Results of an advanced nursing triage protocol in emergency departments

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Abstract:

OBJECTIVES: The increasing number of patients admitted to emergency departments (EDs) and overcrowding of EDs lead to a global problem. Advanced nursing triage is an important solution in facilitating patient and time management, also increasing the efficiency of the ED. This study was conducted to predict the possible effects of applying advanced nursing triage modeling with predetermined protocols during the current nursing triage in the ED.

METHODS: This was a descriptive and cross-sectional study. An advanced “triage assessment protocol,” which was developed previously, was hypothetically applied for 5 days by triage nurses in the adult ED of a university hospital. The hypothetical application was tested by triage nurses in all shifts. The nurses recorded the examination or treatment options which they thought to apply for the patient on the study form. The data recorded on the advanced triage evaluation protocol form by the triage nurses were compared with the patient outcomes and physician examination/treatment requests in the Hospital Information Management System by the researchers.

RESULTS: In the study, it was determined that the rate of examination/treatment that could be requested according to the advanced nursing triage protocol was 46%. There was a good level of agreement on X-ray and a moderate level of agreement on urinary test and urinary beta-Human chorionic gonadotropin (hCG) test between physicians and triage nurses regarding examination/treatment requests. In addition, it was found that there was a 61.2% of agreement on decisions made for patients aged between 18 and 35. The rate of agreement between doctors and nurses regarding a gluco-stick request for patients admitted outside the prime time (92.2%) was found to be significantly higher (87.9%) than for patients admitted during prime time (P = 0.046).

CONCLUSION: “Advanced triage” practices recommended for busy EDs were tested “hypothetically” at the national level due to the lack of legal regulations and were found to be compatible with the actual results of physicians’ practices at an acceptable level, especially for selected medical conditions. The method used in this study can be useful in planning the transition to “advanced triage” practices. These results can show the readiness of nurses for the transition to this practice.

Keywords:
Advanced triage, clinical decision-making, emergency departments, emergency nursing

Introduction

In recent years, there has been an increase in the number of patients admitted to the emergency department (ED) all over the world. Increasing patient density can lead to poor clinical outcomes, decreased patient satisfaction, and long stays.¹ As a result, the quality of patient care can decrease, and undesirable events can occur.² One of the ways to facilitate patient and time management and improve patient outcomes in ED is advanced nursing triage.

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Box-ED
What is already known on the study topic?
• Advanced nursing triage is one of the safe practices to facilitate patient management and increase the efficiency of the emergency department.

What is the conflict on the issue? Has it important for readers?
• There is no legal regulation on advanced nurse triage at the national level
• A pilot study method can be effective in establishing and implementing the legal infrastructure of advanced triage nursing.

How is this study structured?
• This study was conducted as a single-center, descriptive, and cross-sectional study with 842 adult patients’ data on advanced nurse triage.

What does this study tell us?
• In line with the protocol determined in this study, it was found that patient specification in selected groups might be done at an acceptable level by triage nurses in accordance with criteria
• In countries where legal regulations regarding advanced nursing triage practices are inadequate, the method applied in this study can be used to determine nurses’ adjustment and shortcomings. Preferring applications with higher consistency, especially outside prime times, can provide a safe transition period.

practices. Advanced triage is a comprehensive process and includes initiating diagnostic tests for eligible patients based on a predefined protocol or algorithm. Advanced nursing triage protocols can be used for patients who do not urgently need a bed and whose main complaint is suitable for the protocol. Advanced triage protocols have been used in EDs for many years. However, it is vital to ensure that this process is approved within the terms set by state laws and statutes. There is no legal regulation on advanced nursing triage at the national level. For this reason, this study was planned to apply advanced nursing triage modeling with predetermined protocols and to predict possible effects during the current nursing triage in the ED. Furthermore, it was aimed to present important findings of the feasibility of advanced nursing triage with this study.

Methods

Study design
This study was conducted in a descriptive and cross-sectional design to test the possible results of advanced nursing triage application in a sample model. This study has been prepared in accordance with the STROBE checklist. Ethical approval was obtained by the Akdeniz University Faculty of Medicine Ethics Committee for Non-Interventional Clinical Research with the approval number of 2012/KAEK/20/325/2020 on the date of May 13, 2020.

Sample and setting
The study was conducted in the adult ED of a university hospital which has approximately 280 patient visits daily and 100,000 annually. The emergency overcrowding score of the department according to National Emergency Department Overcrowding Score (NEDOCS) was calculated to be level 4 (overcrowded). Triage is routinely performed by 18 shiftly working nurses with an ED experience of at least 1 year and who received 6h of triage training. When a patient applied to the triage area, the nurse asked the chief complaint and a brief history of the symptoms (primary complaints, patient’s past medical/surgical history, chronic diseases, and other information such as pain scale and Glasgow Coma Scale), checked the vital signs (blood pressure, pulse rate, body temperature, respiratory rate, and oxygen saturation), and then decided the category based on the triage scales. Triage nurses are using the Australasian Triage Scale and Emergency Severity Index Version 4 (ESI) scale routinely. Patient management in ED was carried out by emergency medicine residents under the supervision of an attending physician or faculty of emergency medicine. All diagnostic and treatment modalities done for the patient are recorded to the hospital information management system (HIMS) electronically.

Participants
The study consisted of patients who presented to the adult ED within 5 days, did not require emergency intervention, and needed resources according to the triage nurse’s decision. Patients who were presented to ED by ambulance and required emergency intervention and all patients under the age of 18 were excluded from the study.

Study procedures
The triage nurses hypothetically applied the advanced triage evaluation protocol to the consecutive patients who presented to the adult ED and met the inclusion criteria, simultaneously with the routine triage protocol. Advanced triage evaluation protocol was created by a team of specialists based on the literature. The specialists were two ED professors and two ED nurses with 10 years
of experience. The advanced triage evaluation protocol included implementing X-ray, analgesic pomade, gluco-stick, urinary test, oral paracetamol, urinary beta-Hcg, and local anesthesia of the eye. Table 1 shows in which patient complaints this protocol could be applied.

The admission date and time, patient’s name and surname, chief complaint, triage category, and the code data (A, B, C, and D) in the advanced triage assessment protocol were recorded on the application form of the research protocol. The protocol was applied out of the prime time (the time interval between 00.00 and 17.59, the hours when patient density was known to be moderate to low) and during the prime time (the time interval between 18.00 and 23.59, the hours when patient density was highest). These time intervals were decided according to patient admission data in the hospital information system that was achieved in our ED previously. In addition, the form was filled out both for the patients who were directly admitted to the department and those in the waiting room. The ED advanced nurse triage model was applied as follows: first, the patient comes to the adult emergency triage area. The triage nurse completes the patient’s history and physical assessment. The nurse fills out the application form of the research protocol found in the area for the patient. In this form, the codes in the advanced triage evaluation protocol are written in the code field. The triage nurse determines whether the patient meets one of the criteria determined in the advanced triage evaluation protocol by listening to his/her complaint and making an assessment. The nurse records the tests that he/she has determined for the patient on the research protocol application form as coded in the protocol. During this process, the triage nurse does not request any treatment and/or examination for the patient. In the study, a hypothetical treatment and/or examination was chosen among the options in the advanced nursing triage at that moment. Here, a hypothetical description of what examination/treatment would be required for the patient if advanced triage was to be applied was made.

In the study, the tests requested for the patients, demographic data, and the length of the patient’s stay in the ED and the waiting room were obtained from the HIMS database. Before starting the study, the researchers informed the triage nurses about how to use the protocol [Table 1] that was developed and how to fill out the application form of the research protocol. The decisions of physicians about patient management and the hypothetical decision of the triage nurses were blind to each other during the study period.

**Data analysis**

Categorical variables were presented as frequency values (n) and percentages (%), and continuous variables as mean ± standard deviation and median (min–max) values. The assumption of normality was tested by using the Shapiro–Wilk test. Pearson Chi-square test and Fisher’s exact test were used to analyze the relationships between categorical variables. The agreement between triage nurses and doctors on possible tests to be requested for the patients was evaluated with the kappa test. The degree of agreement based on kappa coefficient was classified as follows: ≤0.20, insignificant; 0.21–0.40, poor; 0.41–0.60, moderate; 0.61–0.80, good; and 0.81–1.00, very good.[11] All analyses were performed on the IBM SPSS 23.0 software package (IBM Corp., Armonk, NY, USA), and P < 0.05 was considered statistically significant.

**Results**

A total of 2817 patients were admitted to the adult ED of the hospital where the study was conducted for 5 days. The study included data on advanced nursing triage obtained from 842 adult patients who met the inclusion criteria.

Of the 842 patients included in the study, 51.8% were female, and 48.2% were male. The mean age of the patients was 38.46 ± 17.28 years. Furthermore, 68.5% of the patients were included in the study out of prime time and 31.5% during prime time. In the study, it was determined that the rate of examination/treatment that could be requested according to the advanced nursing triage protocol was 46%. It was found that the mean length of stay in the ED was 87.48 ± 105.23 min and the length of stay in the waiting room was 17.5 ± 34.48 min [Table 2].

### Table 1: Advanced triage evaluation protocol

| Procedure                  | Code   |
|----------------------------|--------|
| X-ray                      | A - Trauma, suspicion for trauma or sprains around knee-elbow, and hand-foot (except open fracture and wound) |
| Analgesic pomade           | A - Trauma, suspicion for trauma or sprains around knee-elbow, and hand-foot (except open fracture and wound) |
| Gluco-stick                | A - All diabetics |
| B - Dizziness or syncope   |        |
| Urinary test               | A - Dysuria (Urinary burning, pain) |
| B - Female patients with low pelvic pain |        |
| Oral paracetamol           | A - All acute pains except stomach and chest pain (low back, head and throat pain, simple traumatic pains) |
| B - Fever above 38°C       |        |
| Urinary beta-Hcg           | A - All female patients in the reproductive age group with abdominal pain |
| B - Patients with symptoms of pregnancy (menstrual delay, nausea, etc.) |
| C - Dizziness or syncope for female patients of reproductive age |
| D - Female patients with suspicion of pregnancy, who will receive radiography |
| Topical anesthesia of the eye | A - Red eye and pain |
| B - Minor eye trauma and pain |
| C - Foreign body in eye and pain |
| D - Exposure of the eye to chemical substances and pain |

Hcg: Human chorionic gonadotropin
It was found that the rate of tests/treatments likely to be requested by the triage nurse for patients with triage categories 4 and 5 (55.4% and 50.6%) was higher than for patients with triage category 3 (34.4%) \( (P < 0.001) \). When the distribution of possible tests that might be requested by the nurses was analyzed according to triage categories, it was found that the rate of X-rays in patients with triage category 4 (14.2%) was higher than in those with triage categories 3 and 5. Urine test (8.9%) and gluco-stick ratio (7.5%) were found to be higher in triage 3 group compared to triage 4 and triage 5. The rate of oral paracetamol administration was observed the highest in patients with triage category 5 (43.2%) and the lowest in those with triage category 3 (5%) \( (P < 0.001) \) [Table 3].

According to the advanced nursing triage evaluation protocol, the rates of agreement between the examinations/treatments that were likely to be requested by the nurses and the examinations/treatments requested/given by the doctors during the examination were compared [Table 4]. The results are presented in Table 4.

The rates of agreement between examinations/treatments were compared by the age groups of patients [Table 5]. According to this comparison, it was found that the agreement between the decisions made by doctors and nurses in patients aged 18–35 (61.2%) was higher than the agreement obtained (45.7%) in patients aged 65 and over \( (P = 0.009) \). The highest rate of agreement with regard to gluco-stick requests was observed in patients aged 18–35 (95.1%) \( (P < 0.001) \). The rate of agreement between decisions made by doctors and nurses regarding a urinary test request was significantly higher in patients aged 18–35 and 36–64 (92.7% and 95%) than in patients aged 65 and over \( (P < 0.001) \) [Table 5].

The rates of agreement between examinations/treatments were compared according to the prime time periods of the ED [Table 6]. According to this comparison, it was found that the agreement between the decisions made by doctors and nurses regarding gluco-stick requests in patients admitted outside prime time (92.2%) was higher than in patients admitted outside prime time (87.9%) \( (P = 0.046) \) [Table 6].

### Discussion

In this study, advanced triage nurses used an application that could accelerate the delivery of health services and ensure patient satisfaction in about half of the patients. It was observed that 68.5% of the examination/treatment requests were made out of the prime time in line with the protocol applied by triage nurses. The number of patients admitted to the ED in a time frame is the most important factor affecting the nurse’s triage management.\[12\] We observed that the advanced triage protocol was applied more frequently by nurses at out of prime time in our study. The tendency of triage nurses to participate in the study may have decreased during crowded hours. Some patients may not have been included in the study in crowded prime time intervals. Since this situation was not specialized to any patient group or any symptom, we do not think that this creates bias. Of course, the fact that they did not receive any advanced triage training may have been a factor affecting their choices.

It was found that more than half of the examination/treatment requests determined by the triage nurses over the protocol were compatible with the doctors’ examination/treatment requests made during the examination. The X-ray, urinary test, and urinary beta-Hcg requests of triage nurses according to the protocol were consistent with doctors’ requests and management. Rosmulder et al.\[13\] found that 93% of
Çetin, et al.: Advanced nurse triage

Table 3: Distribution of tests/treatments likely to be requested by the triage nurse by triage categories

| Triage category | 3 | 4 | 5 | P |
|-----------------|---|---|---|---|
| Requesting a test, n (%) | | | | |
| No | 236 (65.6) | 179 (44.6) | 40 (49.4) | <0.001 |
| Yes | 124 (34.4) | 222 (55.4) | 41 (50.6) | |
| Test, n (%) | | | | |
| X-ray | 21 (5.8) | 57 (14.2) | 1 (1.2) | <0.001 |
| Analgesic pomade | 1 (0.3) | 12 (3) | 1 (1.2) | 0.013 |
| Gluco-stick | 27 (7.5) | 12 (3) | 0 | 0.001 |
| Urinary test | 32 (8.9) | 12 (3) | 0 | <0.001 |
| Oral paracetamol | 18 (5) | 92 (22.9) | 35 (43.2) | <0.001 |
| Urinary beta-Hcg (n=436) | 16 (8.1) | 11 (5.5) | 1 (2.6) | 0.334 |
| Local anesthesia of the eye | 9 (2.5) | 26 (6.5) | 3 (3.7) | 0.028 |

Hcg: Human chorionic gonadotropin

Table 4: Agreement between the examinations/treatments requested by the physician and nurse

| The nurse’s decision | The physician’s decision | Kappa value | P |
|----------------------|--------------------------|-------------|---|
| Requesting an examination | No, n (%) | Yes, n (%) | |
| No | 235 (62.2) | 220 (47.4) | 0.145 | <0.001 |
| Yes | 143 (37.8) | 244 (52.6) | |
| X-ray | | | | |
| No | 737 (98.5) | 26 (27.7) | 0.762 | <0.001 |
| Yes | 11 (1.5) | 68 (72.3) | |
| Analgesic pomade | | | | |
| No | 828 (98.6) | 0 | 0.247 | <0.001 |
| Yes | 12 (1.4) | 2 (100) | |
| Gluco-stick | | | | |
| No | 742 (97.9) | 61 (72.6) | 0.332 | <0.001 |
| Yes | 16 (2.1) | 23 (27.4) | |
| Urinary test | | | | |
| No | 740 (98.9) | 58 (61.7) | 0.485 | <0.001 |
| Yes | 8 (1.1) | 36 (38.3) | |
| Oral paracetamol | | | | |
| No | 611 (90) | 86 (52.8) | 0.389 | <0.001 |
| Yes | 68 (10) | 77 (47.2) | |
| Urinary beta-Hcg (n=436) | | | | |
| No | 394 (96.3) | 14 (51.9) | 0.437 | <0.001 |
| Yes | 15 (3.7) | 13 (48.1) | |
| Local anesthesia of the eye | | | | |
| No | 804 (95.5) | - | - | - |
| Yes | 38 (4.5) | - | - | - |

In our study, we think that advanced triage nursing practices can be started for examination/treatment groups which show good and moderate levels of agreement between nurses and doctors. The results of this study, which was conducted without giving any advanced triage training to nurses, were slightly below the results in the literature. Nevertheless, our study results showed the areas that needed improvement to the future researchers.

In our study, it was found that the rates of examinations/treatments that were likely to be requested by the triage nurse were higher in patients with triage categories 4 and 5. Robinson[8] found that triage nurses could initiate treatment and request tests for patients with triage category 4 by using a protocol.[8] In our study, the rate of X-ray requests in patients with triage category 4 and the rate of oral paracetamol administration in patients with triage category 5 were found to be high. When triage nurses were compared with doctors in terms of requesting examination/treatment, a good level of agreement was found regarding X-rays requests, while a weak level of agreement was found in terms of administering oral paracetamol. Bengen[9] found that, in accordance with the protocol prepared in the ED, specialist nurses determined the radiograph requests for patients with extremity trauma correctly to a great extent.[9]Seguin[10] found that triage nurses could provide safe and effective pain management for patients.[10]Since the physicians or patients preferred intravenous or intramuscular analgesia instead of oral tablets, the level of agreement regarding oral paracetamol administration in our study was found to be low.

In our study, it was found that the rate of consistency between decisions made by triage nurses and doctors about gluco-stick requests and urinary tests in patients aged 18–35 was found to be significantly high. In addition, the agreement between triage nurses and doctors for gluco-stick requests was significantly higher in patients presenting in the time frame out of the prime time. We think that triage nurses do not request gluco-sticks when the ED is crowded. Predicting the tests needed by patients and making requests can increase the overall efficiency of the EDs.[1] We think that the results of our study shed light on the time period and patient age group in which advanced nurse triage practices could be performed, also tests that could be chosen at the triage area.

Limitations
The fact that this research was conducted in a university hospital and hypothetically due to the lack of a legal infrastructure can be considered a limitation. It may be necessary to first determine the shortcomings by conducting a pilot study and providing the necessary education and physical conditions so that the method can be implemented in a very busy ED. Another limitation is the patient’s length of stay and loss of...
Table 5: The rates of agreement between examinations/treatments requested by doctors and triage nurses by patients’ age groups

| Examinations                | Age       | 18-35, n (%) | 36-64, n (%) | ≥65, n (%) | P   |
|----------------------------|-----------|--------------|--------------|-----------|-----|
| Requesting an examination  | 253       | 275 (61.2)   | 162 (53.8)   | 42 (45.7) | 0.009 |
| X-ray                      | 288       | 423 (94.2)   | 291 (96.7)   | 91 (98.9) | 0.071 |
| Analgesic pomade           | 427       | 441 (98.2)   | 298 (99)     | 91 (98.9) | 0.830 |
| Gluco-stick                | 370       | 427 (95.5)   | 266 (88.4)   | 72 (78.3) | <0.001|
| Urinary test               | 416       | 416 (92.7)   | 286 (95)     | 74 (80.4) | <0.001|
| Oral paracetamol           | 236       | 370 (82.4)   | 236 (78.4)   | 82 (89.1) | 0.057 |
| Urinary beta-Hcg           | 206       | 206 (91.6)   | 146 (93.6)   | 55 (100)  | 0.078 |
| Local anesthesia of the eye| 428       | 428 (95.3)   | 288 (95.7)   | 88 (95.7) | 0.970 |

Table 6: The rates of agreement between the examinations/treatments requested by the doctor and nurses according to the prime time of the emergency department

| Examinations                | Prime time       | 00:00-17:59, n (%) | 18:00-23:59, n (%) | P   |
|----------------------------|------------------|--------------------|--------------------|-----|
| Requesting an examination  | Inside            | 337 (58.4)         | 142 (53.6)         | 0.190|
| X-ray                      | Outside           | 555 (96.2)         | 250 (94.3)         | 0.224|
| Analgesic pomade           | Inside            | 571 (99)           | 259 (97.7)         | 0.209|
| Gluco-stick                | Outside           | 532 (92.2)         | 233 (87.9)         | 0.046|
| Urinary test               | Inside            | 532 (92.2)         | 244 (92.1)         | 0.950|
| Oral paracetamol           | Outside           | 466 (80.8)         | 222 (83.8)         | 0.294|
| Urinary beta-Hcg           | Inside            | 285 (94.4)         | 122 (91)           | 0.198|
| Local anesthesia of the eye| Outside           | 551 (95.5)         | 253 (95.5)         | 0.988|

waiting room data in the ED. Although we had these data in the study form, since the study was decided hypothetically, we cannot make any comment and statistical analysis about if this triage system can affect these parameters. In very crowded EDs, it may be reasonable to establish more than two triage areas, to increase the number of triage nurses, and to gain time for examinations.

Conclusion

This study shows that a pilot study method is effective for advanced triage practices in countries that do not have a legal infrastructure for advanced triage nursing. It also indicates that nurses can safely implement an examination- or treatment-accelerating application in almost half of the patients, especially in busy areas where they can spare time. More effective protocols can be developed and legal infrastructure studies can be supported by eliminating the shortcomings identified via these hypothetical measurements.

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Author contribution statement

OE was responsible for the study conception, design, data analysis, and drafting of the manuscript. SBÇ was responsible for the study design and the drafting of the manuscript. ŞE was responsible for the study design and accessed to data. MG accessed to data. OY was responsible for the drafting of the manuscript and supervised the study.

Conflicts of interest

None declared.

Ethical approval

Ethical approval was obtained by the Akdeniz University Faculty of Medicine Ethics Committee for Non-Interventional Clinical Research with the approval number of 2012/KAEK/20/325/2020 on the date of May 13, 2020. In addition, none of the identifying information of the patients was used so that the privacy of patients could be protected.

Consent to participate

A consent form was not obtained from the patients in the study. Because what is tested here is the nurse’s decision, not the patient’s condition. The management of the patients did not change in any way during the study period. Since only admission data were used, data usage permission was obtained from the hospital. We did not use any patient data, requiring consent in our study.

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