

Quality Assurance of Nurse Triage: Consistency of Results Over Three Years

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The study objective was to evaluate the capability and the consistency of the triage nurse to categorize correctly emergency patients and its impact on the waiting time for physician examination over a period of 3 years. The study was performed at the emergency department of the Barzilai Medical Center, Ashkelon, Israel. A retrospective review of the medical records was performed. All patients who were examined by a triage nurse during 2 randomly chosen consecutive weeks during the years 1995 and 1998 participated. All the medical records were reviewed by the authors and the following information was extracted from the medical records: nurse triage category, time of initial evaluation by a triage nurse, duration of employment of the nurse in the ED, and her experience as a triage nurse, time of initial examination by a physician, the total length of stay in the ED, the history taken by the triage nurse and the physician, and the physician's urgency category. Patient in urgency category 1 is a patient whose condition may deteriorate if not examined within 1 hour; patient in category 2 is a patient whose condition may deteriorate if not examined within 2 hours; category 3 is all the rest. Any deterioration and or delay of treatment of the patients were also recorded. Data concerning patients with an initial complaint of chest pain were extracted separately. The data were analyzed using the SPSS software and the results were tested by the student t test and chi square test. Interobserver agreement was measured using the κ value. A total of 2,886 completely full medical records were reviewed by the authors: 1,310 records from period I (1995) and 1576 from period II (1998). Of the patients 92% and 88.2% were classified by the triage nurse as category 3 in periods I and II respectively, 7% and 9.8% as category 2, and 1% and 2% as category 1 respectively. Full agreement of triage category between nurse and physician was found in 90.5% of the cases in period I and 93% in period II ($\kappa = 0.90$ and $\kappa = 0.93$ respectively). In period I, 70% of the patients in category 1 were examined by a physician in 1 hour versus 100% in period II. Almost all the patients in category 2 were examined within 2 hours (98%, 97%), and 98% of those in category 3 were examined within 3 hours. The average waiting time for physician examination in category 1 patients dropped from 43.1 minutes in period I to 18.2 minutes in period II. The average waiting time for the triage nurse was 9 minutes in period I, and 7.42 minutes in period II. The average length of stay in the ED in period I was 1 hour and 24 minutes and 1 hour and 30 minutes in period II. Of the anamneses taken by the triage nurse 91.8% were fully identical with the physicians' anamneses, but in period II this percentage jumped to 98%. Patients with chest pain were categorized correctly by the triage nurse in 76.8% of the cases in period I and 72.4% in period II, with an overtriage of 18.6% and 20.7% respectively ($\kappa = 0.75$, $\kappa = 0.70$ respectively). In our study, nurse triage was safe and effective in classifying patients to urgency categories. The results are consistent and even improved over a 3-year period. The rates of incorrect classification,

deterioration, and delay of treatment of patients because of incorrect triage are very low. Most of the patients were examined by the physician within the expected time. Triage nurse predicted correctly the urgency category of patients with chest in most of the cases and the rate of missing acute coronary events was very low. (Am J Emerg Med 2001;19: 113-117. Copyright © 2001 by W.B. Saunders Company)

Triage was introduced to the emergency departments (EDs) to overcome the problem of overcrowding and to provide immediate care to the most urgent patient.¹⁻¹⁰ Some of the triage systems use computerized algorithms,¹¹⁻¹³ others are nurse triage systems,^{7,8,14-22} and some use telephone triage systems with contradictory results.²³⁻²⁸ In Israel, even while writing this article, there is no formal training in emergency medicine, and EDs are divided into sections: medical, surgical, pediatric, orthopedic, and gynecologic. Permanent physicians staff the EDs in the morning and residents from the different hospital wards staff the EDs during the evening and night shifts. Until the late 1980s, the registration clerk directed patients to the most appropriate section in the ED. Nurses in some of the EDs performed some informal triage. During the late 1980s and the beginning of the 1990s, only 2 EDs in Israel performed formal but partial nurse triage. In late 1992 we decided to implement nurse triage system in our ED, using the American model as the basis, but with some modification of the classifications to meet the needs of the Israeli regulations. All the nurses in the ED were instructed about this method of triaging patients and the goals of patient triage were clearly defined. Guidelines were written to standardize the performance of the nurses. Nurses were instructed to triage patients into 3 urgency categories according to the initial complaint, the vital signs, and other objective criteria, such as peak flow rate, pulse oximetry, urine test, and bedside blood glucose test. In case of doubt or difficulty, the nurse was advised to consult a senior physician. The urgency categories were defined strictly to set the priority for treatment. In no way it was meant to predict hospital admission. It is important to emphasize that all the patients are examined in the ED. We have no separate examination area for the nonemergent patients. The design of the ED is old and the number of examination beds is far less than sufficient.

Late in 1995, and as a part of the quality assurance program of the ED, we conducted a study to evaluate the capability of the triage nurse to categorize correctly emergency patients and its impact on the waiting time for physician examination. We also deliberately chose to evaluate separately the triage of patients with an initial complaint of chest pain. In 1998 we repeated the same study as a part of the quality assurance program and also to confirm the consistency of the results. The methods and the results are described later with full discussion and literature review.

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TABLE 1. Results of Medical Records Review

	1995	1998
No. of records reviewed	2,335	2,224
No. of incomplete records	1,025	648
Records with full information	1,310	1,576

METHODS AND MATERIALS

A qualified nurse performs nurse triage every day from 7 am to 11 pm. The triage station is located in the waiting room. Large transparent glass separates the station from the public and a back door opens into the ED. A qualified nurse is a nurse with an experience of at least 1 month in triaging patients under the supervision of a senior nurse. Patients are first registered at the reception desk and then referred with their medical charts to the triage nurse. The triage nurse documents the main complaint of the patient, relevant diseases, and drug therapy, any known allergies, and vital signs. In certain cases, the triage nurse uses other bedside tests like pulse oximetry, peak flowmeter, urine stick examination, and blood glucose test. The nurse assigns the patient 1 of 3 urgency categories; *Urgency 1*: a patient whose condition may deteriorate if not examined within 1 hour; *Urgency 2*: a patient whose condition may deteriorate if not examined within 2 hours; and *Urgency 3*: all the others. Patients with a life-threatening or organ-threatening conditions are directed immediately inside the ED and are not triaged at the triage desk. Patients who are brought by ambulance and patients who need to be laid down are triaged inside the ED and not at the triage station. Non-trauma pediatric patients are triaged in the pediatric section area. In case of uncertainty, the triage nurse consults a senior physician, but this was only for few cases.

In 1995 and 1998, we conducted a retrospective review of the medical charts of all the patients who were examined by the triage nurse and treated in the ED. We randomly chose (by majority) to examine 2 identical consecutive weeks. Only patients with complete charts were enrolled on the study. Charts with incomplete or without information on nurse triage and incomplete physician forms were carefully studied by the authors but discarded for the purpose of the study. The following information was extracted from the medical records: time of arrival and shift, time of initial examination by the triage nurse, nurse triage category, duration of employment of the triage nurse in the ED and her experience as a triage nurse, the history taken by the triage

nurse, time of initial examination by a physician, the total length of stay in the ED, the history taken by the physician, and the physician urgency category as can be derived by the authors from the physician's diagnosis. The duration of employment of the triage nurses and their experience were coded and blinded for the physician reviewers. All the charts were reviewed by the authors. In case of disagreement between the authors, the head of the ED, the principal author of the study, made the final decision. Any information about deterioration of the patients' condition or delay in the treatment because of incorrect categorization by the triage nurse was recorded separately. Hospital records of admitted patients were also reviewed by the authors. Because acute myocardial infarction was one of the most serious diseases that the triage nurse feared to miss, we chose to look specifically at the patients who had a chief complaint of chest pain and compared the triage categories.

Exclusion criteria from the study were the following: (1) patients who arrived during the night shifts 11 pm to 7 am; (2) patients who were brought by ambulance; (3) nonwalking patients; (4) patients who needed immediate treatment for life-threatening or organ-threatening conditions; (5) nontrauma pediatric patients up to age 15 years; (6) patients who were not examined by the triage nurse; (7) incomplete medical records.

Parameters for efficiency of the nurse triage were the following: (1) compatibility of the urgency category of the triage nurse and that of the attending physician, as can be derived from the physician's diagnosis; (2) compatibility of the anamnesis taken by the triage nurse and the attending physician; (3) compatibility of the urgency category of the triage nurse and the waiting time to physician examination; (4) the incidence of deterioration of patients because of incorrect categorization by the triage nurse; (5) the incidence of miscategorized patients with chest pain.

The data were analyzed using the SPSS software (SPSS, Chicago, IL). The results were tested for significance by the student's *t* and chi-squared tests. Interobserver agreement was evaluated using the κ value. The study was approved by the hospital management and conducted under its direct supervision.

RESULTS

The authors reviewed 2,335 patients' charts from the year 1995 (period I) and 2,224 charts from the year 1998 (period II). All the charts belong to patients who were referred to the ED during 2 identically consecutive weeks and examined by

TABLE 2. Compatibility of Urgency Categories of Triage Nurse and Attending Physician

Nurse Urgency Category	Physician Urgency Category							
	1995				1998			
	1	2	3	Total	1	2	3	Total
1	5 0.4%	7 0.5%	2 0.2%	14 1.1%	5 0.3%	22 1.4%	4 0.3%	31 2.0%
2	9 0.7%	42 3.2%	40 3.1%	91 7%	—	96 6.1%	58 3.7%	154 9.8%
3	12 0.9%	54 4.1%	1139 86.9%	1205 91.9%	—	26 1.6%	1365 86.6%	1391 88.3%
Total	26 2.0%	103 7.9%	1181 90.2%	1310 100%	5 0.3%	144 9.1%	1427 90.5%	1576 100%

TABLE 3. Compatibility of Urgency Category of Triage Nurse and Attending Physician According to Nurse Experience in Triage

Nurse Experience	Full Compatibility		Partial or No Compatibility	
	1995	1998	1995	1998
Up to 1 year	88.5%	92%	11.5%	8%
1 to 3 years	91.5%	93.4%	8.5%	6.6%

the triage nurse at the triage desk only. Half of the patients were admitted during the morning shifts. Sunday is the busiest day of the week because Saturday is the weekend in Israel, and most of the family physicians do not work on Saturdays. Of the reviewed charts, 1,025 from period I, and 648 charts from period II were found to be deficient in information on triage and/or physician’s diagnosis and were excluded from the study. So for the purpose of our study we included 1,310 records from period I and 1576 charts from period II (Table 1).

In period I, 92% of the patients was classified as category 3, 7% as category 2, and only 1% of the patients was classified as category 1. In period II, 88.2% of the patients was classified as category 1, 9.8% as category 2, and 2% as category 3. We compared the urgency category assigned by the triage nurse with the urgency category according to the physician’s diagnosis (Table 2). In period I, we found full agreement in 90.5% of the cases, $\kappa = 0.90$ (probability of agreement on a random case 0.47). Only 0.7% of the patients in nurse triage category 2 and 0.9% of those in nurse triage category 3 were classified as category 1 according to the physician’s diagnosis (total 1.6% of the cases). In period II, we found full agreement in 93% of the cases, $\kappa = 0.93$ (probability of agreement on a random case 0.3). There was no misclassification of category 1 patients in period II. The rate of agreement was lower for nurses with an experience in triage of up to 1 year in comparison to more experienced nurses (1-3 years) in period I, but such difference was not found in period II (Table 3).

We checked if the patients were examined within the expected time according to their urgency category. In period I, we found that 70% of the patients in category 1 was examined by a physician within 1 hour, and almost all the patients in categories 2 and 3 (98%) were examined within the expected time (Table 4). The average waiting time for physician examination in each category was 43.1 minutes in category 1, 49.8 minutes in category 2, and 55.3 minutes in category 3. The average waiting time for triage nurse examination was 9 minutes and the average length of stay in the ED was 1 hour and 24 minutes. The average length of

TABLE 4. Waiting Time From Nurse Triage to Physician Examination

Percentage of Patients Examined	Nurse Triage Category					
	1		2		3	
	1995	1998	1995	1998	1995	1998
Within 60 Minutes	70%	100%				
Within 120 Minutes			98%	97.1%		
Within 180 minutes					98%	98.1%
Average waiting time to physician examination	43.1 min	18.2 min	49.8 min	40.6 min	55.3 min	41.9 min

TABLE 5. Other Efficiency Parameters

	1995	1998
Compatibility of anamnesis of triage nurse and attending physician	91.8%	98%
Percentage of patients who deteriorated due to incorrect triage category	0.3% (4/1,310)	0.1% (2/1,576)
Percentage of patients whose treatment was delayed because of incorrect triage category	0.5% (7/1,310)	0.2% (3/1,576)

stay in the ED before the triage system was $4\frac{1}{2}$ hours. In period II, we found great improvement in the waiting times. All of the patients in category 1 were examined within 1 hour, and the average waiting time for physician examination in category 1 dropped to 18.2 minutes. The average waiting time for triage nurse examination was 7.42 minutes, and the average length of stay in the ED was 1 hour and 30 minutes.

The history taken by the triage nurse matched that taken by the physician in 91.5% of the cases in period I with great improvement to 98% agreement in period II. Only 0.3% of the patients deteriorated because of incorrect triage classification, and in only 0.5% of the cases there was a delay in the treatment because of incorrect triage (Table 5). These percentages dropped to 0.1% and 0.2% in period II respectively. No deaths or irreversible disabilities occurred to the patients because of incorrect triage or delay in the treatment during the examined periods.

We chose also to focus on the charts of the patients with an initial complaint of chest pain to examine the category agreement rate. Chest pain is the most common complaint in the ED and it represents 11% of the complaints in the medical section. In period I, we found an agreement rate of 76.8% and in period II 72.4% ($\kappa = 0.75$ and 0.70 respectively). Triage nurses missed only 2 patients out of 108 with chest pain in period I: one was classified as category 2 and one as category 3, whereas the physician’s diagnosis was compatible with category 1 (Table 6). In period II, there were no patients with chest pain in category 1. The triage nurse overtriaged 18.6% of the patients with chest pain in period I and 20.7% in period II.

DISCUSSION

There is much written in the English literature on nurse triage but little is written on the comparison of the nurse triage results with the results of the physician’s triage. Albin

TABLE 6. Compatibility of Urgency Categorization of Patients With Chest Pain by Triage Nurse and Attending Physician

Nurse Triage Category	Physician Urgency Category							
	1995				1998			
	1	2	3	Total	1	2	3	Total
1	1 0.9%	2 1.9%	—	3 2.8%	—	4 3.4%	2 1.7%	6 5.2%
2	1 0.9%	9 8.3%	18 16.7%	28 25.9%	—	35 30.2%	21 18.1%	56 48.3%
3	1 0.9%	3 2.8%	73 67.6%	77 71.3%	—	5 4.3%	49 42.2%	54 46.5%
Total	3 2.7%	14 13.0%	91 84.3%	108 100%	—	44 37.9%	72 62.1%	116 100%

$P = .000$

et al in 1975²¹ evaluated the triage performed by nurses in the ED. The triage nurse decided whether the patient should be examined in the ED, walk-in clinic, particular outpatient clinic, or outside the hospital. Correct triage decision was defined as the agreement that the patient would receive the most appropriate care at the facility to which the nurse had sent the patient. Mistriage was defined as the agreement of 2 evaluating physicians that the patient's condition was an emergency and should have been treated in the ED on the same day, as opposed to the nurse's decision. Uptriage was the agreement of 2 evaluating physicians that the patient had a nonemergency condition as opposed to the triage nurse decision. The results revealed that 80% of the patients were correctly triaged, 17% uptriaged, and 3% mistriaged. There was an 84% agreement rate on the history taken by the triage nurse in the correctly triaged and uptriaged groups, and 75% agreement in the mistriaged group. Parmar and Hewitt in 1985²⁹ performed a study to determine the accuracy of nurse triage in an accident and ED. The study included more than 400 patients. There were errors in patient assessment in 20% of the cases. Their conclusions were that triage nurses should have formal orientation for triage and clear guidelines for patient assessment must be developed. George et al in 1993³⁰ studied the differences in priorities assigned to patients by triage nurses and consultant physicians in the ED. The urgency categories used were based on the priority of treatment of the patients. Agreement on patient's category was found in 49% of the cases only, and the agreement was even less in patients younger than 15 years. They found that nurses tended to assign patients more urgent states than did doctors. They thought that these differences in triage classifications could be explained by the timing of the assessment and the different professional perspectives of doctors and nurses. It seemed also that the extent of the distress of the children and their parents had a greater effect on the decision of the triage nurse. Brillman et al in 1996³¹ reported a study to examine the agreement among observers with regard to the need for ED care and the ability to predict the need for hospital admission by the triage nurse. They conducted a crossover design in which each subject was subjected to nurse triage, computer-guided triage, and physician triage. Comparisons of these groups revealed a 60% agreement in triage category between physicians and triage nurses, and a 40% agreement between physicians and computer-guided triage.

In our study, we were surprised by the fact that almost half of the charts in period I were incomplete. Continuous

education of the nurses and the physicians through the 3 years resulted in a great improvement and only one-third of the charts were incomplete in the second study. We are not satisfied with this improvement, and we hope that with continuous education we shall be able to eliminate this problem. However, it should be emphasized that all these incomplete charts should have been classified as category 3 according to the contained information.

Not surprising was the consistency of a very high percentage of agreement in the 2 studies between the triage nurse category and the category that was derived from the medical record (90.5% and 93% respectively). Mistriage of category 1 patients was found in only 1.6% of the cases in period I and none in the second study. Probably this high percentage of agreement can be explained by the good orientation program of the triage nurses and the clear guidelines on triaging patients. We obtained similar results when comparing the triage of patients with chest pain. We found a 76.8% and 72.4% agreement rate and an overtriage rate of 18.6% and 20.7%. We were not concerned about overtriage. Most important was the finding that the undertriage rate was consistently low.

It is important to emphasize the small percentage of patients in category 1: 14 patients out of 1,310 in 1995, and 31 out of 1,576 in 1998. Looking at the results of category 1 in 1995, we find that 26 patients were identified as category 1 according to the physician's diagnosis and the nurses missed 80% of them (21 of 26). In 1998, the nurses did not miss any patient from urgency category 1, most probably a result of intensive teaching for better triage, but these results should be interpreted with caution because of the small group. The same caution should be undertaken in interpreting the results of the patients with chest pain.

Brillman et al³¹ reported that all types of triage: nurse triage, computer-guided, and physician triage did not accurately predict hospital admission. We did not examine this point. Regardless, we do not think that triage is intended to be a tool or should be used as a tool to predict hospital admission.

CONCLUSION

Our study clearly indicates that nurse triage is safe and effective in classifying patients into priority categories. The results are consistent and even better over a 3-year period and even patients with chest pain can be safely triaged. The total length of stay in the ED was markedly reduced in

comparison to the pretriage era and most of the patients are examined within the expected time. Improvement of the triage process, continuing education, and addition of a senior physician resulted in better agreement rates and decrease in the waiting time for physician examination mainly in category 1 patients. We highly recommend to implement nurse triage in all the departments of emergency medicine in Israel.

REFERENCES

1. Cross F: Utilization patterns in a categorized system: Are the concerns real or imagined? *J Am Coll Emerg Phys* 1979;8:284-286
2. Hilker T: Non-emergency visits to a pediatric department. *J Am Coll Emerg Phys* 1978;7:3-8
3. Salander J, Averbush M, Wilson M: Reorganization of emergency room triage at Womack Army Hospital. *Milit Med* 1983;148:216-219
4. Weinerman ER, Edwards HR: "Triage" system shows promise in management of emergency department load. *Hospitals* 1964;38:55-62
5. Shah CP, Carr LM: Triage a working solution to overcrowding in the emergency department. *Can Med Assoc J* 1974;110:1039-1043
6. Pool M: Triage nursing as a problem solving. *J Emerg Nurs* 1976;2:25-27
7. Selvig M: Triage in the emergency department. *Nurs Mann* 1985;16:30B-30H
8. Estrada EG: Triage systems. *Nurs Clin N Am* 1981;16:13-24
9. Derlet R, Kinser D, Ray L, et al: Prospective identification and triage of non-emergency patients out of an emergency department: A 5-year study. *Ann Emerg Med* 1995;25:215-223
10. Baltzan MA: The new role of hospital emergency department. *Can Med Assoc J* 1972;106:249-256
11. Mason D, Gibson P, Sanders D: Computerized triage: One department's process. *J Emerg Nurs* 1997;23:330-335
12. Berman DA, Coleridge ST, McMurry TA: Computerized algorithm-directed triage in the emergency department. *Ann Emerg Med* 1989;18:141-144
13. Wilson L, Wilson F, Wheeler M: Computerized triage of pediatric patients: Automated triage algorithms. *Ann Emerg Med* 1981;10:636-640
14. Slater R: The triage nurse. *Hospitals* 1970;44:50-52
15. Gelfant B, Lovelace P: The triage nurse. *Ethicon* 1987;24:6-7
16. Rivara F, Wall H, Worley P, et al: Pediatric nurse triage: Its efficacy, safety and implications for care. *Am J Dis Child* 1986;140:205-220
17. Jackson EB, Seeno E: The screening nurse. *Hospitals* 1971;45:66-73
18. Slater R: Triage nurse in the emergency department. *Am J Nurs* 1970;70:127-129
19. Canizaro P: Management of the non-emergent patient. *J Trauma* 1971;11:544-551
20. Zwicke DL, Bobzein WF, Wagner EG: Triage nurse decisions: A prospective study. *J Emerg Nurs* 1982;8:132-138
21. Albin S, Wassertheil-Smoller S, Jacobson S, et al: Evaluation of emergency room triage performed by nurses. *Am J Public Health* 1975;65:1063-1068
22. Mills J, Webster AL, Wofsy CB, et al: Effectiveness of nurse triage in ED of an urban county hospital. *J Am Coll Emerg Phys* 1976;5:877-882
23. Buckles E, Carew-McColl M: Triage by telephone. *Nursing Times* 1988;87:26-28
24. Verdile VP, Paris PM, Stewart RD, et al: Emergency department telephone advice. *Ann Emerg Med* 1989;18:278-282
25. Isaacman DJ, Verdile VP, Kohen FP, et al: Pediatric telephone advice in the emergency department: Results of a mock scenario. *Pediatrics* 1992;89:35-39
26. Glotzer D, Sager A, Socolar D, et al: Prior approval in the pediatric emergency room. *Pediatrics* 1991;88:674-680
27. Shaw KN, Selbst SM: Indigent children who are denied care in the emergency department. *Ann Emerg Med* 1990;19:59-62
28. Gadowski AM, Perkis V, Horton L, et al: Diverting managed care Medicaid patients from pediatric emergency department use. *Pediatrics* 1995;95:170-178
29. Parmar M, Hewitt E: Triage on trial. *Senior Nurse* 1985;2:21-22
30. George S, Read S, Westlake L, et al: Differences in priorities assigned to patients by triage nurses and by consultant physicians in accident and emergency departments. *J Epidemiol Commun Health* 1993;47:312-315
31. Brillman J, Doezema D, Tandberg D, et al: Triage: Limitations in predicting need for emergent care and hospital admission. *Ann Emerg Med* 1996;27:493-500