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

EMILE HAY, MD, LILY BEKERMAN, RN, GALIA ROSENBERG, RN, AND RONIT PELED, MPH

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 $\kappa$ 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 patients. Some of the triage systems use computerized algorithms, others are nurse triage systems, and some use telephone triage systems with contradictory results. 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.
TABLE 1. Results of Medical Records Review

<table>
<thead>
<tr>
<th></th>
<th>1995</th>
<th>1998</th>
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<tbody>
<tr>
<td>No. of records reviewed</td>
<td>2,335</td>
<td>2,224</td>
</tr>
<tr>
<td>No. of incomplete records</td>
<td>1,025</td>
<td>648</td>
</tr>
<tr>
<td>Records with full information</td>
<td>1,310</td>
<td>1,576</td>
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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) non-walking patients; (4) patients who needed immediate treatment for life-threatening or organ-threatening conditions; (5) non-trauma 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; (5) the incidence of mis-categorized 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

<table>
<thead>
<tr>
<th>Nurse Urgency Category</th>
<th>1995</th>
<th>1998</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>0.7%</td>
<td>3.2%</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>0.9%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>103</td>
</tr>
<tr>
<td></td>
<td>2.0%</td>
<td>7.9%</td>
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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 1. 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 7.42 minutes, and the average length of stay in the ED was 1 hour and 24 minutes. The average length of stay in the ED before the triage system was 4.2 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
et al in 1975\(^{21}\) 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 1985\(^{25}\) 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 1993\(^{30}\) studied the 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 1996\(^{31}\) 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 al\(^{31}\) 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

<table>
<thead>
<tr>
<th>Nurse Triage Category</th>
<th>1995</th>
<th>1998</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>0.9%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Total</td>
<td>2.7%</td>
<td>13.0%</td>
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</tbody>
</table>

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