage and Rapid Treatment (START) and the Sacco Triage Method (STM), in an MCI scenario and determine which way leads to a more accurate and quicker triage.

Methods: This simulated cohort study was conducted in the Department of emergency medicine at AJA university of medical sciences, Tehran, Iran, from April 2021 until January 2022. In this simulated prospective cohort study, observers were selected among 2nd-year medical students and newly graduated paramedics and presented with an imaginary disaster scenario. Half of the medical students and paramedics used the START method, and the other half prioritized patients with STM. The triage accuracy, time to triage, and time to evacuation in the two methods were recorded and analyzed.

Results: One-hundred-fifty observers were divided into four groups. All of them were male, and their mean age was 20.37±1.22 years. The overall accuracy for STM was 89.52% which showed a better and statistically significant performance than the START method ($p<0.001$). The mean time to triage for each patient in START and STM was 14.29+-2.95 and 16.84+-3.33 seconds, respectively. The mean time to evacuation for each triage method was 4.76+-.98 minutes for START and 5.61+-1.11 minutes for STM. In both STM and START groups, medical students performed better in triage than paramedics ($p<0.001$ for START and $p=0.025$ for STM). Medical students were also significantly faster than paramedics in the time to triage and evacuation categories in the STM group ($p<0.001$).

Conclusion: In conclusion, 2nd-year medical students and newly graduated paramedics performed a more accurate and quicker triage with STM than the START method.

Keywords: Sacco Triage Method, Simple Triage, Triage, Mass Casualty Incident, Medical Student, Paramedic.

Introduction

After the introduction by Baron Larry in the nineteenth century during the Napoleonic wars[1], triage is now one of the most crucial aspects of victims' management in mass casualty incidents (MCIs)[2]. The urgent and accurate assignment of limited resources available at the site of an incident based on victims' priority for medical intervention could save more lives

and result in the faster evacuation of the MCI's site[3]. Although the term is now well-known and used in different systems and complexes, searching for a more effective and quicker triage method to mitigate mortality in an MCI still continues[4].

In the late twentieth century, Newport Beach Fire Department introduced the Simple Triage and Rapid Treatment (START) method, a quick instruction to assess patients based on a series of physiologic and clinical evaluations and prioritize their need for medical care[5]. START, the most widely used triage method todays, labels victims into four different colors. All patients without breathing after airway condition (dead), all walking injured entered the green group (small), patients with respiratory tract after airway condition, number of breaths (RR) over 30, capillary refill time (CRT) for more than 2 seconds and a changed mental state that cannot follow the instructions is marked with a red (immediate) sign and must first receive emergency medical care. Second, comes the yellow (delayed) group, stable victims (RR<30, CRT<2s) with altered mental function but can obey commands[6]. Although victims' triage with START showed promising results, this non-evidence-based method with no specific adjustment for resource availability triggered researchers' curiosity for a more comprehensive way of victims' prioritizing[7, 8].

In 2006, Sacco et al. introduced Sacco Triage Method (STM), a new resource and evidence-based instruction for victims in an MCI[9]. STM uses a computable physiologic scoring called RPM; "R" stands for respiratory rate, "P" is pulse rate, and "M" is measured based on the victim's motor response[10]. After initial computation, the RPM value is adjusted with the victim's age. According to resource availability and time to evacuate all victims in MCI, medical care providers tag the injured with RPM 0 to 12 in three different groups; victims with the highest priority for medical intervention receive the red tag (urgent), and the green label is used for patients with the lowest preference (either deceased or minor injuries). All other wounded are tagged as yellow (secondary) and will gain medical attention after urgent victims[11]. The outcome-driven STM has been validated through multiple studies and is currently used as the primary triage instruction for MCIs by different emergency care providers worldwide[12].

Although START and STM are reliable triage methods, the literature becomes controversial in their comparison[8, 13]. Experienced medical care providers are more familiar with START thanks to its history and simplicity, but the evidence-based STM showed more efficient victims and resource management results[14]. However, calculating RPM values and making adjustments seems more time-consuming in an MCI[15]. This study aims to assess the difference between these two triage methods, START and STM, in an MCI scenario when applied by two different medical caregivers, paramedics and medical students, and determine which way leads to more accurate and quick triage results between these two populations.

Methods

Participants

This simulated cohort study was conducted in the Department of emergency medicine at AJA university of medical sciences, Tehran, Iran, from April 2021 until January 2022. A total number of 150 observers participated in our study. Our entry criteria were second-year volunteer medical students and newly graduated paramedics, most of whom were 20 years old and had comparable grades for their field. Those who could not complete the study or withdrew voluntarily were excluded from the study. One number was assigned to each medical student, and then two groups were selected by random sampling of IBM SPSS. The same method was applied for paramedics. Our study groups were:

1. Paramedics using the START method
2. Paramedics using the Sacco method
3. Medical students using the START method
4. Medical students using the Sacco method

Study Design & Assessments

Our imaginary disaster scenario described a missile hitting next to a twenty-floor tower with severe damage caused by the explosion's blast. However, the entrances to the building are still open, and participants should search the building for victims and prioritize their need for medical support based on START or Sacco triage methods (STM). Victims presented by patient's cards

containing a written description of patient's history, including a brief explanation of how the injury was caused, as well as their age, gender, respiratory rate (RR), pulse rate (PR), motor response (MR), and capillary refill time (CR). The distribution of patients is demonstrated in Figure 1.

			START			
		RPM	Immediate	Delayed	Minor	Expectant
STM	Lowest	0	0	0	0	1
		1	0	0	0	0
		2	0	0	0	1
		3	0	0	0	2
	Urgent	4	0	0	0	0
		5	2	0	0	0
		6	1	0	0	0
	Secondary	7	1	1	0	0
		8	2	0	0	0
		9	0	0	0	0
		10	2	1	0	0
		11	0	2	1	0
	Lowest	12	0	0	3	0

Figure 1: Patients' distribution based on their START and STM triage results.

The study took place on three different days, each with 50 participants. In the beginning, observers received a 30-minutes lecture on the implementation of both triage methods and our study design. After the initial course, observers were randomly divided into two different groups. Each observer ordered the patient's priority using their unique triage method (START or Sacco), and an investigator recorded the time to triage (seconds) for each patient's cards using a stopwatch. Also, we measured each observer's time to evacuation (minutes), the amount of time it takes for an observer to rate all the patients. All observers' rights were preserved, and their information was withheld. The National Ethics Committee approved the study, and informed consent was obtained from each participants.

Statistical Analysis

Continuous variables were described by mean and Standard Deviation (SD), and class variables by number and percentage. The accuracy of each observer and method is expressed as the percentage of correct triage choices. Fisher exact test was used to compare the accuracy between our two methods and participants' majors. It was also tried to measure the time difference to triage among the identified groups using t-test of two samples. Statistical analysis was performed with IBM SPSS Version 26 software, and the p-value<0.05 was considered significant.

Results

Our one-hundred-fifty observers (77 medical students and 73 paramedics) were divided into four groups: 38 medical students and 36 paramedics with the START method, 39 medical students and 37 paramedics using STM. The mean age of participants was 20.37+-1.21 years, and all were male. Observer's demographic data and essential characteristics for each triage method are demonstrated in Table 1.

The overall accuracy for STM was 89.52% which showed a better and statistically significant performance compared to the START method (START's overall accuracy: 80.06%, p<0.001, Spearman's correlation). The mean time to triage for each patient in START and STM was 14.29+-2.95 and 16.84+-3.33 seconds, respectively. The mean time to evacuation for each triage method was 4.76+-.98 minutes for START and 5.61+-1.11 minutes for STM. Although START seems to be faster in triage timing, this difference was insignificant (p=0.24 for time to triage and p=0.31 for time to evacuation, Spearman's correlation).

Among our 77 medical students, 39 observers with STM showed significantly more accurate performance in rating victims compared to 38 subjects with the START method (p<0.001, Pearsons' r test). However, this significance was not observed when we evaluated paramedics' results (36 with START method compared to 37 in the STM group, p=0.127, Pearsons' r test). In both STM and START groups, medical students performed better in triage than paramedics (p<0.001 for START and p=0.025 for STM, Pearsons' r Test). Medical students were also significantly faster than paramedics in the time to triage and evacuation categories in the STM group (p<0.001, Pearsons' r test). However, this difference in the START group was not considerable (p=0.83, Pearsons' r test) (Table 2).

Table 1. Demographic data and basic triage results of observers.

		Mean±SD	Count	Column N %
Age		20.37±1.22		
Major	EMS		73	48.7%
	Medical Student		77	51.3%
START Overall Accuracy		85.38±8.26		
STM Overall Accuracy		90.88±10.94		

Table 2. The difference in overall accuracy, time to triage and evacuation between medical students and paramedics using START and STM methods.

		Major		P value	
		Paramedics	Medical Students	Between methods	Between majors
		Mean±SD	Mean±SD		
START	Overall accuracy, N/N %	79.44±8.43	80.66±8.63	*<0.001*	*<0.001*
	Time to Triage, seconds	14.15±2.99	14.43±2.95	0.241	0.830
	Time to Evacuation, minutes	4.72±1.00	4.81±.98	0.317	0.794
STM	Overall accuracy, N/N %	89.23±11.67	90.00±7.36	*<0.001*	*0.025*
	Time to Triage, seconds	17.15±3.52	16.54±3.17	0.241	*<0.001*
	Time to Evacuation, minutes	5.72±1.17	5.51±1.06	0.317	*<0.001*

Discussion

One of the most crucial aspects of victims' management in a disaster or battlefield is the medical team's ability to prioritize victims' need for medical intervention as accurate and quick as possible. Choosing a fast and effective triage method could save more lives in mass casualty injuries (MCI). This study investigated two triage methods, START and Sacco, and compared their performance based on their accuracy and speed in rating patients. The difference between these two methods in noted variables were also measured when applied by a medical student or a paramedic. The results revealed medical students and paramedics using STM were more accurate than their colleagues with the START method. Although START was slightly quicker in terms of triage timing, this difference with STM was not significant. Second-year medical students performed better than paramedics using the same triage method. The significant difference between these two majors was also evident in comparing their STM's time to triage and evacuation categories. While medical students' triage decisions were faster and more reliable with the Sacco method, paramedics seem to need more practice to enhance their triage skills.

To avoid over-or under-triage, which can lead to more mortality and loss of time/resources, especially in a resource-constrained MCI, it is crucial to use an appropriate triage method. Researchers have made several comparisons of different triage methods in recent years to determine the most accurate one. In 2019, Aoyu et al. conducted a study on 1,612 patients referred to a hospital in China after an earthquake[14]. They evaluated the efficacy of both triage methods, START and STM, in death risk assessment. STM showed more effective results than the START method in predicting patients' death risk, either in an ambulance car or the emergency department. In another study, Navin et al. made an operational comparison between START and STM in a 99-victim simulated building collapse responded by emergency care providers[15]. Despite their long-term training and experience with START, STM results were significantly more accurate than the START method (91.7% vs. 71.0%). Our study results confirmed this considerable difference. STM was more accurate than the START method, whether applied by a medical student or a paramedic (89.5% vs. 80.0%, $p<0.05$). This finding could help care providers avoid over and under-triage and perform more efficiently in victims' priority for medical intervention.

Our desired triage method should be quickly applicable. The sooner the medical needs of victims are prioritized in the MCI; the more lives can be saved. A reliable and quick triage method can reduce the time to clear the scene, preventing further casualties at the site of the incident. Jain et al. assessed these parameters in virtual reality (VR) simulated train crash with ten real victims' scenarios done by 26 advance care paramedic students in 2016[16]. The mean total triage time was slightly quicker in the START than in the STM group, but this difference was not statistically significant (709 vs. 609 seconds, $p=0.07$). Navin et al. also found this insignificant difference after comparing the average time to assess each patient with START and STM methods (9.37 vs. 11.94 seconds)[15]. Following previous studies, our results also confirm this hypothesis. Although START was more quickly applicable, this difference was not considerable compared to either STM's time to triage or clear the scene. Further analysis revealed medical students to be faster than paramedics with the same triage method. However, this difference was only significant for STM parameters.

We faced several limitations in the course of our study. We wished to conduct this study with bigger sample size, but the COVID-19 pandemic restricted our research environment and number of participants. Future studies with more observers from multiple educational centers are suggested. We were able only to include second-year medical students and recently graduated paramedics. Also, investigating the differences between START and STM in a more experienced population with multiple disaster scenarios is recommended.

Conclusion

In conclusion, STM was a more reliable triage method than START for medical students and paramedics compared to their colleagues. Although the START program was insignificantly faster, STM accuracy was worth sacrificing for a few seconds and preventing more or fewer triads of victims.

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Authors' contributions

SZHR and SD contributed to conceptualization, study design, and consultation. RM, AP, and AMN contributed to data analysis, and provision of study materials and equipment. ME, and AM contributed to data collection, data analysis, and writing the paper.

Conflict of interest

Authors declare no conflict of interests.

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Ethical Statement

Iran National Committee for Ethics in Biomedical Research approved the study in 2020. All data remained concealed, and patients' rights were preserved. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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