



## Novel Triage for Crowded Emergency Clinics: Patient Triage

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### Abstract

*More effective and accurate methods of triage are needed for overcrowded emergency clinics. In this study, the starting point was taken as 'the patient is the primary and most important factor in determining emergency condition', and thus, the triage was conducted by the patient him/herself. The study involved 308 patients over the age of 16 who were admitted to the Adult Emergency Clinic of Emergency Medicine Department, Hacettepe University Medical School, between May 1st and 9th, 2010. The mean age of the patients was 46 years (SD ± 20.894). Of the patients, 47.9% (n=147) were male, 52.1% (n=160) were female. Considering the complaints of the patients at presentation, and compatibility of diagnosis at triage, Kappa statistics were used and the compatibility rates were as follows: 49.8% in the patients, 41.8% in the paramedics, 63.8% in the nurses, 6.2 % in the intern doctors, 62.6% in the junior residents, 65% in the senior residents, and 66.5% in the specialists. The accuracy rates of prediagnosis based on the patient complaints were 53.1% (n=163) for the patients, 67.1% (n=206) for the paramedics, 71.2% for the nurses, 64.5% (n=198) for the intern doctors, 73% (n=224) for the junior residents, 80.8% (n=248) for the senior residents, and 82.4% (n=253) for the specialists. The overtriage and undertriage rates of the patients were 25.1% and 15.5% respectively, which are compatible with the recommendations by American College of Surgeons Committee on Trauma (ACSCOT). The patients were found successful in establishing the correct triage and diagnosis for themselves. Thus, in cases where the patient him/herself cannot cooperate, experimentation with triage scales developed to involve active participation of patients' relatives may be helpful. In addition, active participation will significantly reduce the rates of complaints for waiting times and related arguments among patients.*

**Key Words:** Overcrowding EDs, triage, self triage, length of stay

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## **Introduction**

In 2002, American Hospitals Association published a report where the hospitals in big cities were claimed to serve more patients than the capacity of the hospitals could handle, which in turn reduced the quality of health care provided [1]. In 2005, American College of Emergency Physicians (ACEP) reported that 69% of Americans considered this state of affairs as an approaching crisis [2].

The number of patients applying to the emergency departments cannot be limited. Therefore, triage is an indispensable aspect of modern medicine since emergency clinics provide relatively narrower range of medical care [3-4]. Increasing number of patients presenting to the emergency clinics leads to delayed treatment or undertreatment of patients who require priority intervention [5-6] In order to prevent these conditions, triage systems that are reliable and easily applicable are needed.

We did not find a similar study in the literature, but in healthy individuals some studies with questionnaires has made to measure of determining emergency conditions. Unlike these studies, in our study participants were the patients that are in real emergency environment [7-9]. Our aim was to measure patient's objective assessment of their situation and contribution of this situation to triage.

## **Materials and Methods**

This prospective study was planned to evaluate the reliability and validity of a novel triage strategy. The study protocol was approved by the ethics committee of Hacettepe University. The study involved 308 patients over the age of 16 who were admitted to the Adult Emergency Clinic of Emergency Medicine Department, Hacettepe University Medical School, between May 1st and 9th, 2010. The patients and all the other participants were informed on the details of the study. Those who volunteered signed an 'informed consent form'. The study also involved healthcare personnel with different positions at the emergency clinic and the patient him/herself, and when the patient was not able to cooperate, one of the relatives of the patient. In some cases, although the tests were began because of emergency of patient, not all the patients could be evaluated by the healthcare personnel. One patient died at the emergency clinic before a diagnosis could be made, and thus was excluded from the study. Of the remaining 307 patients, 100% (n=307) were evaluated by a specialist; 100% (n=307),

by a senior resident, 99.0% (n=304), by a junior resident; 98.0% (n=301), by an intern doctor; 16.6% (n=51) by a nurse; and 100% (n=307), by a paramedic. In 94.1% (n=289), however, the triage and prediagnosis were made by the patient and in 5.9% (n=18), by the patient's relatives.

The patients who were discharged from the hospital or the emergency clinic before the definitive diagnosis was established were enrolled into the follow-up, and until the diagnosis was established, telephone contact was sustained with either the patient or his/her relatives. The laboratory or imaging results were followed. In addition, communication with the outpatient or inpatient clinics where the patient was treated previously was continued.

In this study, a 5-step triage system based on patients' symptoms was used. T1 was used to determine patients in critical condition; T2, to determine patients in high emergency condition; T3, to determine patients with emergency conditions; T4 to determine patients with low-emergency condition, and T5 to determine patients with non-emergency condition.

The patients were asked to classify their conditions as shown in the list below, and the responses were recorded as 'patient triage'.

T1-Critical: I have a very critical condition, serious discomfort, and cannot wait. A doctor should examine me right away.

T2-High-emergency: I have a high-emergency condition, feel terrible, but if there are other patients with higher emergency conditions, I can wait for 30-60 minutes.

T3-Emergency: I have an emergency condition, but if there are other patients with higher emergency conditions, I can wait for 1-2 hours.

T4- Low-emergency: I actually do have a condition, but do not feel very bad. If there are other patients in worse conditions, I can wait for 3-4 hours.

T5-Non-emergency: If the emergency clinic is overcrowded and there are other patients that require urgent care, I can apply to the outpatient clinic.

In the following steps, the patients were asked to predict the disease/condition that was the reason for their symptoms and complaints. The disease/condition that was predicted by the patient was considered 'prediagnosis'.

The same procedure was applied on each of the healthcare personnel who participated in the study. Each of the paramedics, intern doctors, nurses, junior residents, senior residents (>3 years), and specialists was asked to categorize the patients according to their symptoms. In the next step, the same personnel were asked to determine a prediagnosis based on the symptoms of the patients. The responses were recorded as 'triage by healthcare personnel' and 'prediagnosis by healthcare personnel'. The participants were blinded to the responses of the others.

The diagnoses established in the light of examinations and test results were considered 'correct diagnoses'. The triage that each patient should receive based on correct diagnosis and symptoms were considered 'triage based on definitive diagnoses'.

The triages by the healthcare personnel and patients were compared with the triages based on definitive diagnosis, and thus, over and undertriage rates were determined. Undertriage means classifying the patient as a lower-emergency case than he/she actually is, while overtriage means classifying the patients as a higher-emergency case than he/she actually is. For example, evaluation of a T3 patient, based on definitive diagnosis, as T4 (undertriage) or as T2 (overtriage).

Exclusion criteria:

- Patients under the age of 16
- Patients who died before putting diagnosis or brought dead to the emergency room
- The disease was diagnosed as being allocated to the emergency room and you want to go to another health center or routed patients.

Statistical analyses were conducted using SPSS for Windows Version 15.0 program. The numeric variables were presented in median (min-max) or mean  $\pm$  standard deviation. The categorical values were presented as percentages and numbers. The inter-group differences were evaluated on the bases of the type of the variable and parametric test hypotheses, using t-test, Kruskal Wallis test, or chi-square test. The similarities and differences between the triages by various healthcare personnel categories were evaluated with McNemar test and weighted Kappa correlation.  $p < 0.05$  was considered statistically significant.

## Results

In 9-day period, 1698 patients applied to the emergency clinic. Of these, 308 (18.1%) patients were admitted to the emergency clinic and evaluated for triage. The mean age of the 307 patients who were enrolled into the study was 46 (SD  $\pm$  20.894) years. Of the patients, 47.9% (n=147) were male, and 52, 1% (n=160) were female. Based on the patients' complaints, the triage evaluation rates were as follows:

Paramedics: T1, 2.6% (n=8); T2, 17.9% (n=55); T3, 43% (n=132); T4, 29% (n=89); T5, 7.5% (n=23).

Nurses: T1, 49% (n=25); T2, 27.5% (n=14); T3, 13.7% (n=7); T4, 5.9% (n=3); T5, 3.9% (n=2).

Intern doctor: T1, 19.9 % (n=60); T2, 17.6 % (n=53); T3, 35.2 % (n=106); T4, 22.9% (n=69); T5, 4.4 % (n=13).

Junior Resident: T1, 18.8% (n=57); T2, 19,7 % (n=60); T3, 32.9 % (n=100); T4, 25% (n=76); T5, 3.6 % (n=11).

Senior Resident: T1; 18.6 % (n=57); T2, 20.2% (n=62); T3; 32.9 % (n=101); T4; 24.1% (n=74); T5, 4.2 % (n=13).

Specialist: T1, 17.6 % (n=54); T2, 21.2 % (n=65); T3, 32.2 % (n=99); T4, 24.8% (n=76); T5, 4.2 % (n=13).

Patient: T1, 18.6% (n=48); T2, 19.4 % (n=50); T3, 29.8% (n=77); T4, 24% (n=62); T5, 8.1 % (n=21).

Triage Categories According to Patients' Definitive Diagnoses: T1, 14.7% (n=45); T2, 14.7 % (n=45); T3, 35.8 % (n=110); T4, 27% (n=83); T5, 7.8 % (n=24).

A statistically higher number of patients were in T3 category than in the other categories ( $p < 0.05$ ) (Table 1). The compatibility rates of triage by both the patients and healthcare personnel and definitive diagnosis triage were evaluated using weighted Kappa statistical method (Table 2). The compatibility rates were as follows: 49.8 % for the patients, 41.8% for the paramedics, 63.8% for the nurses, 62.2% for the interns, 62,6% for the junior residents, 65 % for the senior residents, and 66.5% for the specialists. Overtriage and undertriage rates as follows: Overtriage: 25.1% for patients, 17.5% for paramedics, 17.6% for the nurses, 24.9%

for the interns, 23% for the junior residents, 21.4% for the senior residents, and 20.5% for the specialists; Undertriage:15.5% for the patients, 35.8% for the paramedics, 17.6% for the nurses, 8.9% for the interns, 8.8% for the junior residents, 8.75 for the senior residents, and 9.4 % for the specialists (Table 3). The correct prediagnosis based on the patient’s complaints were made by 53.1% (n=163) of the patients, 67.1% (n=206) of the paramedics, 71.2% of the nurses, 64.5% (n=198) of the interns, 73% (n=224) of the junior residents, 80.8% (n=248), of the senior residents, and 82.4 %(n=253) of the specialists (Table.4).

The paramedica, interns, and junior residents did not differ statistically in terms of correct diagnosis rates ( $p>0.05$ ). Similarly, the senior residents and specialists did not differ statistically in terms of correct diagnosis rates ( $p>0.05$ ). However, the correct diagnosis rate by the paramedics was statistically significantly different from those by senior residents and specialists ( $p<0.05$ ). The rate of correct diagnosis by the patients was statistically lower than that of the healthcare personnel ( $p<0.05$ ).

**Table 1:** Comparison of the rates for triage by the healthcare personnel and patients based on the complaints of the patients and definitive diagnosis rates

	T1	T2	T3	T4	T5
Patients	18.6%	19.4%	29.8%	24%	8.1%
Paramedics	2.6%	17.9%	43%	29%	7.5%
Nurses	49%	27.5%	13.7%	5.9%	3.9%
Interns	19.9%	17.6%	35.2%	22.9%	4.3%
Junior Residents	18.8%	19.7%	32.9%	25%	3.6%
Senior Resident	18.6%	20.2%	32.9%	24.1%	4.2%
Specialist	17.6%	21.2%	32.2%	24.8%	4.2%
<b>Definitive Diagnosis Triage</b>	<b>14.7%</b>	<b>14.7%</b>	<b>35.8%</b>	<b>27%</b>	<b>7.8%</b>

**Table 2:** Comparison of the compatibility rates of triage by the healthcare personnel and patients and definitive diagnosis rates by weighted Kappa statistical method.

<b>Triage</b>	<b>Compatibility</b>
Patients	49.8 %
Paramedics	41.8 %
Nurses	63.8 %
Interns	62.2 %
Junior Residents	62.6 %
Senior Resident	65 %
Specialist	66.5 %

**Table 3:** Overtriage and undertriage rates

	Undertriage %	Overtriage %
Patients	15.5	25.1
Paramedics	35.8	17.5
Nurses	17.6	17.6
Interns	8.9	24.9
Junior Residents	8.8	23
Senior Resident	8.7	21.4
Specialist	9.4	20.5

**Table 4:** The correct prediagnosis rates by the patients and healthcare personnel

	Correct prediagnosis rates
Patients	53.1%
Paramedics	67.1%
Nurses	71.2%
Interns	64.5%
Junior Residents	73%
Senior Resident	80.8%
Specialist	82.4%

## Discussion

Based on the definition of emergency patient by ACEP in 1994 [7-10]: Each individual applying to emergency clinic and defining him/herself as “emergency patient” should be admitted to the clinic and evaluated. In this study, we made start from ‘the patient is the primary and most important factor in determining an emergency health state’ as in the definition by ACEP. Thus, the triage was made by the patient him/herself. Literature does not present any studies on hospital triage where the patient evaluated his or her own complaint and determined his or her state of emergency. However, there are some questionnaire based studies measuring the success rates of healthy individuals in determining the emergency. In the study by Huang et al, far-sighted laypersons, who possess an average knowledge of health and medicine, families with kids, and babysitters defined the emergency situations correctly for premeditated scenarios [8]. In another study, Li et al [7] asked prudent laypersons to mark emergency conditions on ICD-9 diagnostic code list, and it was expected that the decisions of more than 50% of the participants would be considered as prediagnosis and emergency state. They accurately determined emergency cases such as loss of consciousness, seizure, plegia, shock, gangrene, bloody vomit, respiratory difficulty, chest pain, and suffocation at a rate of 75%. The same participants (5%) also determined non-emergency conditions such as sleep disorder, hiccup, gas, swelling, indigestion, cough, lack of appetite, or sore throat as



emergency states. Moll Van Charante et al [9] sent questionnaire forms to the addresses of the patients who applied to the emergency clinic and primary healthcare centers and asked them why they preferred emergency clinics or primary healthcare centers. In that study, the range of patient profile applying to emergency clinic was evaluated and the compatibility of the reasons for application was studied. In the majority of the patients, reasons for application to emergency departments were found to be correct on the basis of the need for emergency treatment. The rate of the patients who did not need to apply to the emergency department was lower and the determination of a non-emergency state was made by a physician only after diagnostic tests and treatment.

In this study, the rates of correct prediagnosis and triage by the healthcare personnel based on the symptoms of the patient were in direct correlation with seniority. Compared to the rates by the other groups of healthcare personnel, the rates of correct prediagnosis and triage by the senior resident and specialist were statistically significantly higher. Any unexpected finding was attributed to the marked success of the paramedic in correct diagnosis despite his/her failure in establishing correct triage because although the paramedic was aware of the correct diagnosis, s/he did not have through knowledge of the triage category of the complaints and the paramedic and the nurse did not have any training to establish triage. They did not base their evaluations on the triage card, and they did it in haste. Even if they had evaluated the emergency condition correctly, they did not know its triage category. Thus, the rates of correct triage were lower, but the rates of correct diagnosis were higher.

The rate of patient triage (49.8%) was parallel to the rate of triage for definitive diagnosis. The correct prediagnosis rate by the patients was 53.1%. These findings show that the patients were highly successful in both the correct diagnosis and triage evaluation. Strikingly, these rates were similar to those by the paramedics, nurses, and intern doctor who did not receive any particular training for triage, which implies that if the triage is not established by trained healthcare personnel, the triage by the patient is just as important as that by the healthcare personnel. The patients were also asked to consider the conditions of the other patients while establishing their triage. To this end, the questionnaire involved answers that particularly emphasize the emergency states of the other patients. The findings of the study showed that when the responsibility and control is given to the patient, s/he does not tend to exaggerate his/her condition; on the contrary, s/he acts honestly and uses common sense. With this

practice, we observed that the number of occasions where patients and their relatives waiting to be served complained or had arguments decreased.

The overtriage or undertriage rates were also compared. According to the recommendations by ACSCOT, the undertriage rate in any given triage system should not be below 10%. To keep the undertriage rate below 10%, the rate of overtriage may exceed 50% [11-12]. In our study, the undertriage rates by the nurse and the paramedic were higher than that recommended by ACSCOT and the patients' undertriage rates. Medically speaking, the triage made by the physician and healthcare personnel with special training for triage is expected to be correct [13-14]. In addition, the higher the priority of the emergency state of the patient is, the shorter the time for admission to the emergency clinic and physician and patient encounter. The physician considers the high emergency state of the patient and leaves the work that s/he has been performing on the other patients and meets the new patient in a hurry. At the end, if the emergency is of lower priority (triage category) than expected, s/he feels that all the panic and haste is unnecessary. This creates tension between the physician and the paramedic or nurse that established the triage. Thus, the undertriage rates by the healthcare personnel other than the specialist may have been higher since they do not want to set an alarm for emergency for wrong conditions.

The undertriage rates by the intern, senior resident, and specialist were below the recommended 10%, and the overtriage rates by the same personnel were below 50%. When the paramedic and the nurse were excluded, the undertriage and overtriage rates by the other healthcare personnel were more successful than the rates reported in the literature [12, 15-16]. The overtriage rates by the patients were compatible with the recommendations of ACSCOT, but the undertriage rate was 15%. This still indicates that the patients were highly successful in estimating their triage category.

The complaint of a patient is a subjective evaluation. This evaluation is considered important at varying degrees by different positions of healthcare personnel. Based on the findings of this study, we believe a novel triage system should be developed and the evaluation of the patient him/herself should also be included. Patients with chronic diseases frequently apply to our hospital. These patients have gained experience in recognizing ordinary or emergency states. This may have been effective in high rate of success in prediagnosis by the patients. The number of elderly patients with chronic diseases applying to hospitals has been increasing

[17-18]. Therefore, the number of applications by those who are aware of their conditions and emergency category will also increase.

### **Conclusion**

Literature does not reveal any studies where the patients actively participate in determining his/her triage. Nevertheless, our findings indicated that the patients were almost as successful as any healthcare personnel with no training for triage determination in establishing both triage and prediagnosis. Thus, in cases where the patient him/herself cannot cooperate, experimentation with triage scales developed to involve active participation of patients' relatives may be helpful.

### **Conflict of Interest**

The authors declare no conflicts of interest.

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