Original Article

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Internal Medicine Section

Outcomes for Emergency Severity Index Triage Implementation in the Emergency Department

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ABSTRACT

Introduction: Hospital triage scale in emergency departments needs to be valid and reliable. Lack of sufficient data exists on triage scale rigor in emergency departments of Iran. This study aimed to determine the impact of the emergency severity index (ESI) triage scale in the emergency department.

Materials and Methods: A single-center study was conducted. Proportion of triage categories allocated to high-risk patients admitted to high-acuity departments was examined in observational period in June 2012 and May 2013. True triage score was reported based on patients` paper- based scenario questionnaire. Interrater reliability was assessed using unweighted kappa. Concordance among experts, nurses and physicians was examined. The Chi-square test and Kappa statistics was used for statistical analysis.

Results: Triage decisions regarding high-risk patients before and after implementation period are independent from each other (χ^2= 22.254; df=1; p<0.05) and more high-risk patients were recognized after implementation of the ESI. Overall agreement and concordance were (79%) and (κ=0.54) among nurses; (71%) and (κ=0.45) among physicians, (85%) and (κ=0.81) among experts, respectively. Correct triage decisions among clinicians were increased after implementation of the ESI.

Conclusion: The ESI as valid and reliable tool improving desirable outcomes` in the emergency department has been recommended but it may not reveal optimal outcomes in developing countries comparing to what have been achieved in the developed countries. In addition, patient influx in ESI level II could create considerable controversy with clinicians.

Keywords: Algorithm, ESI, Reliability

INTRODUCTION

Hospital triage in the emergency department (ED) is defined as allocating priority for the provision of care and cure for the patients in the emergency department [1]. In response to overcrowding in emergency departments and in order to ensure critically-ill patients receive services in a timely manner, so hospital triage is developed by using reliable and valid guidelines in order to improve effectiveness [2]. Since the triage decision making process has been introduced as a context-dependent process which is affected by significant internal and external factors [3-8], so the complexity of triage decision making has resulted in special attention to the validity and reliability while using triage scales in the emergency departments [6-11].

The reliability of the Emergency severity index (ESI) triage has been assessed using inter-rater agreement mainly and test- retest among nurses and physicians [2,12-15]. The validity of triage has been assessed by key indicators such as emergency department admission [13-21] or ICU admission [13,14,19], length of ED [16,19] or hospital stay [13,22], mortality [17,19,20], Hospital discharge [13,14] or left without being seen [16-19] and resource utilization [13,20,22].

Being simple and objective has made the ESI triage system reasonable to be accepted worldwide. The reliability and validity of the ESI has been approved in U.S. [23-25] but in the other countries need more investigation and verification. Kyranou in Greece [16] demonstrated that the establishment of the ESI in the ED had good reliability and validity but improvement of nurses` experience and long-term follow-up are necessary to succeed. Grossmann in Switzerland [13] revealed that using the ESI in the ED of an urban tertiary care center is valid, reliable and culturally adapted. Chi in Taiwan [19] found that the ESI produces more accurate discrimination on the basis of patient acuity than the Taiwan triage system. Elshove-Bolk in Norway [21] showed that the ESI triage reliably predicts patient acuity in a population of self-referred patients. Selman [26] revealed that the ESI triage system assists the practitioner in identifying the priorities of care and has the potential for significantly improve patient outcomes. But there are serious concerns about using the ESI in emergency departments of other countries because there are significant differences in the structure of their health care system and culture of care comparing to U.S. Therefore, it is essential to consider the compliance of the triage process in emergency departments with the ESI

The ESI has been shown to have good reliability and validity in EDs of many developed countries [12,13,16,19,21]. The importance of applying valid and reliable scales in EDs has been recommended [27,28] however, little information on the ESI reliability and validity in emergency departments of Iran is available [29]. In early 2011, there were only a few emergency departments which used Triage system; but gradually, many of emergency departments became familiar with the triage system through formal training programs that were held by the Ministry of Health and Medical Education by the end of 2012. The ESI (V.4) has been widely accepted compared to other triage scales but few studies on outcomes of ESI implementation in Iran is available. Therefore, this study aimed to investigate outcomes of the ESI implementation in adult emergency department.

MATERIALS AND METHODS

The present study has been approved by the Ethics committee of Mashhad University of Medical Sciences and disaster management committee of hospital. Informed consent was obtained for all staff involved in the study and waived for patients.

Farabi hospital as a primary and tertiary care center has 202 bed and 24000 square meter area which is located in Mashhad in north east of Iran. Hospital offers all specialties services except gynaecology, obstetrics and paediatrics. Emergency department had more than 150,000 patient visits per year.

In 2001, the traditional three-level triage scale had been introduced in ED. Traditional triage scale is constructed using expert consensus on common complaint of patients who present to the ED. The triage scale was extended to four-level triage scale in 2008.

The translation process and cross-cultural adaptation described by Beaton [30] was used for this study. The Hospital Emergency Management/Disaster Preparedness Committee had held two sessions to evaluate executive and educational requirements for implementation of ESI triage scale.

Training programs consist of workshop and field training were held every three month from July 2012 to April 2013 in the implementation period. Twenty nurses and eight physicians participated in project. "ESI Preparedness" workshops had been arranged in the four sessions for nurses and physicians. Project was based on Emergency Severity index (V.4) [31].

June 2012 and May 2013 were defined as the first and second observational periods in which data were collected. Only high-risk emergency department patients who had Cardiopulmonary resuscitation, Intensive Care Unit, Coronary Care Unit, Cardiac Unit and Operating room admissions were included in the study. High-risk patients' triage category was retrieved from triage data sheet in emergency department. Patients were assigned triage categories according to urgency by triage nurse. Triage data sheet included name, chief compliant, triage category, date and signature. High-risk patients` triage categories which have been collected were compared between the first and second observational periods.

A paper-based scenarios questionnaire was developed from the Emergency Severity Index, Version 4: Implementation Handbook [31]. Inter-rater reliability of the questionnaire was investigated by senior physician and researcher who scored 40 paper-based scenarios independently. The validity of questionnaire was determined using patient scenarios have been published by the developers of the ESI. In addition expert panel including researchers, senior physician and expert nurse investigated content validity of the questionnaire which covers common chief complaints in different populations related to all five triage categories.

In the observational periods, reliability of physician and nurses` triage allocation was assessed using paper-based scenarios questionnaire and correct decisions were reported too. Reliability of triage decision-making between nurses and physicians was assessed through paper-based scenario questionnaire in the observational periods. Correct answers based on ESI criteria set for paper-based scenario questionnaire and calculated for each group.

STATISTICAL ANALYSIS

Chi-square statistics was used to assess the impact of ESI on triage categories of high-risk patients. Lambda chi-square was used to examine association between the triage categories of admitted high-risk patients related to first and second observational periods.

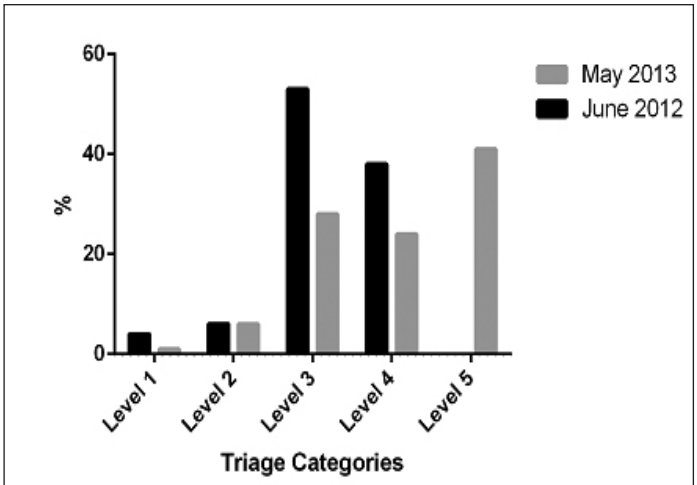
Inter-rater agreement between researcher and senior physician was reported based on raw agreement using Cohen`s Unweighted Kappa and Spearman's rank correlation coefficient statistics. Inter-rater agreement among nurses and physicians was assessed according to raw agreement and Fleiss Unweighted Kappa. The percentage of correct decisions for nurses and physicians who completed paper-based questionnaire was reported. Descriptive and inferential statistics were performed using the SPSS (version 16.0; SPSS, Inc., Chicago, IL) and MS Excel 2010.

RESULTS

In June 2012 and May 2013, 7539 and 10567 patients visited emergency department consequently [Table/Fig-1,2] and also 400 (5.3%) and 466 (4.4%) ED patients admitted in all departments of hospital respectively. Thirty-six (4.1%) of these were excluded because of incomplete data, leaving 866 patients.

	1	2	3	4	5	Total
Jun-2012	267 (3.5)	439 (5.8)	3987 (52.9)	2900 (38.5)	-	7539 (100)
May-2013	90 (0.9)	682 (6.5)	2938 (27.8)	2537 (24.0)	4320 (40.9)	10567 (100)

[Table/Fig-1]: Frequency of patients` triage category (%)



[Table/Fig-2] Proportion of patients assigned to each triage category in observational period

	Researcher triage allocation score					
Senior emergency physician allocation triage score	1	2	3	4	5	Sum
1	8	0	0	0	0	8
2	0	8	2	0	0	10
3	0	2	4	0	0	6
4	0	0	2	6	0	8
5	0	0	0	0	8	8
Sum	8	10	8	6	8	40

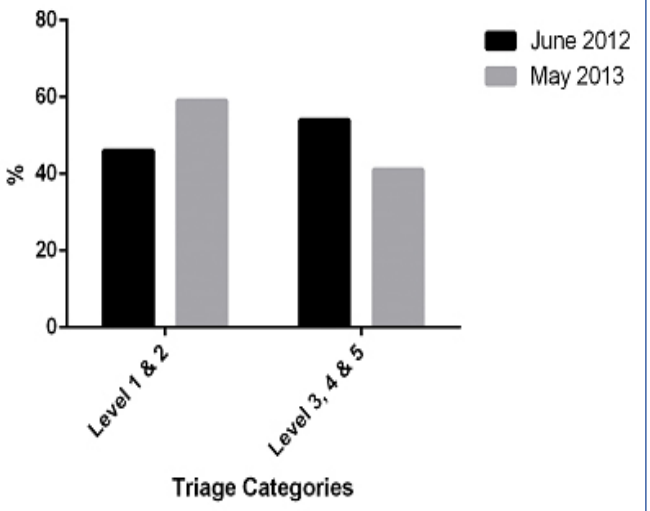
[Table/Fig-3]: Reliability scores: researcher and senior emergency physician

Researcher and senior physician` concordance on the 40 written-cases was almost perfect [Table/Fig-3] and raw agreement was (85%), Cohen`s un-weighted kappa (κ=0.812; 95% CI 0.674 – 0.95), linear weighted kappa (κ =0.906; 95% CI 0.832 – 0.980) and Spearman rank correlation coefficient was very strong (0.96) between researcher and senior physician. Most disagreement was in ESI level 3.

In the first observational period in June 2012, inter-rater reliability among nurses using the 20 written-cases was examined by overall agreement was (64%), Fleiss un-weighted kappa was fair (κ =0.33; 95% CI 0.313 – 0.347). In the second observational period in May 2013, overall agreement was (79%), Fleiss un-weighted kappa was moderate (κ =0.548; 95% CI 0.531 – 0.564). Also, inter-rater reliability among eight physicians using the 20 written-cases was examined by overall agreement was (61%), Fleiss un-weighted kappa was fair (κ =0.34; 95% CI 0.296 – 0.381) in the first period and overall agreement was (71%), Fleiss un-weighted kappa was moderate (κ=0.455; 95% CI 0.413 – 0.497) in the second period.

In the first period, correct answer to 20 written-cases questionnaire for 20 nurses was (60%) and in the second period after implementation period was (72.5%). Correct answer for physicians increased from (40%) to (63%) after implementation period.

Chi-square statistics revealed that triage decisions regarding high-risk patients before and after implementation period are independent from each other (χ^2= 22.254; df=1; p<0.05). So admitted patients in high-acuity departments categorized more in level 1 and level 2 triage categories after implementation period [Table/Fig-4]. Lambda



[Table/Fig-4] Porportion of patients who admitted to high-acuity department in observational period

	First observational period	Second observational period
Triage categories	June 2012	May 2013
1 & 2	99 (46%)	126 (58%)
3, 4 & 5	116 (54%)	89 (42%)
Total	215 (100%)	215 (100%)

[Table/Fig-5]: Distribution of high-risk patients based on triage categories (%).

Chi-square statistics showed there is no significant difference between two groups in the observational period regarding number of admitted patient in high-acuity departments. (Chi Square: λ=0.011; p=0.593) [Table/Fig-5].

DISCUSSION

Implementation of the ESI triage system in the ED revealed acceptable validity and reliability. Simple and clear structure along with objectivity related to vital sign criteria enhances reliability of decisions among clinicians. It`s important to notice that ESI could improve triage process but it`s far from desirable outcomes and in fact it was a partial improvement and resulted in fair agreement upgraded to moderate. Although ESI reliability as weighted kappa has been verified in several studies [2,12-15] but it`s worth mentioning that un-weighted kappa could provide more realistic estimation of reliability comparing to weighted kappa [32,33]. So reliability coefficients are nearly close to the findings of Durani et al., [25] and Storm-Versloot et al., [34] who reported substantial agreement.

The ESI level I and II have been found to be superior to recognizing high-risk patients, so ESI as a valid scale which enhances high-risk patients recognition comparing traditional triage system. Vital sign measures in algorithm help nurses categorize high-risk patients in level I and II more accurately. Several studies have supported ESI validity in emergency departments referring to hospital admission, length of stay in hospital, mortality rate, discharge, left without being seen and consumed resources [13,14,16-21]. Supporting validity of ESI, clinicians` decisions have improved from the first to second observational periods.

Some blind spots emerged relating to ESI triage scale during this study. Nurses perceived “high-risk patients” in ESI level II as a broad and general concept and to some extent ambiguous which is not enough clear to identify high-risk patients sufficiently and prevent misclassification. Tanabe et al., [35] defined level II patients as individuals who are more stable than level I and they indicated critically ill patients’ triage criteria needs further revisions [22]. This ambiguity congests a considerable amount of patients in level II. Patient influx in ESI level II remains other parts of the ED unused. This issue could not be tolerated in the ED because triage nurses wants to consume all ED resources as much as possible consensiously and reduces overcrowding. This issue deteriorated longer practice of ESI in ED. This ambiguity should be considered in further study.

In addition, we found that defined resources in level III to V could put validity of decisions in risk because ED physicians may select diverse clinical pathway for same patient`s chief complaint. Van der wulp et al., [36] indicated that a substantial number of patients in level V are undertriaged.

This study is limited to single-center that affects generalizability of study for other center with different populations. Since Emergency severity index isn`t indigenous in Iran, ethical concerns requires implementation in single-center to support further research in the other EDs. So desirable outcomes lead to multi-center studies. Previous studies argued interrater reliability based on paper-based scenario shows higher concordance than real situations [37]. There is no computerized tracking system for patients in this emergency department so we only examined triage categories related to high-risk patients but it can be extended consisting of low-acuity patients further. Outcomes of implementation research needs long time to be evaluated more realistically so further studies is suggested.

CONCLUSION

ESI triage shows a significant impact on enhancing triage accuracy in the emergency department, so high-risk patients’ allocation to level I and II have been increased after implementation of ESI. ESI as valid and reliable tool improving desirable outcomes` in the emergency department has been recommended but it may not reveal optimal outcomes in developing countries comparing to what have been achieved in the developed countries.

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