Original Article

Studying nurses' performance and effectiveness in patient triage by emergency severity index in Kermanshah educational and medical centers in 2016

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Abstract

Introduction: One of the most important tasks of nurses is to save the lives of clients in emergencies. Having an efficient triage system is one of the basic needs of the emergency department. Therefore, we conducted the present research to evaluate the performance and effectiveness of nurses in patient triage by emergency severity index method. Method: The present research is a descriptive study performed on all eligible triage nurses in the emergency department of educational and medical centers affiliated to Kermanshah University of Medical Sciences. Samples were selected by census. Data were collected through three tools, including: personal-job profile form, checklist of performance evaluation of triage nurses and triage algorithm by emergency severity index method. The validity of the three tools was confirmed by the formal and content validity method. The reliability of the performance appraisal checklist was determined by calculating Cronbach's alpha; the reliability of the triage algorithm for evaluating the effectiveness was determined by the correlation among observers. Data analysis was performed using SPSS version 20 and descriptive tests. Results: In studying the performance of triage nurses, the mean and standard deviation of participants' scores were 82.69 and 12.99, respectively, the lowest score was 24.71 and the highest was 100. 85.4% of nurses had a performance score between 76 and 100. In the study of effectiveness, 84.4% of nurses had 3 or 4 correct triage of 4 opportunities. Of the 412 triage trials, 329 were correct; the under and over triage were 42 and 41 cases, respectively. Conclusion: The performance of nurses was at an acceptable level; the effectiveness of nurses was optimal. However, given that 20.1% of the triage was under or over, this indicates the need to conduct triage courses among nurses.

Keywords: Triage, Performance, Effectiveness

Introduction

In medical emergencies, seconds and minutes are important for the patient, and these times may determine the distance between death and serious disability or useful life. Increasing the waiting time and the length of time it takes to provide medical services in the emergency department will reduce the quality of care and increase adverse outcomes in patients with life-threatening conditions. No aspect of emergency care is as important as the ability of the emergency department to assess, treat, and assign a patient within a reasonable and acceptable time. Given the crowds and the limited facilities available, it is important to prioritize patients to receive services. This action is known as triage in emergency departments.

The triage process, which is the first step in addressing the clients of the emergency department, prioritizes these clients and distributes them based on the degree of deterioration of clinical conditions at different levels of the triage. This prioritization is done in order to differentiate clients who can wait without complications due to delays from those who need immediate action and delays in treatment will cause complications; so death and injuries caused by delays in treatment are minimized. Triage, which is usually performed by emergency nurses, determines also in some hospitals the place of visit and the course of treatment of the patient in addition to the priority of treatment [1].

Since the early 1990s, several countries have designed and offered triage systems. Until the late 1990s and early 2000s, five-level triage systems were introduced and created.

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Among these systems, the Australian, Canadian, Manchester triage system and emergency severity index gained the most acceptance.

In the meantime, the five-level triage system or emergency severity index has become more popular in most emergency departments of hospitals around the world due to its simplicity, easy training, perceptual approach and its being operational. In this method, in accordance to the model of the Ministry of Health, the triage nurse classifies the patient based on two criteria of severity of disease and required facilities. The first criterion is determined by the life-threatening factors and the second one by the nurse's experience. This determination of diagnostic and therapeutic resources by nurses is the difference between this system and other triage systems [2].

The American College of Emergency Physicians emphasizes the support of five-level triage systems and believes that the quality of patient care will be improved following the implementation of a precise and standardized classification method.

There is no universal agreement on how to triage patients; as a dynamic process, it has no fixed rules. For example, it can be based on vital signs, the patient's main complaint or the necessary facilities to care him/her. An efficient triage system should be able to make decisions about each patient quickly and accurately. Simplicity in performance and trustworthy are the most important features of a standard triage system.

In Iran, following the establishment of emergency medicine in the last decade, emergencies have been equipped with a triage unit, which in the vast majority of cases uses a five-level system. At present, the triage of patients in most emergencies is a task of the nursing system. Like other triage systems, running this triage system requires sufficient levels of training and applied support [3]. Nurses will not be able to use triage correctly and in accordance with the standards provided without proper and codified training in this field. When using any triage scale, triage leveling may fall into one of three categories: triage at precise level, triage at higher level, and triage at lower levels [4].

Just as improper classification of the patient at lower levels of triage puts the patient waiting for a visit and treatment at serious risk, incorrectly placing the patient at higher levels of triage has other consequences, such as the use of scarce financial and human resources in hospitals [5, 6].

Undoubtedly, nurses, through their professional activities such as patient triage, play an important role in the length of stay of patients in the emergency department and can be effective in reducing this time [7]. Different studies have had different results on the accuracy of nursing triage [8]. Appropriate triage will increase the quality of patient care services, increase satisfaction, reduce patient waiting time and stay, reduce mortality, increase the efficiency and effectiveness of emergency departments while reducing related costs.

Nurses in Iran also do not receive comprehensive training for triage systems during their university years, and the share of triage in the heading of nursing courses in the emergency department is a two-hour session [9]. These shortcomings can lead to a behavior not based on the nursing knowledge. In other words, triage is performed in Iranian hospitals while not enough knowledge and training is provided to nurses. Studies have shown that determining the severity of patients' initial triage has the most significant impact on the timing of patients' transfer to hospitalization wards [10]. Triage Nurse's decisions directly affect the timing of services, and errors in patient triage have serious consequences. Half of all fatalities have occurred due to the delay in emergency treatment [11]. Rapid and correct triage of patients is the key to successful performance in the emergency department; if the inappropriate level of triage is chosen based on misinterpretation or ignoring patient variables and triage criteria, the nurse will be exposed to triage error [12].

Therefore, proper triage is important in the emergency department and the nurses play an essential role in performing it; the nursing managers in the emergency department need to the meaningful data to ensure proper triage and identify existing failures to adopt solutions to improve and increase quality. We conducted this process with the aim of determining the performance and effectiveness of nurses in patient triage by emergency severity index method.

Materials and Methods

The present research is a descriptive study that examines the performance and effectiveness of nurses in patient triage using the emergency severity index method.

In this research, nurses of emergency triage of seven educational and medical centers in Kermanshah in 2016, selected based on sampling method and specifications of the research units, constituted research samples. Taking into account the 95% confidence level, the 50% effectiveness ratio and the maximum estimated error of 0.05, we obtained 385 samples for patients. The total number of triage nurses was 126. Of these, 109 were eligible to study based on the characteristics of the research units. Of these, 6 did not participate in the research. Therefore, we performed the study with 103 nursing samples.

The information required in this research was collected through a personal-job information form, a performance appraisal checklist, and the triage algorithm of emergency severity index. After collecting the data, we used SPSS software version 20 to analyze the descriptive and inferential statistics. To investigate the relationship between performance and effectiveness of personal-job variables, we used independent T-tests, one-way analysis of variance and

Pearson correlation coefficient and, in case of non-normality of performance and effectiveness scores, tests of Mann-Whitney, Kruscal-Wallis and Spearman correlation coefficient.

Determining scientific validity (validity of tool):
Performance Evaluation Checklist: The validity of this tool was confirmed in a study conducted by Haghdoost et al in 2010 in the emergency department of Poursina Hospital in Rasht to investigate the effect of training on the awareness, attitude and performance of nurses working in the emergency [13]. After preparing this form, by adapting the available scientific resources and using the opinions of the research group, the desired checklist was provided to ten faculty members of the Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, who have knowledge and experience in the field of nursing, triage and validation of the tool of research. We applied the experts' opinions on the appearance of questions, editing, meaning and concept, relevance, and clarity of expression.

Emergency Severity Index Triage Algorithm: This tool is used to determine the effectiveness of nurses in patient triage. As mentioned in the definition, effectiveness means achieving the goal, which in this study is to determine the correct level of patient triage. On the other hand, the Ministry of Health of Iran has approved this algorithm. After preparing this algorithm, by adapting the available scientific resources and using the opinions of the research group, the desired algorithm was provided to ten faculty members of the Faculty of Nursing and Midwifery, Kermanshah University of Medical Sciences, who have knowledge and experience in the field of nursing, triage and validation of the tool of research. According to experts, the tool had sufficient scientific validity to determine its effectiveness.

Determining scientific validity (reliability of tool):
Performance Appraisal Checklist: In order to determine the reliability of the performance evaluation checklist, we used the internal consistency reliability method (Cronbach's alpha). Cronbach's alpha coefficient was obtained by r=0.85 for the whole performance checklist. According to the results obtained, this research tool has a good reliability.

Emergency Severity Index Algorithm: This algorithm is approved by the Ministry of Health and its purpose is to properly classify patients based on the emergency severity index. In this case, we used the reliability method of observers. Thus, the researcher, together with a nurse and a physician specializing in emergency medicine, completed the triage form using the triage algorithm; the correlation results between the observers were 96.1% (P <0.001) indicating the observer's appropriate reliability.

Procedure

We obtained a license to conduct research from the ethical committee of Shahid Beheshti University of Medical Sciences, coded IR.SBMU.PHNM.2016.533. In this research, the researcher nurse was present in three shifts in the morning, evening and night; at the beginning of each shift, after completing the personal-job profile form by each of the nurses, to measure the effectiveness, each nurse performed 4 triages successively. The number of under, over and correct triages for each nurse was recorded based on the triage algorithm of the emergency severity index and the opinion of the researcher nurse who simultaneously triage the same patients. As mentioned, the criterion for the accuracy of a researcher's triage, which is the basis for comparison, is the triage algorithm. To determine the performance of each nurse, the checklist of 63 questions were completed by the researcher in a work shift for two nurses. From the beginning of the shift until the end, the researcher accompanied the nurse and completed the checklist by observing the performance of the nurses. Thus, 8 triages were recorded in each work shift and 2 performance evaluation checklists were completed. In each shift, according to the nurse's performance in the mentioned areas, the checklist for each nurse is completed once. Data collection took 127 days due to cases like interference of the researcher's own shifts, and the researcher collected data in 57 shifts.

Results and Findings

Descriptive results: In the present study, most of the nurses participating in the data research were female (56.3%), mostly married (61.2%), most with the BSc in nursing (92.2%), mostly with formal employment status (47.6%) and mostly with rotating shifts (58.3%).

The nurses in this research had (100%) work experience in the emergency department. They had the minimum age (23.1) years and the maximum age (44.8) years. The mean age of the participants in the research was 30.4 years with standard deviation (4.58). The minimum work experience was (1) years and the maximum was (22) years. The mean and standard deviation for the history of nurses in this research are (6.55) and (4.64), respectively.

Table 1: Distribution of absolute and relative frequency of research samples in terms of effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016

Number of correct triage (effectiveness)	Number	Percentage
0	0	0
1	1	1
2	15	14.6
3	50	48.5
4	37	35.9

Total	103	100

The table above shows that the majority of samples (84.4%) have 3 or 4 correct triages.

Table 2: Absolute and relative frequency distribution of research samples according to the number of high (over) triage in triage nurses working in the emergency departments of Kermanshah educational and medical centers in 2016.

Number of high (over) triage	Number	Percentage
0	71	68.9
1	24	23.3
2	7	6.8
3	1	1
Total	103	100

The table above shows that the majority of samples (68.9%) do not have high (over) triage.

Table 3: Distribution of absolute and relative frequency of research samples according to the number of low (under) triage in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Number of low (under) triage	Number	Percentage
0	67	65
1	30	30.1
2	6	4.9
Total	103	100

The table above shows that in the majority of samples (65%) they do not have low (under) triage.

Table 4: Absolute and relative frequency distribution of research samples according to the performance score in triage nurses working in the emergency departments of Kermanshah educational and medical centers in 2016.

Performance score	Number	Percentage
0-25	1	1
26-50	7	6.8
51-75	7	6.8
76-100	88	85.4
Total	103	100
Minimum score	24.71	
Maximum score	100	
Mean	82.68	
Standard deviation	12.99	

The table above shows that the majority of samples (85.4%) had a performance score between 76 and 100. The minimum score obtained is 24.71 and the maximum is 100.

Table 5: Relationship between gender and performance score in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Gender	Number	Mean performance score	Standard deviation	P
Male	45	73.82	10.16	0.97
Female	58	65.82	14.92	

The results of the T-test statistics in the table above show that there is no significant statistical relationship between gender and performance score.

Table 6: Correlation between work history and performance score in triage nurses working in emergency departments of educational and medical centers of Kermanshah in 2016.

Variable	Correlation coefficient	P
Work experience	-0.117	0.24

The results of Pearson's statistical test in the table above show that there is no significant relationship between age and performance score.

Table 8: Relationship between employment status and performance score in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Employment status	Number	Mean performance score	Standard deviation	P
Formal	49	4.0	15.17	0.90

For a limited period of time	22	14.0	13.37
Contractual	6	9.0	5.46
Project-based	26	07.0	9.32

The results of the ANOVA statistical test in the table above show that there is no significant relationship between employment status and performance score.

Table 9: Relationship between shift status and performance score in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Shift status	Number	Mean performance score	Standard deviation	P
Morning	38	85.80	12.13	0.17
Night	5	82.61	14.6	
In turn	60	80.72	09.13	

The results of ANOVA statistical test in the table above show that there is no significant relationship between shift status and performance score.

Table 10: Relationship between the previous information source of triage (clinical experience) and the performance score in triage nurses working in the emergency departments of Kermanshah educational and medical centers in 2016.

Previous information source of triage (clinical experience)	Number	Mean performance score	Standard deviation	P
Yes	85	83.48	12.72	0.17
No	18	78.90	13.98	

The results of the statistical T-test in the table above show that there is no significant relationship between clinical work experience as a previous source of triage information and performance score.

Table 11: Relationship between gender and effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Gender	Number	Effectiveness (number of correct triage)	Standard deviation	P
Male	45	3.22	0.76	0.66
Female	58	3.17	0.67	

The results of the Mann-Whitney Statistical Test in the table above show that there is no significant statistical relationship between gender and effectiveness (number of correct triage).

Table 12: Correlation between work experience and effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Variable	Correlation coefficient	P
Work experience	-0.164	0.09

The results of Spearman statistical test in the table above show that there is no significant relationship between work experience and effectiveness (number of correct triage).

Table 13: Relationship between employment status and effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Employment status	Number	Effectiveness (mean number of correct triage)	Standard deviation	P
Formal	49	3.32	**0.65**	0.03
For a limited period of time	22	3.31	**0.64.**	
Contractual	6	3.33	**0.51**	
Project-based	26	2.80	**080**	

The results of the Kruskal–Wallis statistical test in the table above show that there is a significant statistical relationship between employment status and effectiveness (number of correct triage). The average number of correct triage in nurses with design employment status is lower than others.

Table 14: Relationship between shift status and effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Shift status	Number	Effectiveness (mean number of correct triage)	Standard deviation	P
Morning	38	3.28	0.65	0.50
Night	5	3	0.00	
In turn	60	3.15	0.77	

The results of the Kruskal–Wallis statistical test in the table above show that there is no significant statistical relationship between shift status and effectiveness (number of correct triage).

Table 15: Relationship between previous information source of triage (clinical work experience) and effectiveness (number of correct triage) in triage nurses working in emergency departments of Kermanshah educational and medical centers in 2016.

Previous information source of triage (clinical work experience)	Number	Effectiveness (mean number of correct triage)	Standard deviation	P
Yes	85	3.25	720.	0.02
No	18	2.88	580.	

The results of Mann Whitney statistical test in the table above show that there is a significant statistical relationship between the source of previous triage information (clinical work experience) and the effectiveness (number of correct triage). The average number of correct triage in nurses who have introduced the clinical work experience as a source of previous triage information is higher than nurses who have not used this information source.

Discussion and Conclusion

The emergency department is one of the most important departments of the hospital with a large number of patients. It is possible to provide effective services at the right time in this department through efficient and effective performance. Overcrowding has always been a serious problem affecting patients' satisfaction in emergency departments. To deal with this issue, a triage system has been created in the emergency department of hospitals.

Based on the obtained findings, we can conclude that the most important source of information for nurses in the field of emergency severity triage is personal clinical experience. This is consistent with the study conducted by Haghdoost et al. in which 54.2% of the nurses have selected the clinical experiences from among the four information sources [13]. On the other hand, in the study of Tabatabai et al. (2013), the most important source of information has been university courses. Since this study has been performed on 143 students in the seventh and eighth semesters in the educational hospitals of Tehran University of Medical Sciences, the inconsistency of the findings regarding the triage information with the present research can be explained by the lack of sufficient clinical experience by students.

According to the data collected in this research, out of 412 triages performed by 103 nurses, and according to the fact that each nurse had 4 triage opportunities, we recorded 329 correct triages, 41 high (over) triages and 42 low (under) triages. The criterion for diagnosing the accuracy of the triage was the triage algorithm of the emergency severity index and the researcher's opinion. Based on the effectiveness levels in this research, out of 103 nurses participating in the research, 37 had 4 correct triage, 50 had 3 correct triage, 15 had 2 correct triage and one had 1 correct triage. In the present research, 79.8% of triages are correct, 10.19% are under and 9.95% are over. There is a significant relationship between effectiveness (correct triage number) and personal and professional information in some cases.

The percentage of correct triage, over triage and under triage in the present study and the study of Kamrani et al. (2013) are close to each other [14]. This indicates that in many cases, the triage is done correctly and the percentage of under and over triages is close to each other.

In a study done by Lehman et al. (2009) on 244 traumatic patients between 2007 and 2008, the rate of under triage was 0.4& and the percentage of over triage was 79% [12].

Mir Haghighi et al. (2010) performed a study on 102 nurses in all hospitals of Sistan and Baluchestan province under the title of examining the level of awareness of emergency department nurses about hospital triage [6]. They reported under triage by 8.57% and over triage by 48%.

Comparison of the above studies inside and outside Iran shows the high statistics of under and over triage. In most studies, the amount of over triage is higher than under triage.

Based on the effectiveness levels defined in this research, 35.5% of nurses had 4 triage opportunities with 4 correct triages, 48.5% had 3 correct triages, 14.6% had 2 correct triage and 1% of nurses had one correct triage.

In a study carried out by Gholipour et al. entitled "Audit of the validity of triages performed in Shahid Madani Hospital in Tabriz in the first quarter of 2012, 30 emergency cases in the first quarter of 2012 were examined randomly. The contents of these files were compared with the leveling standards of emergency severity triage index and their compliance with the standard was determined. The findings showed that about 21.21 percent of the cases whose triage levels were three were considered as incorrect. In total, 31.92% of the triages performed were evaluated as incorrect.

In the past, there has been no direct study on the effectiveness of nurses in triage using the emergency severity index; in the field of triage accuracy, under and over triage, there have been studies that have been used indirectly in our study. In this research, based on the practical definition, effectiveness means correct leveling of patients by triage of emergency severity index. In comparison with previous studies, we can conclude that holding courses and training classes to increase the correct triage statistics and reduce the number of under and over triages will be effective.

The relationship between personal and job information and effectiveness (number of correct triage) showed the following results. To investigate the relationship between effectiveness (number of correct triage) and employment status of nurses participating in the research, we used Kruskal–Wallis test. There was a significant relationship between employment status and effectiveness (number of correct triages).

The mean number of correct triage in nurses with the project-based employment status was (2.80) which is less than that of the nurses with formal, limited and contractual employment status. According to Mann-Whitney test, there is a significant relationship between effectiveness (average number of correct triage) and clinical work experience as a source of previous information in the field of triage.

This result shows that, in this study, nurses who chose the experience of clinical work as one of the sources of triage information compared to nurses who did not choose this case, according to the average number of higher correct triage (3.25), have a higher effectiveness.

The second purpose of the research was to determine the performance of triage nurses in six areas: performing cardiopulmonary resuscitation, assessing the patient's pain, prioritizing hospitalized patients, communication with other members of the medical team, supervisor, colleagues and patient companions, following up counseling و Paraclinical actions and visits, recording of events and reporting. Performance levels were reported as a general score due to the unity of the performance evaluation checklist without differentiation in different areas. In the present research, nurses were ranked in 4 levels based on the score obtained from the performance evaluation checklist. According to the results, 85.4% of nurses had a performance score between 0 and 25, 6.8% had a score between 26 and 50, 6.8 had a performance score between 51 to 75 and 1% had a performance score of 76 to 100. Based on the score range of the performance evaluation checklist (0 to 100), the average performance score was 82.69 with a standard deviation of 12.99. The minimum score was 24.71 and the maximum was 100.

Javadi et al., who performed a prospective study in 2015 on the knowledge and performance of emergency department nurses in in-hospital triage, obtained the following results. An examination of the results of nurses' performance also showed that 50.44% of the answers given to this section were correct and the average scores obtained in this field was 5±1.47. In total, 45.33% of the responses of the nurses participating in the research to the scenario test were correct. In the study of Javadi et al., the performance evaluation tool is a checklist 10 questions whose questions are only in the field of triage. In addition to triage in the other 5 areas mentioned above, the performance appraisal tool in the present study evaluates the performance of nurses.

In this study, the evaluation of triage nurses shows acceptable levels of performance. The results obtained are close and similar to the present study. Since the sampling method in both studies was census and on the emergency nurses in educational centers in Yazd and Urmia provinces, the closeness of the results is expectable.

Kalantari Meybodi et al. conducted in 2014 a descriptive study on 50 nurses entitled the effect of education on the awareness and the performance of nurses of emergency department in the field of triage of patients. The average score of the participants in the area of performance increased from 31.8±9.9 to 69.7±8.1. The relatively large difference between pre- and post-intervention performance scores indicates the importance of training in increasing nurses' performance level. In this study, in order to evaluate and score the performance of the participants in the study, a checklist containing 20 standard questions was used in accordance with the description of the duties of the officials of Triage, approved by the Ministry of Health and Medical Education.

In the present study, no significant relationship was found between personal-job information and performance score in any case; while in Javadi et al.'s (2015) study, statistical analysis showed only a significant relationship between work shift and the score of knowledge and performance of nurses in the field of triage.

In the study of Kalantari Meybodi et al (2014), formal-temporary and contractual individuals had higher average scores than project-based individuals in terms of performance [15]. This could be due to fact that project-based nurses have less clinical experience in performing many treatment procedures and have less organizational commitment to their workplace. In our study, there was no significant relationship between employment status and performance score. This may be due to factors such as employee fatigue, lack of time, crowded emergency department and the presence of critically ill patients, lack of staff, motivation and self-confidence.

Regarding the overall goal and determining the level of performance and effectiveness of nurses in patient triage by emergency severity index in educational and medical centers affiliated to Kermanshah University of Medical Sciences in 2016, the results showed overall score in the field of performance in areas: 1) performing cardiopulmonary resuscitation, 2) examining the patient's pain, 3) prioritizing hospitalized patients, 4) Communication with other members of the medical team, supervisor, colleagues and companions of the patient, 5) Following up on consultations, paraclinical measures and visits and 6) recording events and reporting. Of the 103 triage nurses participating in the research, 88 nurses had a performance score of 76 to 100. This result shows that the performance of triage nurses working in educational and medical centers affiliated to Kermanshah University of Medical Sciences is in good condition.

After examining the participants in terms of the effectiveness of triage, we also found that 37 nurses have 4 correct triages and 50 nurses have 3 correct triages; it shows the moderate conditions in triage using the emergency severity index. Out of 412 cases of correct triage, we recorded 41 over triage and 42 under triage; according to the obtained results, nurses need courses and workshops to reduce the amount of over and under triage.

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