Improve the Quality of Emergency Department Services in the Hospital by optimizing the triage process using a valid instrument: A scoping review

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ABSTRACT

Introduction: Cases that occur in almost all emergency departments are in the form of overcrowding of patients which is a problem with emergency conditions, triage is carried out to overcome the problem. This study aims to describe valid scala triage instruments used in the Emergency Department to improve the quality of service in hospitals

Methods: Design research scoping review with a review of several results of a search. Reviewed research results have been selected by three authors with the use Rayyan Shopware application, then five steps are taken in scoping review procedures according to the guide from Arskey and O'Malley in 2005 and the JBI.

Results: Based on the results of a review of 13 articles There are several types of triage systems used in the service hospital, as the triage ESI with an average p-value <0.001 and ka value $=0.94$, ATS with kappa $0.51-0.87(p,0.01)$, ESI+ flow fullchak with value $(p<0.002)$, STS $p=0.009$, JTAS $p= 10$ and also the Three Level Triage Scale weighted Cohens Kappa of 0.75. as well as CETS with p-value $= 0.001$.

Conclusion: This consists of several design research among them studies prospective, experimental quasi-experimental, retrospective, descriptive, and proportional, cohorts, RCT can conclude that the triage who have the highest validity and reliability is ESI triage on average p-value <0.001 and the under is STS with p-value $=0.009$.

INTRODUCTION

Triage is one method used to evaluate the risk of death in patients in the emergency unit emergency for all comers [1]. One stage in determining the order of care and treatment in the emergency unit is emergency [2]. The phenomenon that occurs in several EDs is a density of patients in the emergency unit emergency which is a problem or case with a condition terrible and threatening emergency health patient because that triage is done to overcome the problem [3]. Triage as part of an effort to increase Patient safety is a process carried out in service of terrible emergencies that collects information about patients, categorizing and prioritizing the needed patient [4]. Triage can be concluded as a step initially carried out by officers triage for set action that will be given to the patient by priority the problem [5].

Triage aims to determine priority maintenance medical and time wait by the level severity condition medical each patient [6]. Retrieval process decision triage has been introduced and influenced by many factors both internal and external [2]. System triage used must show validity and reliability are adequate and recommended [7]. Error in classifying level need patients, especially in older patients is one problem main in triage [8].

Triage is very functional and important in the ED described as function sorting or sorting patients into

categories or priorities for a given action [9]. The objective of sorting patients is to identify patients who have threatening conditions soul or emergencies then patients place room curtains on their condition [10]. Nurses do have not quite enough answers to evaluate short, focused, and established triage-level patients in the ED [3]. If the nurse makes a mistake in the triage process, then will be worse for patients visiting and being treated in the ED [11].

Review several studies about instrument triage patients' terrible emergencies that have been done, but not yet there is research that reveals the triage instruments used in a way common in the ED [12]. Study studies prospectively carried out forknow comparison reviewed ESI and STS instruments from executor triage that is doctors, nurses, and patients [13]. Evaluate validity and reliability triage Emergency Severity Index and ATS in patients children in Iran, ESI and ATS reliability is good for children [14]. Validation to service triage version 4 in patients and adults was also carried out on 1008 subjects with studies prospective observational cohort, especially in patients with cancer. Validity and reliability implementation triage Emergency Severity Index in Spanish Hospitals [6].

Other research also related comparison and difference of several triage instruments that as a comparison triage Emergency Severity Index plus pulse peak in COPD [11]. Difference application Emergency Severity Index in cases of neurology, children, and disease lungs [9]. Service results triage Emergency Severity Index in the country developed and developing countries [2]. The effectiveness of the ESI instruments was compared with the Spot check instrument in Iran [14]. System triage used in the world, including Indonesia which has the percentage highest is triage Emergency severity index is 70 % in the United States [15].

Application triage varies across developing countries as well as in developed countries, which has been depicted from the results study. Several studies prospectively, reported There are several triage systems used in emergency installations valid and reliable emergency. However, not yet some are standardized in a way national or international for use in the ED. Understand that triage is very important for lowering the number of deaths and preventing disabilities in admitted patients to the ED. Therefore, we reviewed scoping to explore and map several scale instruments triage moment this is what is in the installation terrible emergency. Information will

be useful in service at installation terrible emergencies for giving more service good.

METHODS
Design Studi

Study This is a review scoping carried out with the adopted methodology from Arskey and O'Malley (Arksey & O'Malley, 2005) in for scoping review, one framework methodology first to form the study [16]. A scoping review is a method that evidence systematically maps several results of research and identifies wide related data sources and gaps in the literature in complex and extensive data in the form of quantitative, qualitative, and mixed. The goal is to map with fast concepts underlying key something field research and sources main as well as type available evidence. Overview scoping involves synthesis and analysis of various materials research and non-research to give clarity and more conceptual good about something field certain. In matter, review scoping provides proof maps of what has been generated from different sources or is heterogeneous compared to only looking for proof best to answer a question related to policy or practice.

Population Concept and Context:

Population: Study this focuses on instruments triage used to categorize patients by their needs.

Concept: Instrument triage used in Emergency Department

Context: Unit Services bad Emergency Department intra Hospital

Criteria inclusion and exclusion:

Inclusion: Article study related to national and international issues with triage in the emergency unit emergency hospital, published research in the range 10 years final, language research English and Indonesian, research that can accessed in a way full.

Exclusion: Article study national and international related with triage outside hospital, study published before 2013.

Identify relevant study literature and strategies search

With using keywords triage, patient, emergency unit emergency, and homesick. In this review, we use a database that will search for include: PubMed, Willey,

ScienceDirect, and Doaj. The keywords used in the search literature include "Triage", "Emergency Department ", Hospital. Boolean used namely AND and OR. The same keywords are used for all database sources based on PCC. Besides the reference in the machine Google Scholar searchers also searched for article possible additions missed in previous database searches. Search limited to articles the complete text is published in English and Indonesian from 10 years old final that is 2013 up to 2023

Selection Studi

The selection process was carried out by three people (HR, EF, RR) using the Rayyan Shopware Program application, which illustrates the process, results filtering, and criteria extraction manuscript after the search finished based on the criteria inclusion and exclusion study [17]. In conclusion, from 5 databases 862 relevant abstracts were collected. After deleting the article duplicate as many as 52 so 810 articles remain. next, the title was filtered for its relevance which produced 79 articles for filtering more carry that as an article discussing triage. From the amount of these, 13 articles were categorized as related directly to question research. Studies chosen for review are in a process of two steps. first, the writer reviews the title and abstract, and second, the text completes the article. The selection process through criteria inclusion and exclusion is gradually shown in Figure 1 using PRISMA Image [18]. All abstract that has been identified from the search article is entered in Mendeley and exported using RIS data in the Rayyan app, to sort duplicate articles, then do inclusion to ensure reliability in screened articles based on criteria existing inclusion and exclusion arranged. Extracted data will include specific details about the patient, triage instruments, and terrible emergencies and hospitals.

RESULTS

Of the 13 studies reviewed, 4 were conducted in a country Iran, 2 studies in Spain, 1 study in Jamaica, 1 in Australia, New York 1, America United States 1, Switzerland 1 and Japan 1 study and 1 in China. Design research and test methods used very diverse namely 6 using prospective studies, 1 retrospective study, 3 quasi experiment. Sturdy observational 2. Samples used in the research studies extracted are also diverse that is some is researching nurses and some also do research emergency unit patients emergency.

In studies quantitative with method and design mixture or various, triage Emergency Severity Index is scale most triage its use reported, however, type scale disease used in study This These include Emergency Severity Index (ESI), Australian Triage Scale (ATS), Stroke Triage Scala (STS), ESI+ Peak Expiratory Flowmeter (PEF), Triage Scala three-level or Three Tier system, JTAS (Japan Triage Acquired Scale) and CETS (Chinese Emergency triage scale) [19].

Based on findings, after Scoping was carried out on the instruments used in the emergency unit intra-hospital, validity and reliability of ESI in Spanish hospitals carried out with experimental method with carrying out the index kappa test was obtained exists suitability inter ESI classification nurse with mark coefficient ka = 0.94 [1]. Studies proportionately is also done foreknow impact from ESI in the ED for evaluate reliability between nurse with Chi-Square test and Unweighted test with value 0.455: 95% concluded that ESI as valid tool for use in emergency services, especially in other countries proceed [2]. The Stroke Triage Scale (STS) was tested using compare with ESI in Iran from 143 patients, 52 in STS triage, 53 in ESI triage, and 38 samples that were not fulfil criteria, then the Independent T-test is carried out with significant p-value namely STS (p=0.009) and ESI (p=0.001) viz reliability ESI taller compared to STS [9].

Study similar related validity of the Emergency Severity Index version 4 in the emergency unit emergency with objective for evaluate validity triage version 4 in patients adults conducted in New York with do studies Cohort observational especially in patients cancer with amount population sample as many as 1075 have been filtered of 2337 patients, 1562 patients complied condition because 67 were issued because no complete in matter the documentation. Distribution score triage this version 4 in a way significant for emergency unit patients emergency as many as 1358 with value (p=0.001). Triage results this version 4 namely ESI 1: 1%, ESI 2: 43%, ESI 3: 54%, and ESI 4:2%, from results can concluded that triage Emergency Severity Index version 4 or version 5 can considered in the future for patient cancer active in the emergency unit emergency [11]. To evaluate validity and reliability ATS triage (Australian Acquired Scale) is carried out in studies prospective in children child mofid at hospital children in Iran, obtained that patient child get decision triage is not accurate their triage low (12%) there are also decisions the triage high (15%). Reliability

test value with a Kappa index of 0.65 – 0.92 (p=0.01) for these emergency severity index, and for ATS the Kappa value was 0.51 -0.87 (p=0.01) which means that ATS has good reliability for triage in children likewise with triage Emergency Severity Index due choose mark the same significance [10].

Researchers also in Iran did a comparison between ESI alone and ESI + PEF (Peak Expiratory Flowmeter) especially in COPD patients with RCT study with ESI results (p<0.001) whereas for ESI +PEF(p<0.002) [12]. Effectiveness The five-level Emergency Severity Index triage was carried out on 770 patients referred to Imam Khomeini Hospital in Iran with use Quasi experimental study for survey effectiveness system five- level ESI triage and also perform comparison with an inspection system straight away, got it that For triage inspection straight away triage Emergency Severity Index has the same advantages in other words no found significant difference with value (p = 0.998) [14]. Modification Emergency Severity Index triage carried out in Switzerland for improve clinical parameters to NSC patients, totaling 948 patients on average he is 81 years old done Observational Multicenter study prospective with follow carry on for 30 days for measure ESI strength is obtained exists significant improvement from 0.66 to 0.71 with value (p=0.004) is interpreted that triage this effective for NSC patients and need consideration especially in elderly patients [1].

Descriptive Study conducted by Ruiperz in Spain forknow is ESI valid for triage based on evidence carried out on nurses totaling 32 nurses and 410 patients, relations between take care stay with level severity with carry out the Spearman's rho coefficient test with the result is rho= 0.437 and the value (p=0.01) which means that the length of treatment patient correlated with triage [20]. Almost research similar done in Japan with evaluate utility triage by accuracy agreement interpreter by expert nurses triage with method RCT, which aim for inspect accuracy decision triage to specialists nursing between JTAS triage (Japan Triage Accurated Scale). Experimental research was conducted on 14 nurses and 23 nurses for inspect results triage from research got this that Japan using a triage system alone namely JTAS but Emergency Severity Index triage can also be done introduced in the country, because found in factors age JTAS: 35.5% and ESI: 35.4% with value (p=0.75) while in the working period JTAS: 6.8% while ESI: 9.2% with value (p= 10) [21].

In 2021 in Jamaica there will also be done research on 166 cases during the education period consisting from collaborative learning fund participants in a way consistent, useful know reliability application triage to nurses new compared to existing nurses trained in emergency units emergency with reliability testing interpreter PT and SF compare one each other for evaluate how far are they agree to triage this. The results of the agreement between two interneter get recommendation for increase implementation triage emergency severity index that can be used in a way complain in Jamaica [15].

System triage three level validity and reliability tests were carried out compared to with five levels carried out in Australia on 300 triage patients three level and 280 patients were triaged five levels with design prospective study research using Cohen's kappa statistical test, it was obtained mark significance five-tier triage more tall compared to with triage three level that is five- level triage : 0.81 and triage three level : 0.57 which means sensitivity five- tier triage more tall rather than a triage system three level [14]. CETS (China Emergency Triage Scale) triage is implemented in the emergency unit emergency hospital in China is also done evaluation related validity and reliability, where participant as many as 51 nurses and 800 patients were carried out in the room terrible emergency in 2018 with a multicenter design Cross-sectional for evaluate reliability than CETS triage in eight emergency units in hospital. As for the variable being assessed that is average time triage in the room terrible emergency to all nurses, obtained 1 51.5 hours on average not enough over 26.3 seconds with using triage instruments computer based. The Chi Square statistical test shows exists significant difference in time triage between CETS and level value (p<0.001) which has meaning that connection between level CETS acuity triaged by nurses show significant results [13].

DISCUSSION

The level of ED occupancy does not have a significant influence on the necessary health services for suspected patients who have suffered a stroke, according to a recent study. In general, there are four known patterns that form the basis of the impact of density on emergency services: adverse outcomes, declining quality, interference with access, and loss of provider health services. The consequences are unpleasant and can threaten the mortality and morbidity of patients' lives. A systematic

review was published that introduced three major factors related to the quality of service for patients, including the amount of waiting patients in triage, the level of ED occupancy, and the number of patients on the waiting list to enter the ward [22].

A previous study has shown that the Emergency Severity Index (ESI) triage has been proven to be valid and reliable. However, according to Amir (2015), the ESI shows good results in countries like the United States, but for developing countries like Iran, it has yet to show optimal results[1]. In a study evaluating the validity and reliability of triage carried out by nurses using the ESI system, reliability between raters and intra-raters was calculated for every nurse and pointed out a perfect fit. The emergency room can become overcrowded, and limited health services can result in long wait times, termination of treatment, and quality patient management. Currently, five-tier triages such as ESI are widely used as an emergency triage tool. ESI is a comprehensive algorithmic triage system that can predict hospital reception and use resources efficiently [14].

Several studies have been conducted using the ESI triage algorithm. A study in Belgium showed good agreement between nurse triage and reference answers using ESI-v4, with a kappa value of 0.72. The maximum level of disagreement occurred at triage level 2. Another retrospective study was conducted on 780 pediatric patients, which showed a suitability mark of 0.92 for level nurse-assessed triage and 0.78 for level triage assessed by nurses and doctors. During the validity phase, 510 patients were involved in the final data analysis. These studies show that the ESI triage algorithm is a reliable and valid tool for triage [23].

In other studies, the overall suitability between assessments carried out by nurses and actual ESI scores was 0.89, and the ESI levels were correlated with the possibility of entering the hospital. In a study by Wuerz et al., 493 patients were registered, and 159 (32%) patients were treated at the hospital. The weighted kappa between doctors and nurses was 0.80 (95% CI = 0.76-0.84). The agreement between nurse participants and nurse experts is 0.65, which is similar to our research that shows almost perfect agreement between both of them [14]. On the other hand, we don't can find significant relationship between level ED occupancy and quality service stroke patient. Ben- Jakov et al. in 2015 showed that the more severity level ED crowding is related with low possibility go out from hospital because attack ischemic transient and mild stroke [9]. For confirm results study this, Chaterjee et al. in 2011 concluded that density room terrible emergency no relates with lateness adequate care for stroke patients condition thrombolysis. However, they show that patient with symptom more from 3 hours and without indication thrombolytics experience CT delay during level more ED density high [24]. In study retrospective, also shows that changes in nursing shifts and times transition maintenance No cause delay giving thrombolytics in eligible patients condition with a diagnosis of ischemic stroke I [25].

I generate AI models for triaging patients with painful stomachs that have a high level of accuracy. The model works with variable amounts of optimized input for fast evaluation. One of the main benefits of designing an AI-based triage model is that it can accurately triage patients into Levels 3 and 4 independently. Our approach is dynamic and based on a system that uses different models. Our operationalized interface considers this matter and gives the best perceived results. The second strength point is that it gives individual accuracy for predictions to the user end. Our interface enables staff to triage patients by seeing individual probability predictions and making decisions based on information about the possibility of its accuracy. For most patients with painful stomachs, at least one source of power is used for diagnosis and treatment, so they are practically scaled at Level 4 ESI v.4 [26].

CONCLUSION

Our review is purposeful to explore type triage in the installation of terrible emergency House sick. Our findings show that of six triage systems used in the ED, the triage system Emergency severity index is the most triage adopted by some installation terrible emergency hospital. Our review shows that there is a lot of type of triage used that is good for a country to proceed nor develop but there are studies that reveal this about standardized triage in a way national or international standard are used in the ED.

ETHICAL ISSUES

In the study we did not use ethical permission because this study only reviewed a few relevant articles

AUTHOR'S CONTRIBUTIONS

The three of us have made an article selection and then decided on the article to be reviewed together.

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ScienceDirect	Willey	PubMed	ProQuest	Garuda
180	311	285	85	1

Identification

Identified articles
n: 862

Exclusion:
Double Publication
n: 52

Screening Results
n: 810

Screening

Exclusion:
The title doesn't relate (n: 731)

Eligibility

Relevant with title
n: 79

Exclusion:
Not Full text (n: 57)
No by-question research (n: 8)

Inclusion

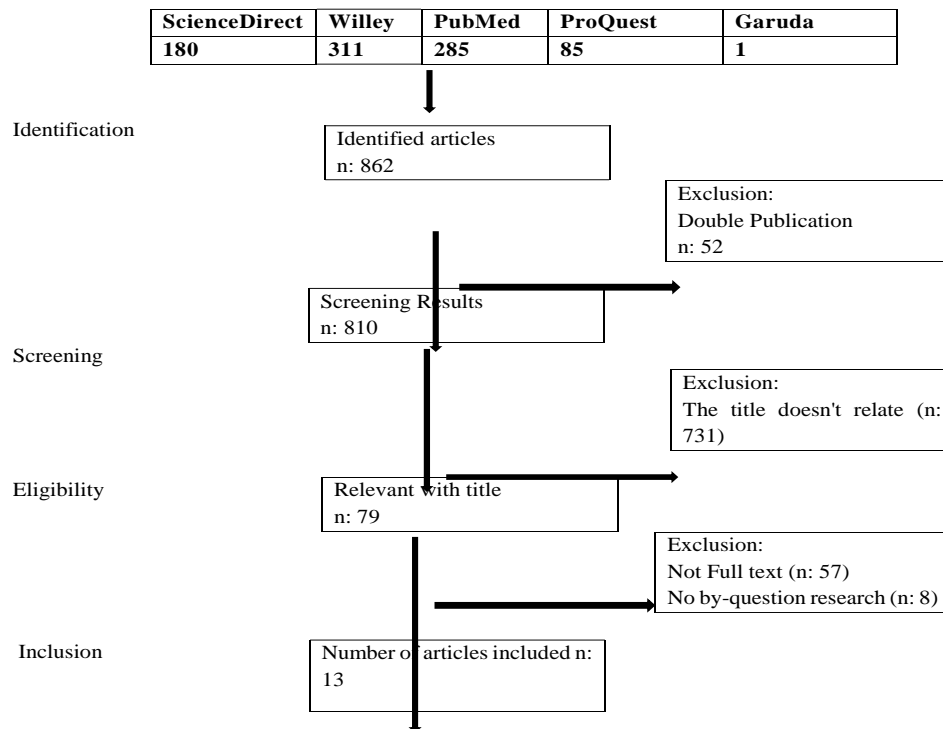Number of articles included n: 13

Figure 1. PRISMA flow diagram

Table 2. Extraction of Research Results about Instrument Triage

No	Author and year	Country	Title	Objective	Sample	Method	Results	Conclusion
1	6	Spanish	Validity and reliability against the Spanish Hospital ESI	To verify the validity and reliability of the ESI system	241 patients with One case abandonment, for useful sample of 240 cases with an average age of 43	Experimental, Kappa index kc2	Analysis reliability shows suitability ESI classification between a nurse with ka value p = 0.94	In determining the nurse's ESI own very capable good and appropriate with Landis and Koch criteria.
2	2	United States	Results for Severity Emergency Implementation of Triage Index in ED	To know the impact of ESI on the ER	7539 and 10567 patients were admitted to the Emergency Department 400 (5.3%) and 466 (4.4%)	Studies proportional Unweighted kappa with chi-square statistic kappa test	Reliability between evaluator from the chi-square statistical test with mark K; 0.455: 95%	Esi as a valid and reliable tool for services in emergency rooms, especially in other countries proceed
3	9	Iran	Comparison between scale stroke triage and Index severity emergency with triage patient with Complaint neurological	Forknow comparison ESI triage and STS	One hundred four ten three patients registered in a study, 38 of they excluded based on criteria exception, and therefore that's 52 of who remained in the STS (intervention) and 53 in the ESI (control) group.	Studies prospective, clinical trials random prospective designed to evaluate level miscarriage between STS and ESI groups.	From the results of the independent t-test, no show difference significant value (p=0.158) in the Majority STS group (p=0.009) while in the ESI group (p=0.001)	More ESI reliability tall compared to STS reliability
4	12	Iran	Comparison ESI Plus Pulsfek triage in COPD patients	For comparing ESI and ESI+ Peak Expiratory flowmeter in COPD patients	COPD and dyspepsia patients are randomly assigned to COPD patients with dyspnea to ESI + PEF or ESI group.	Studies prospective RCT. The reliability of the ESI was assessed with agreement	There is a significant difference in miscarriage between the two groups. ESI + PEF with value (p<0.002) and	The ESI scale can give more methods accurate in COPD patients

							interobserver (kappa)	ESI with value (p<0.001)	
5	14	Iran	Effectiveness System Triage Index Severity Five Level Emergencies Compared with Inspection Direct Three Levels: The Iranian Experience	The objective of the study This is to evaluate the effectiveness of system 5 level triage index severity emergency (ESI) compared with spot check triage	770 notes referred patients emergency unit emergency House Imam Khomeini's illness (in Sari, northern Iran)	Studies quasi-experimental this done for survey effectiveness system ESI five-level triage, version 4 was compared with inspection direct	387 patients triaged with spot check stage 1, namely man men 635, and women 37%. Stage 2 with ESI triage was 48% men and 52% women. No found exists significant difference that is P: 0.998)	Triage Spot check and ESI have the same advantages Because they have no significant difference.
6	1	Swetzerland	Modification Index Severity Emergency Increase Prediction Death in More Patients Old	The objective of the study is to evaluate the strength of predictive clinical parameters addition in NSC patients.	948 patients with an average age of 81 years	observational multicenter study prospective with follow-up carry-on for 30 days.	ESI power occurs significant improvement from 0.66 to 0.71 with a value (p=0.004)	ESI triage is effective For NSC patients. And necessary consideration special For patient elderly.
7	20	Spanish	Validity ESI-based triage proof	For now is ESI valid for triage based on proof	32 ER nurses with 410 patients	Studies descriptive observational and Crosssectional	Coefficient test results. The connection between take care stay with the ESI level is currently with Rho; 0.437 and P: 0.01	Long treatment stay correlated with hair ESI triage.
8	27	Japan	Utility index severity emergency by Accuracy Interrater agreement by experts	Study this aim to inspect the accuracy of ESI decision for scenario clinical simulation between specialist	14 Nurses who were selected become a sample of 23 participants identified to provide	Experimental, trial random group parallel done.	At age = ESI=35.5 and JTAS = 35.4 % with p-value =0.75, During work ESI=9.2 and JTAS 6.8 with p-value =10	ESI can introduced in Japan, though Japan using the JTAS triage system

			Nurse triage in scenario simulation in Japan: test try controlled randomized	nursing in Japan compared to JTAS to inspect accuracy decision ESI for scenario clinical simulation between specialist nursing in Japan to with JTAS	Study with Power exceed 80%			
9	11	New York	Validation index severity emergency (version 4) for triage emergency unit patients emergency mature with active	To evaluate the validity tool Emergency Severity Index (ESI; version 4) triage for predicting ED-relevant outcomes in between patients' mature	Patient cancer 1075 subjects studies of 2337 screened and 1562 eligible ED patients' conditions. We excluded 67 patients from the analysis Because No there is an ESI recorded,	studies prospective observational cohort significant For ER patients were 1358.81 with p-value <0.001	Triage results classified as ESI 1: 1%, ESI 2: 430%, ESI 3: 54%, ESI 4: 2% and ESI 5: 1% Distribution ESI score significant For ER patients were 1358.81 with p-value <0.001	ESI is a necessary triage considered in the future For patients with cancer active in ER care
10	28	Iran	Validity and Reliability Index Severity Emergency and System Deep Australasian Triage Maintenance Mofid Children's Emergency House Childhood Sickness in Iran	To evaluate validity, reliability, sensitivity, and specificity Index Severity Emergency (ESI) and Australasian Triage System (ATS)	Patient child namely Under triage and over triage occurred in 12% and 15% of patients in ESI and 13% and 15% of patients, respectively each in the ATS	Studies prospective occurrence in children Mofid	ESI Reliability between evaluator with kappa 0.65-0.92 (p,0.01), while ATS has reliability between evaluator with kappa 0.51-0.87(p,0.01)	ESI and ATS both apply For triage children in the Home ED section Sick ESI reliability is good, moderate-good for ATS.

11	15	Jamaica	Interrater reliability test emergency severity index after applied in the ER with collaboration	For know realities application triage to nurses new and nurse-trained	A total of 166 cases were accepted during the study period. Participation in collaboration learning in a way consistently below 50%.	Studies retrospective	PT and SF were compared One each other to evaluate how far are they. agree with ESI triage with a P value < 0.05	Recommendation made For increase possible implementation of ESI used For support implementation department emergency Jamaica globally.
12	29	Australia	Validity and Reliability Index Severity Emergencies and Systems Triage Three Conventional Levels in the Department Emergency, (HUSM).	For test reliability and validity from three system triage levels and systems triage five levels of emergency new, index severity emergency (ESI), in (ED)	300 patients are triaged below three level system. However, only 280 got it used to become sample Period studies Secondly, 280 patients were triaged	Prospective study. Use Cohen's Kappa statistics	System more ESI triage tall with Cohe Kappa with a weight of 0.81 with a weighted Cohen's Kappa of 0.75.	Sensitivity Esi more taller compared to a Three Tier system
13	24	China	Reliability and validity scale triage emergency China four level in China mainland: Multicenter assessment	To evaluate the reliability and validity of CETS by emergency unit nurses emergencies (ED) in eight EDs in China land.	Participant A total of 51 ED nurses and 8,000 active ED patients participated in the study between May and September 2018 in eight Eds	Design A a cross-sectional multi-center study was conducted	Average ED triage time Nurses in all locations are 151.5 ± 26.3 seconds, using instrument triage based computer. The chi-square test shows that There is a significant difference in time triage between CETS levels (p < 0.001). AUC was 0.968 (95% CI =	The connection between level CETS acuity triaged by nurses study shows significant results

							0.958 to 0.979).	