



A model of complaint based for overcrowding emergency department: Five-Level Hacettepe Emergency Triage System

Aşırı kalabalık aciller için şikayet temelli bir model:
Beş-Düzeyle Hacettepe Acil Triyaj Sistemi

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BACKGROUND

To compare ESI Five-Level Triage System with 5-Level Hacettepe Emergency Triage System (HETS), which was developed for Overcrowded EDs in our country.

METHODS

Over a period of six days, patients were assessed by a different ED staff everyday using HETS, then re-evaluated blindly by an emergency physician using HETS. Then patients were evaluated blindly for a third time by an independent, ESI-using emergency physician.

RESULTS

Of the patients in the study, 133 were men, 175 were women and the average age was 44.41±18.033. Inter-rater agreement was 97.40% (Kappa=0.963) between HETS and HETS-Blind, 74.35% (Kappa=0.646) between HETS and ESI-Blind, 74.67% (Kappa=0.652) between HETS-Blind and ESI-Blind. Inter-observer agreement between the second emergency physician performing HETS-Blind and the first emergency physician, resident, or nurse was very good (Kappa=1.0). Intern doctor, non-medical secretary and paramedic were found to have almost very good agreement (Kappa=0.971; 0.935; 0.864, respectively). An overtriage of 7.25% and undertriage of 1.08% were found in HETS.

CONCLUSION

Complaint-based HEST developed for overcrowded EDs is a triage system with a very good agreement between observations and observers. low undertriage and overtriage ratios, and easy application by all staff from a non-medical secretary to the emergency physician.

Key Words: Complaint-based triage system; emergency medicine-department; emergency severity index; Hacettepe emergency triage system; triage.

AMAÇ

Ülkemizdeki kalabalık aciller için geliştirdiğimiz şikayet temelli 5-düzeyle Hacettepe Acil Triyaj Sistemi'ni (HATS) ESI 5-düzeyle triyaj sistemiyle karşılaştırmaktır.

GEREÇ VE YÖNTEM

Altı gün süresince hergün başka bir görevli tarafından HATS ile değerlendirilen hastalar, bir acil tıp uzmanı tarafından HATS ile kör olarak tekrar değerlendirildiler. Her iki değerlendirme kararını bilmeyen ve ESI konusunda uzman olan başka bir acil tıp uzmanı tarafından bağımsız ve kör olarak ESI ile değerlendirildiler.

BULGULAR

Araştırmadaki 308 hastanın 133'ü erkek, 175'i kadın ve yaş ortalaması 44,41±18,033 bulundu. HATS ile HATS-Kör karşılaştırıldığında gözlemler arası tutarlılık %97,40 (Kappa=0,963), ESI-Kör ile karşılaştırıldığında gözlemler arası tutarlılık %74,35 (Kappa=0,646) saptandı. HATS-Kör ile ESI-Kör karşılaştırıldığında gözlemler arası tutarlılık %74,67 (Kappa=0,652) saptandı. Birinci acil tıp uzmanı, acil tıp asistanı ve acil hemşiresi ile HATS-Kör uygulayan ikinci acil tıp uzmanı arasındaki tutarlılığın en yüksek olduğu (Kappa=1,0), intern doktor, tıbbi olmayan acil sekreteri ve paramedikin de çok iyi olduğu (sırasıyla, Kappa=0,971; 0,935; 0,864) saptandı. HATS ile değerlendirilen hastalarda %7,25 yanlış yüksek triyaj, %1,08 yanlış düşük triyaj bulundu.

SONUÇ

Aşırı kalabalık acil servisler için geliştirilmiş olan şikayet temelli HATS, gözlemler ve gözlemciler arası tutarlılığı yüksek, yanlış triyaj oranları düşük, tıbbi olmayan sekreterden acil tıp uzmanına kadar herkesin kolaylıkla uygulayabileceği bir triyaj sistemidir.

Anahtar Sözcükler: şikayet temelli triyaj sistemi; acil servis; acil tıp; acil şiddet indeksi; Hacettepe acil triyaj sistemi; triyaj.

Overcrowded emergency departments, dedicated to providing a continuous medical service 24 hours per day, 7 days per week, are becoming an ever-increasing problem in developing countries, such as Turkey, in terms of emergency medical services.

Different strategies of administration and triage have been developed to notice urgent and critical patients in overcrowded emergency departments and not to cause an increased rate of morbidity and mortality.^[1-9]

Inappropriate care areas and long durations for care in overcrowded emergency departments cause problems between patients and health care providers.^[10-14]

Different triage systems (2-Level, 3-Level, 4-Level and 5-Level) have been applied to determine the priority and management of health care for emergent patients in emergency departments.^[15-19]

A survey carried out in US in 4897 hospitals showed that there is no triage system in 0.7% of emergency departments, a 2-level triage system in 0.3%, a 3-level triage system in 25.2%, a 4-level triage system in 9.6%, a 5-level ESI triage system in 56.9%, another 5-level triage system in 6.3%, and other triage system in 0.1% of emergency departments.^[20]

It was also shown that the triage level application has changed according to the number of incoming patients; while 5-level ESI triage system applied in 78.3% of crowded emergency departments having more than 100.000 or more annual urgent patients, 3-level triage system has been applied in 60.2% of the emergency departments having less than 1.000 annual urgent patients.^[20,21]

As suggested in the statement published in 2009 by the Ministry of Health of Turkish Government, the 3-level triage system has been commonly used in Turkey. In 3-level triage system, patients are categorized as emergent (red), urgent (yellow) and non-urgent (green).^[22]

5-level triage systems such as Australasian or National Triage Scale (ATS-NTS), Canadian Triage and Acuity Scale (CTAS), Manchester Triage System (MTS), and the Emergency Severity Index (ESI) have been widely used in emergency departments of developed countries in terms of emergency medical services.^[23-28]

Validity and reliability of 5-level triage system were found to be greater than 3-level systems.^[15,29-31]

There are various studies about accuracy, reliability and validity of acute patient triage in ATS-NTS, MTS, CTAS and ESI 5-level systems.^[21,32-37]

ESI 5-level triage system which is widely used and has high value in US has been developed by emergency physicians, Richard Wuerz and David Eitel. In this

system, patients are categorized from triage level 1-2 (life-threatening and critical conditions) to triage level 3-5 (diseases according to the necessities for expected sources usage).^[38,39]

With respect to the characteristics of the hospitals, the triage mission is accomplished by different health care providers such as the emergency physicians, nurses or paramedics in emergency departments. Studies about which of these health workers perform more accurate triage are insufficient.^[40-45]

Although ESI 5-level triage system has higher reliability and validity, it is unlikely to be routinely applied in the emergency departments of our country since it requires experience and education and, it is difficult to find a triage expert. Evaluation time is long in triage area and violent actions are made by patients who do not tolerate waits in overcrowded emergency departments (1.000 or more patients/day).

For overcrowded emergency departments, an emergency triage system is needed that can be applied quickly, does not require any education or experience and is determined based on the priority for care according to the chief complaints, prediagnosis or symptoms of the patients.

To address this need, a complaint-based 5-level Hacettepe Emergency Triage System (HETS) has been developed for overcrowded emergency departments in our country.

The aim of this study is to compare ESI 5-level triage system which has been tested for its world-wide validity and reliability and HETS 5-level triage system and to test its consistency and validity for emergency triage applications.

MATERIALS AND METHODS

This methodological study was carried out with 308 patients in the emergency department of Hacettepe University Faculty of Medicine, which had an annual patient number of approximately 35.000 between 08/08/2008 and 08/15/2008. The study was approved by the Ethical Committee.

In the first stage of the study, 5-level triage systems were examined and evaluated.

Secondly, patient triage application complaints from the Emergency Department of Medical Faculty of Hacettepe University over a one-year period were collected and evaluated.

Third, 120 chief complaints, which were mostly applied reasons, were sorted into 5 triage levels according to the priority of the condition. These complaints were then listed alphabetically according to triage levels determined by the users. If there is a condition with a new complaint not written in algorithm,

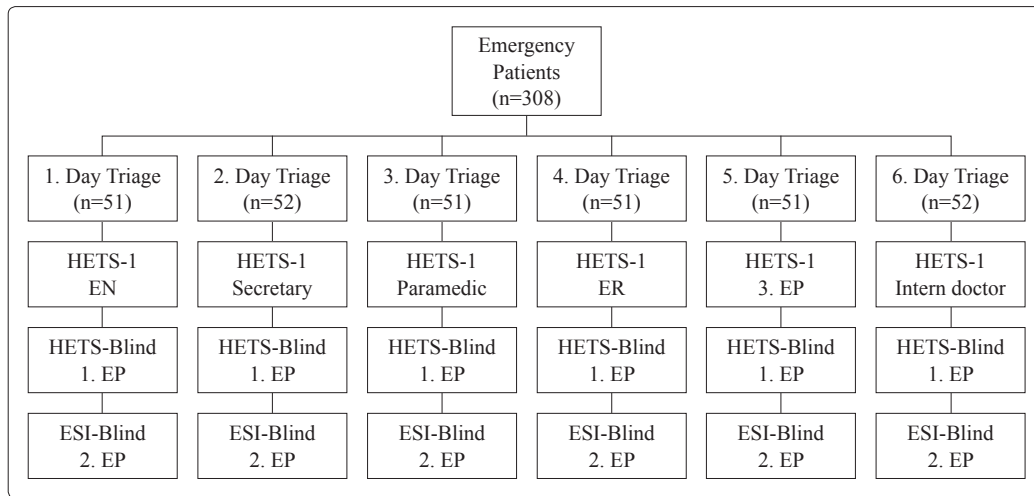


Fig. 1. The study diagram of HATS study. HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index; EN: Emergency Nurse; EP: Emergency Physician; ER: Emergency Resident.

‘Ask to Doctor’ is written on the last line of every triage levels of complaint category.

“Hacettepe Emergency Triage System (HETS)” cards with columns listing the complaint with triage levels of the patients (T1: Critical-Red, T2: Emergent-Orange, T3: Urgent-Yellow, T4: Less Urgent-Green, T5: Non Urgent-Blue), evaluation time (T1: 0 minute, T2: 5-15 min, T3: 30-60 min, T4: 1-2 hours, T5: 3-4 hours) and re-evaluation time (T1: Always, T2: In every 15 min, T3: Once in 60 min, T4: Once in 60 min, T5: Once in 120 min) were hung on the triage table.

In the fourth stage, patients arriving at the Emergency Department were evaluated between 8:00 and

18:00 over a period of six days by different Emergency Department staff (non-medical emergency secretary, emergency nurse, paramedic, emergency intern doctor-last medical student, emergency resident and emergency physician) according to HETS (recorded as HETS-1) (Figure 1).

Patients were also evaluated by an emergency physician who did not know the decision of the first triage staff (the same person over six days) again according to HETS (recorded as HETS-blind).

After the patient’s triage levels, care areas and priorities treatment were determined, an emergency physician who did not know the previous two decisions

Table 1. Vitals signs and demographical information of patients in triage

	(N=308)	Nurse (n=51)	Secretary (n=52)	Paramedic (n=51)	ER (n=51)	EP (n=51)	Intern (n=52)
Gender	Male=133 Female=175	Male=16 Female=35	Male=21 Female=31	Male=21 Female=30	Male=25 Female=25	Male=22 Female=29	Male=27 Female=25
Age (Mean.±SD)	44.41±18.03	44.98±18.20	42.90±19.44	44.00±18.30	46.61±16.22	47.35±18.00	40.67±17.88
Min/Max	16/84	18/78	16/82	17/84	17/83	18/80	20/82
SBP (Mean.±SD)	115.5±22.43	119.61±17.34	115.77±19.73	116.86±21.60	116.47±25.83	114.92±28.79	109.62±19.09
Min/Max	0/220	80/155	80/200	80/180	0/180	80/220	60/175
DBP (Mean.±SD)	72.6±12.99	75±11.24	75.10±12.81	71.18±11.68	73.53±15.20	70.63±14.18	70.19±12.08
Min/Max	0/110	50/101	50/110	45/90	0/100	50/110	40/100
Puls (Mean.±SD)	88.6±16.62	90.9± 16.21	88.52±16.81	85.53±15.17	87.96±20.78	89.51±15.79	89.19±14.61
Min/Max	0/162	60/145	56/140	58/130	0/162	55/137	56/132
RR (Mean.±SD)	17.3±3.27	19.59±3.10	17.73±1.75	17.04±1.87	17.18±4.20	16.71±4.53	15.54±1.40
Min/Max	0/36	16/34	15/24	14/22	0/28	12/36	14/20
PO (Mean.±SD)	96.2±6.37	95.57±4.83	96.60±2.80	96.61±1.88	95.37±13.69	96.22±3.92	96.81±3.08
Min/Max	0/99	75/99	80/99	87/99	0/99	75/99	77/99
Fever (Mean.±SD)	36.49±21.16	36.55±0.61	36.55±0.63	36.76±0.61	35.88±5.16	36.51±0.14	36.66±0.60
Min/Max	0/39.6	35.8/38.9	35.8/39.6	35.9/39.6	0/38.9	35.8/38.1	35.7/38.8

SD: Standart deviation; Min: Minimum; Max: Maximum; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; RR: Respiratory rate; PO: Pulse oximetry.

Table 2. Comparison between HETS-1, HETS-Blind and ESI-Blind in all patients

Triage system	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	24	1	-	-	-	25	1	22	2	-	-	25
T2	1	44	-	-	-	45	-	25	19	1	-	45
T3	-	3	136	-	-	139	-	6	127	6	-	139
T4	-	-	2	82	-	84	-	1	4	65	14	84
T5	-	-	-	1	14	15	-	-	-	4	11	15
n	25	48	138	83	14	308	1	54	152	76	25	308
	Kappa=0.963						Kappa=0.646					
	Agreement=97.40%						Agreement=74.35%					

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

and specialized in ESI independently and blindly re-evaluated the patients (the same person over six days).

Triage and demographical information of patients evaluated as HETS-1, HETS-blind and independent ESI were statistically analyzed with SPSS program for Windows. Inter- and intra-observer agreement was calculated by Kappa statistics.

RESULTS

Of the patients in the study, 133 were men, 175 were women and the average age was 44.41±18.33 years old (median=44, minimum=16, maximum=84).

The numbers and vitals of patients in the study were found to be randomly close to each other (Table 1).

When 308 patients were evaluated by six different emergency department staff with HETS-1 and re-evaluated blindly by the first emergency physician according to HETS (HETS-blind), agreement between triage decisions was 97.40% in all triage levels (Kappa=0.963).

According to triage levels, T1 sensitivity was 96% and specificity was 99.64%; T2 sensitivity was 91.66% and specificity was 99.61%; T3 sensitivity was 98.55% and specificity was 98.23%; T4 sensitivity was 98.79% and specificity was 99.11%; and T5 sensitivity was 100% and specificity was 99.65% (Table 2).

When 308 patients were evaluated by six different emergency department staff with HETS-1 and re-evaluated blindly by the second emergency physician according to ESI, agreement between triage decisions was 74.35% in all triage levels (Kappa=0.646).

According to triage levels, T1 sensitivity was 100% and specificity was 92.18%; T2 sensitivity was 46.29% and specificity was 92.12%; T3 sensitivity was 83.55% and specificity was 92.30%; T4 sensitivity was 85.52% and specificity was 91.81%; and

T5 sensitivity was 44% and specificity was 98.58% (Table 2).

When 308 patients were evaluated by the first emergency physician according to HETS (HETS-blind) and re-evaluated blindly by second emergency physician according to ESI, agreement between triage decisions was 74.67% in all triage levels (Kappa=0.652).

According to triage levels, T1 sensitivity was 100% and specificity was 92.18%; T2 sensitivity was 51.85% and specificity was 93.30%; T3 sensitivity was 83.55% and specificity was 92.94%; T4 sensitivity was 84.21% and specificity was 91.81%; and T5 sensitivity was 40% and specificity was 98.58% (Table 3).

When 51 patients were evaluated by the emergency nurse according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according to HETS on the first day, agreement between triage decisions was 100% in all triage levels (Kappa=1.0). When these same patients were re-evaluated blindly

Table 3. Comparison between HETS-1 and ESI-Blind in all patients

Triage system	ESI-Blind					
	T1	T2	T3	T4	T5	n
HETS-Blind						
T1	1	21	3	-	-	25
T2	-	28	19	1	-	45
T3	-	4	127	7	-	138
T4	-	1	3	64	15	83
T5	-	-	-	4	10	14
n	1	54	152	76	25	308
	Kappa=0.652					
	Agreement=74.67%					

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

by the second emergency physician according to ESI on the second day, agreement between triage decisions was 78.43% in all triage levels. The evaluations by the first emergency physician according to HETS (HETS-blind) and the second emergency physician according to ESI on the first day, had 78.43% agreement between triage decisions in all triage levels (Table 4).

When 52 patients were evaluated by the non-medical emergency secretary according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according to HETS on the second day, agreement between triage decisions was 96.15% in all triage levels (Kappa=0.935). When these same patients were re-evaluated blindly by the second emergency physician according to ESI on the second day, agreement between triage decisions was 82.69% in all triage levels. The evaluations by the first emergency physician according to HETS (HETS-blind) and the second emergency

physician according to ESI had 86.53% agreement between triage decisions in all triage levels (Table 5).

When 51 patients were evaluated by the paramedic according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according to HETS on the third day, agreement between triage decisions was 90.19% in all triage levels (Kappa=0.864). When these same patients were re-evaluated blindly by the second emergency physician according to HETS on the third day, agreement between triage decisions was 66.66% in all triage levels. The evaluations by the first emergency physician according to HETS (HETS-blind) and the second emergency physician according to ESI had 66.66% agreement between triage decisions in all triage levels (Table 6).

When 51 patients were evaluated by the emergency resident according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according

Table 4. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the emergency nurse

Nurse triage	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	7	-	-	-	-	7	-	7	-	-	-	7
T2	-	7	-	-	-	7	-	6	1	-	-	7
T3	-	-	25	-	-	25	-	-	24	1	-	25
T4	-	-	-	10	-	10	-	-	-	8	2	10
T5	-	-	-	-	2	2	-	-	-	-	2	2
n	7	7	25	10	2	51	-	13	25	9	4	51
	Kappa=1.000						Kappa could not calculated because of T1 column is empty					
	Agreement=100%						Agreement=78.43%					

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

Table 5. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the non-medical secretary

Sekretary triage	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	2	1	-	-	-	3	-	3	-	-	-	3
T2	-	3	-	-	-	3	-	2	1	-	-	3
T3	-	1	30	-	-	31	-	1	29	1	-	31
T4	-	-	-	12	-	12	-	-	-	10	2	12
T5	-	-	-	-	3	3	-	-	-	1	2	3
n	2	5	30	12	3	52	-	6	30	12	4	52
	Kappa=0.935						Kappa could not calculated because of T1 column is empty					
	Agreement=96.15%						Agreement=82.69%					

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

Table 6. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the paramedic

Paramedic triage	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	3	-	-	-	-	3	-	3	-	-	-	3
T2	1	9	-	-	-	10	-	4	6	-	-	10
T3	-	2	17	-	-	19	-	3	15	1	-	19
T4	-	-	1	15	-	16	-	-	2	13	1	16
T5	-	-	-	1	2	3	-	-	-	1	2	3
n	4	11	18	16	2	51	-	10	23	15	3	51
Kappa=0.864						Kappa could not calculated because of T1 column is empty						
Agreement=90.19%						Agreement=66.66%						

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

Table 7. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the emergency resident

Resident triage	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	4	-	-	-	-	4	1	3	-	-	-	4
T2	-	6	-	-	-	6	-	4	1	1	-	6
T3	-	-	20	-	-	20	-	-	20	-	-	20
T4	-	-	-	16	-	16	-	-	-	12	4	16
T5	-	-	-	-	5	5	-	-	-	1	4	5
n	4	6	20	16	5	51	1	7	21	14	8	51
Kappa=1.000						Kappa=0.727						
Agreement=100%						Agreement=80.39%						

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

to HETS on the fourth day, agreement between triage decisions was 100% in all triage levels (Kappa=1.0). When these same patients were re-evaluated blindly by the second emergency physician according to ESI on the fourth day, agreement between triage decisions was 80.39% in all triage levels (Kappa=0.727). The evaluations by the first emergency physician according to HETS (HETS-blind) and the second emergency physician according to ESI had 80.39% agreement between triage in all triage levels (Kappa=0.727) (Table 7).

When 51 patients were evaluated by the third emergency physician according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according to HETS on the fifth day, agreement between triage decisions was determined as 100% in all triage levels (Kappa=1.0). When these same patients were re-evaluated blindly by the second emergency physician according to ESI on the fifth day, agreement between triage decisions was determined as 68.62% in all triage levels. The evaluations by the first emer-

gency physician according to HETS (HETS-blind) and the second emergency physician according to ESI had 68.62% agreement between triage decisions in all triage levels (Table 8).

When 52 patients were evaluated by intern doctor according to HETS (HETS-1) and re-evaluated blindly by the first emergency physician according to HETS on the sixth day, agreement between triage decisions was determined as 98.07% in all triage levels (Kappa=0.971). When these same patients were re-evaluated blindly by the second Emergency Physician according to ESI on the sixth day, agreement between triage decisions was determined as 78.84% in all triage levels. The evaluations by the first emergency physician according to HETS (HETS-blind) and the second emergency physician according to ESI had 76.92% agreement between triage decisions in all triage levels (Table 9).

Of all 308 patients evaluated by six different emergency triage staff as HETS-1, HETS-blind and ESI-

Table 8. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the emergency physician

Physician triage	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	3	-	-	-	-	3	-	2	1	-	-	3
T2	-	14	-	-	-	14	-	6	8	-	-	14
T3	-	-	19	-	-	19	-	-	16	3	-	19
T4	-	-	-	15	-	15	-	-	-	13	2	15
T5	-	-	-	-	-	-	-	-	-	-	-	-
n	3	14	19	15	-	51	-	8	25	16	2	51
Kappa=1.000						Kappa could not calculated because of T1 column is empty						
Agreement=100%						Agreement=68.62%						

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

Table 9. Comparison between HETS-Blind and ESI-Blind in patients evaluated by the intern doctor

Intern	HETS-Blind						ESI-Blind					
	T1	T2	T3	T4	T5	n	T1	T2	T3	T4	T5	n
HETS-1												
T1	5	-	-	-	-	5	-	4	1	-	-	5
T2	-	5	-	-	-	5	-	3	2	-	-	5
T3	-	-	25	-	-	25	-	-	25	-	-	25
T4	-	-	1	14	-	15	-	-	1	11	3	15
T5	-	-	-	-	2	2	-	-	-	-	2	2
n	5	5	26	14	2	52	-	7	29	11	5	52
Kappa=0.971						Kappa could not calculated because of T1 column is empty						
Agreement=98.07%						Agreement=78.84%						

HETS: Hacettepe Emergency Triage System; ESI: Emergency Severity Index.

blind over six days, a total of 77 (8.33%) showed an inconsistency with respect to their triage levels.

While HETS triage level in 12.98% of all patients was lower than the ESI triage level (incorrect undertriage), HETS triage level in 87.02% of all patients was higher than ESI triage level (incorrect overtriage).

Of the undertriaged, four patients were categorized in HETS T3 instead of ESI T2; three were HAT T4 instead of ESI T3; and three were HETS T5 instead of ESI T4. The greatest inconsistency at 31.16% was shown in Triage 1. Twenty-two patients evaluated as Triage 1 according to HETS were evaluated as Triage 2 according to ESI.

DISCUSSION

Due to the problems that arise from overcrowded emergency departments, different emergency triage systems and solutions have been tested around the world, including in Turkey.^[1-12]

Five-level triage systems have been commonly used in emergency departments of countries where emergency medical services have been developed.^[23-28]

In the United States, ESI has emerged as a new triage system in which education and experience are needed; it is the most widely used and is the most valuable of emergency triage systems.^[38,39]

There are different studies about the accuracy, reliability and validity of 5-level triage systems for the acute patient triage.^[21,32-37] In an observational study including 486 patients by Worster et al.,^[36] there was no statistical difference between ESI and CTAS triage systems. In a study including 900 patients conducted by eight educated triage nurses, in which Storm-Versloot et al.^[33] used MTS and ESI without using a triage algorithm, it was reported that ESI had a lower triage score than MTS (11% to 20%). In this study, all three systems were found to have a low sensitivity.

In a theoretical scenario study by Storm-Versloot et

al.,^[46] including comparison of MTS and ESI systems, inter-observer Kappa was found as 0.76 for MTS, 0.46 for ESI; intra-observation Kappa was found as 0.84 for MTS and as 0.65 for ESI.

In a study by Burström et al.,^[43] a comparison between triages of physicians and nurses between 8:00 and 21:00 was made; the team led by the physician had a greater advantage than the others in terms of activity and quality indications.

In a study by Chi et al.,^[47] including 3171 patients and comparing Taiwan Triage System (TTS) and ESI, ESI was found to be more accurate than TTS in terms of determining acute patients. When patients determined at 1-level Triage by TTS were evaluated by ESI, their ESI levels were found as ESI 1 in 21.1% of patients, as ESI 2 in 68.1%, as ESI 3 in 7.4%, as ESI 4 in 3.4% and as ESI 5 in 0%. When patients determined at 3-level Triage by TTS were evaluated by ESI, their ESI levels were found as ESI 1 in 0.1% of them, as ESI 2 in 26.2%, as ESI 3 in 39.5%, as ESI 4 in 27.5% and as ESI 5 in 6.8%.^[47]

In a study by Durand et al.,^[41] including evaluations of decisions distinguishing patients between urgent and not urgent by doctors and nurses in France, there was a high level of agreement between the two groups in terms of cranial injury, gynecologic and toxicologic indications while there was a low level of agreement between the two groups in terms of urinary system and hospitalization. Doctors had higher sensitivity (94% to 43.1%) and specificity (89.5% to 30.9%) than nurses in terms of hospitalization of urgent and non-urgent patients.^[41]

In a study by Kahveci et al.,^[45] comparing emergency residents and paramedics, there was agreement between two groups in 47% of 3-level triage decisions (Kappa=0.47) and 45% of 5-level ATS triage decisions (Kappa=0.45).

Kahveci et al.^[45] emphasized that there has to be a new and simple triage scale that can be easily applied by uneducated personnel in all emergency services.

In a reliability study by Tanabe et al.,^[32] including retroactive examination of triage records in terms of the triage accuracy of nurses who have taken ESI education, a better consistency between nurses was found (Kappa=0.89). In a study by Buschhorn et al.^[48] examining the reliability of ESI among EMS personnel, the level of agreement between EMS personnel and emergency triage nurses was found to be medium (Kappa=0.409). In a randomized controlled study by Worster et al.,^[37] comparing 5-level ESI and CTAS triage, there was no difference between triage nurses applying ESI and CTAS (Kappa=0.91, Kappa=0.89).

In our study, HETS was found to have high level

of agreement when applied by different observers and compared to a different triage system.

In our study, when all patients evaluated by emergency department staff using HETS were re-evaluated blindly using HETS, there was a 97.40% agreement between observations (Kappa value was 0.963). When they were re-evaluated blindly using ESI, there was 74.35% agreement between observations (Kappa value was 0.646). When all patients evaluated by the first emergency physician according to HETS were re-evaluated blindly by the second emergency physician according to ESI, there was 74.67% agreement between observations (Kappa was 0.652).

When analyzing the agreement between observers in application of HETS in our study, a very good agreement was detected between the first emergency physician, emergency resident, emergency nurse and the second emergency physician applying HETS-Blind (Kappa=1.0); a very good agreement was also detected between intern doctor, non-medical emergency secretary and paramedic (Kappa levels were 0.971, 0.935 and 0.864, respectively).

Our study showed that the best emergency triage could be applied by emergency physician, emergency resident and emergency nurse who were serving on the subject of emergency medical diseases; a developed and simplified triage system suitable for countries and hospitals according to their patient profiles could be correctly applied even by a non-medical secretary.

The biggest problem in evaluation of emergency triage is to evaluate life-threatening critical or emergent patients as less urgent or non-urgent patients.

These incorrectly undertriaged patients could be kept waiting in incorrect areas of emergency departments for a long time; thus the mortality and morbidity ratios could be increased.

Another problem is to evaluate less urgent or non-urgent patients as emergent or urgent patients. These incorrectly overtriaged patients could unnecessarily occupy emergency departments and emergency department staff and could cause the real urgent patients to be overlooked.

In some of the studies, incorrect overtriage ratios were reported as between 16-62% and incorrect undertriage ratio was reported as 16-61%.^[49-51]

In our study, incorrect overtriage ratio was found as 7.25% and incorrect undertriage ratio was found as 1.08% in evaluation of all patients.

There were no life-threatening cases in the patients with incorrect undertriage ratio. The difference in T1 triage evaluations between HETS and ESI caused the incorrect overtriage of 22 patients. While life-threat-

ening cases such as arrest appeared in Triage 1 category of ESI, all unstable patients appeared in Triage 1 category of HETS.

Complaint-based 5-level Hacettepe Emergency Triage System developed for overcrowded emergency departments is a triage system which has “a very good agreement” between observations and observers, low undertriage and overtriage ratios, and easy application by all staff from the non-medical secretary to the emergency physician.

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