

Triaging self-referred patients attending ophthalmic emergency room

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ABSTRACT

الأهداف: هدفت الدراسة إلى استحداث نظام فعال وآمن لفرز المرضى المصابين بأمراض العيون ليتم استخدامه من قبل أي ممارس صحي من غير أطباء العيون.

الطريقة: تم عمل تقييم لمدة شهرين لنظام معدل منشور سابقاً في دراسة (RESCUE) وهو نظام لفرز المرضى بناءً على الأعراض والعوامل السريرية ذات العلاقة. تم إجراء الدراسة التي صممت بطريقة استباقية في الفترة من مارس وحتى سبتمبر 2014م وذلك في مستشفى الملك عبدالعزيز الجامعي بالرياض، المملكة العربية السعودية. اقتصرت الدراسة على المرضى الذين زاروا المستشفى مباشرة دون أوامر تحويل من مستشفيات أو عيادات أخرى. اتسع نطاق الدراسة ليشمل تمييز الحالات المرضية الحرجة وشبه الحرجة من الحالات الغير الحرجة، وتحديد المرضى الذين يحتاجون إلى تدخل عاجل لتقليل مدد الانتظار وذلك باستخدام إختبار "مان ويتني يو".

النتائج: تضمنت الدراسة 531 مريض في مرحلة تقييم اعتمادية نظام الفرز المستحدث، و 824 مريض في مرحلة التنفيذ (بتطبيق النظام في غرف طوارئ العيون). كانت النتيجة تحسن حساسية تمييز الحالات الحرجة إلى شبه الحرجة من الحالات الغير حرجة من 90.7% إلى 98.7%، بينما انخفضت الخصوصية من 97.2% إلى 87% بالمقارنة مع دراسة (RESCUE). بذلك وصلت حساسية تمييز الحالات الحرجة إلى شبه الحرجة من الحالات الغير حرجة إلى 99% وكانت الخصوصية 90%. وتم انخفاض متوسط وقت الانتظار من 58.23 دقيقة إلى 46 دقيقة ($p=0.014$)، وانخفض الوسيط الحسابي للانتظار من 46 دقيقة إلى 33 دقيقة ($p=0.009$).

الخاتمة: إن نظام الفرز والتعقب الجديد يعتبر آمناً وفعالاً في تمييز مستوى الخطورة لحالات أمراض العيون المختلفة، وتقليل الضغط على غرف طوارئ العيون مما يقلل من مدة الانتظار بشكل ملحوظ.

Objectives: To introduce an effective and safe ophthalmic triaging system to be used by non-ophthalmologists.

Methods: A modified scoring triage system with more relevant clinical symptoms and signs from a previously published Rome Eye Scoring System for Urgency and

Emergency (RESCUE) was evaluated over a 2-month period. The study was conducted following a prospective cohort design between March and September 2014 at King Abdulaziz University Hospital, Riyadh, Saudi Arabia. Only self-referred patients were included. Its reliability in differentiating urgent and semi-urgent conditions from non-urgent conditions, identifying patients who need immediate intervention, and decreasing the waiting time were tested using Mann Whitney U test.

Results: A total of 531 patients were included in the validation phase to evaluate the triaging system reliability, and 824 patients were included in the implementation phase (applying the system in the ophthalmology emergency room). The sensitivity to differentiate urgent and semi-urgent conditions from non-urgent conditions improved from 90.7 to 98.7%, while the specificity decreased from 97.2 to 87% compared with RESCUE. The sensitivity in differentiating urgent conditions from semi-urgent and non-urgent conditions was 99%, and the specificity was 90%. Mean waiting time reduced from 58.23 minutes to 46 minutes ($p=0.014$), and the median waiting time reduced from 46 minutes to 33 minutes ($p=0.009$).

Conclusion: This triage system appears to be safe and effective in recognizing the urgency of different ophthalmic conditions, reducing unnecessary ophthalmic emergency load and waiting time significantly.

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The ophthalmology emergency room (OER) receives patients from different referral sources; such as self-referred, referral from general practitioners, optometrists, or other secondary or tertiary hospitals.¹ The number of self-referrals in a dedicated OER was found to be as high as 89% of the patients who attended the OER.² One major reason for a loaded emergency room (ER) by patients is expected to be related to receiving large number of patients with non-emergency conditions. Only 25% of patients presenting to the ER were found to have urgent medical conditions by using a triaging process.³ Emergency room visits by patients with non-urgent conditions contributes to long waiting times and patients' frustration with the service.⁴ Handling an acute ophthalmic condition is different from the management of general acute medical conditions. It can be challenging for general emergency physicians and nurses to manage patients with ophthalmic complaints, because there are many acute ophthalmic conditions that can be vision threatening without obvious clinical findings.⁵ Therefore, because of the unique presentations of acute ophthalmic conditions, it might be risky to manage the situation entirely by general medical doctors.⁶ Considering such conditions, a reliable ophthalmic triaging system would be of great benefit for non-ophthalmologists working at acute care services to manage peculiar presentations of some of the acute ophthalmic problems. Limited literature exists on OER triage. Further research in this area including triage scales, facilities for triage, qualifications, and experience of triage personnel, triage standards, and guidelines are needed. Revisions of the triage criteria should focus on reducing the unnecessary use of emergency services without compromising the clinical safety.⁷ A recent study carried out in King Abdul Aziz University Hospital's OER in 2013 during the month of July found that 1,094 self-referred patients were seen during that month. Out of those 1,094 patients, 712 (65.1%) were found to have non-urgent conditions after they were examined by the OER doctors.⁸ Lack of an appropriate triaging system for OER with high sensitivity has drawn our attention to address this urgent need for developing a new ophthalmic triage system. We introduce here a newly developed ophthalmic

triage system, which gives the priority to emergency patients to be attended first among self-referred patients presenting to the OER. Our proposed ophthalmic triage system is a modified version of the Rome Eye Scoring System for Urgency and Emergency (RESCUE).⁹ The modification was carried out to overcome some of the limitations of the RESCUE; such as the considerable potential to miss patients with serious ophthalmic conditions as the sensitivity was only 90.7%, and not including important clinical parameters that are known to be the presentations of serious ophthalmic emergency conditions. The main objectives of this project were to evaluate the effectiveness of the newly modified ophthalmic triage system on recognizing patients with emergency ophthalmic conditions and giving the priority to patients according to the level of urgency of the ophthalmic condition.

Methods. This project was conducted at a dedicated OER of a tertiary hospital in Riyadh, Saudi Arabia. Approval was obtained from the Research Review Board (RRB), Department of Ophthalmology, King Abdul-Aziz University Hospital where the research project adhered to the tenets of the Declaration of Helsinki for research involving humans. Oral consent was sought from emergency patients in phase I (validation phase), while in phase II (implantation phase) the triage was set as a policy for the emergency room. All recruited subjects agreed to participate in

Table 1 - Triage of ophthalmic patients presenting to the emergency room without official referral.

Patient's name: _____		Age: ____
Gender: Male ____	Female: ____	
File No: _____	Date of evaluation: _____	
Complaints with the duration of one week or less should ONLY be included in triaging the patients		
Presenting complaints	Best corrected visual acuity: OD: _____ OS: _____	
1. _____	Duration: _____	
2. _____	Duration: _____	
3. _____	Duration: _____	
History of eye trauma in the last one week	Yes ____ No ____	
History of chemical exposure to the eye in the last one week	Yes ____ No ____	
History of contact lens wear in the last week	Yes ____ No ____	
History of corneal transplant	Yes ____ No ____	
OD - right eye, OS - left eye		

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the current study. Literature was carefully reviewed for similar studies following a meticulous search strategy. Relevant scientific databases such as PubMed, Medline, and Google scholar were used. The reviewed literature was then filtered and narrowed down, where a limited number of highly related articles were selected for full article reviewing. Selection criteria were: relevance, regional, and studies categorized as health systems/ services research. A committee consisting of 5 senior ophthalmologists from the ophthalmology department met to develop an ophthalmic triage system more reliable than the previously published RESCUE⁹ (Table 1). Only ophthalmic symptoms and signs that are known to be the presentations of urgent ophthalmic conditions were used for constructing triaging of the patients and getting the total score. Complaints such as

tearing and itching were not scored during completion of the triaging form (Table 2). The committee also classified the ophthalmic conditions urgency based on their expertise and ophthalmic literature^{5,10} (Table 3). Depending on the total score obtained by completing the triage form, patients were divided into 3 categories: a non-urgent ophthalmic condition (total triaging score of 0 or 1), semi-urgent ophthalmic condition (total triaging score of 2 or 3), and urgent ophthalmic condition (total triaging score of 4 or more). Patients with urgent ophthalmic conditions were attended as soon as a vacant space was available in the ophthalmology exam room. An urgent ophthalmic condition was expected to be examined within 45 minutes from registration. Patients with semi-urgent ophthalmic conditions were also seen as soon as there was vacant ophthalmology

Table 2 - Different categories of clinical findings of emergency ophthalmic patients at presentation and the corresponding score.

Clinical presentation	Score 1	Score 2	Score 3	Score 4
Marked decrease in best visual acuity (worst or = 20/60), or 4 lines decrease compared to last visual assessment.				
Mild decrease in best visual acuity (better than 20/60), or 2 lines decrease compare to last visual assessment.				
Peripheral loss of vision				
IOP more than 25 mm Hg by air puff				
Mild ocular pain*/foreign body sensation				
Severe ocular pain*				
Mild eye/eyelid redness [†]				
Severe eye/eyelid redness [†]				
Eye redness in a preschool age				
Contact lens wearer				
History of corneal transplant				
Proptosis				
New onset ptosis				
Double vision				
Double vision with pupil asymmetry				
Flashes				
Floaters				
Suspect traumatic open globe injury				
Suspect chemical burn				
Child less than 6 months				
Total Score				
Time of registration: _____ Time of screening: _____ Time of examination: _____				
Classification: Non ER (total score of 1 or less)	ER (total score of 2 and 3)		Top ER (total score 4 or more)	
Final diagnosis (possible diagnosis): _____				
Name/Signature ER Nurse: _____ Name /Signature ER Resident: _____				

*mild ocular pain means pain not preventing the patient carrying out usual activities such as sleeping and routine work. Severe pain prevents the patient from carrying out usual activities, [†]mild/severe eye redness will be scored based on eye photo posted in emergency room (ER). Unshaded boxes denotes the allowed space for entry. IOP - intraocular pressure

exam room, but with no patient win the red (urgent) category waiting, if presenting between 8:00 am to 12:00 noon. Patients with non-urgent ophthalmic conditions were not attended to at the OER, and were instructed to seek treatment in the outpatient clinic. The development of the new triage system involved 2 critical phases. In the first phase, which was a prospective cohort study, we validated the modified ophthalmic triage system to determine its safety along with the assurance of the proper training of the nurses. During this phase, no action was taken based on the scores obtained by the new triage system. The triaging was performed to all self-referred patients to study its sensitivity and specificity by testing the association between final diagnosis and total score for each patient during the month of September 2013. The patients' waiting time before implementing the triaging system was also recorded. Self-referred patients with presenting complaints of 2 weeks or less were included in the triage. By reviewing all the triage files for this period, we found that complaints of more than one week duration were all of the non-urgent category. A decision was then made to change the accepted duration of the presenting complaints in the triage form from 2 weeks to one week. Before implementing the triaging system all self-referred patients were seen. As soon as the patient presented to the OER, the receptionist registered the patient. Screening was then carried out, which involved taking the patient's visual acuity and intraocular pressure.

Following screening, the patient was examined by OER doctor. The second prospective phase started in January 2014, it involved implementing the triage system and evaluating the self-referred patients with complaints of one-week duration or presenting to the OER. The patients were first registered, followed by triaging to determine the category of the ophthalmic condition and the suitability of the patient to be seen at the OER.

Data were collected and stored in a spreadsheet using Microsoft Excel 2010® software (Microsoft Corporation, Redmond, WA, USA). Data management and coding were then carried out in excel. Data were analyzed via IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to describe numerical values and presented in frequency (percentage) for counts, mean and median for continuous variables (times). Mann Whitney U test was used to detect whether the difference in time was statistically significant. Comparison of proportion test was used to compare pre and post intervention proportion of non-urgent ophthalmic conditions.

Results. During the month of September, 531 self-referred patients presented to our OER. We went over all the triaging forms filled for the 531 patients and determined the level of the urgency of each patient's condition according to the diseases' categories after looking at the final diagnosis given by the OER doctors (Table 3). During this period, 24 (46.5%) patients were found to have non-urgent conditions based on

Table 3 - Categories and clinical diagnosis of common ophthalmic conditions presenting to the ophthalmic emergency room.

Anterior segment			
<i>Urgent conditions</i>		<i>Semi-urgent conditions</i>	
Corneal abrasion/infection/acute inflammation Conjunctival/corneal FB Traumatic globe injury ophthalmic emergency room		Acute conjunctivitis Severe exposure keratopathy episcleritis/scleritis	
<i>Retina</i>		<i>Neuro-ophthalmology</i>	
<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>	<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>
Acute vascular occlusion Acute retinal detachment Acute vitreous hemorrhage	Retinal break Active retinal/choroidal neovascularisation (namely PDR, ROP, CNVM, and others)	Acute third nerve palsy Acute optic neuropathy	Acute cranial nerve palsy (except 3 rd nerve palsy) Acute Horner's syndrome
<i>Oculoplasty</i>		<i>Glaucoma</i>	
<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>	<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>
Acute orbital or adnexal infections/inflammations Traumatic orbital/lid injuries	Acute proptosis Localized lid infection	Acute glaucoma Bleb-related infections	Non-acute glaucoma
<i>Uveitis</i>		<i>Pediatric ophthalmology</i>	
<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>	<i>Urgent conditions</i>	<i>Semi-urgent conditions</i>
Endophthalmitis Acute posterior uveitis	Acute anterior uveitis		Acute leukocoria Acute strabismus

FB - foreign body, PDR - proliferative diabetic retinopathy, ROP - retinopathy of prematurity, CNVM - choroidal neovascular membrane

triaging, and all of them were attended as the triaging system was not approved yet. Statistical association between the total score, and the urgency level of each patient's condition after being examined by the OER doctors was carried out to evaluate the reliability of the triaging system to predict the level of urgency based on the total score. The sensitivity of the triaging system in differentiating urgent and semi-urgent conditions from non-urgent conditions based on the total score obtained by filling the triaging form was 98.7%, and the specificity was 87%. The sensitivity of the triaging system in differentiating urgent conditions from semi-urgent and non-urgent conditions based on the total score obtained by filling the triaging form was 99%, while the specificity for urgent conditions was 90%. The mean waiting time between registration and screening was 22 minutes. The median waiting time between registration and screening was 13 minutes. The mean waiting time between screening and examination was 39.32 minutes. The median waiting time between screening and examination was 25 minutes (Figure 1). The results of evaluating the safety and effectiveness of the modified triage system were very reassuring for the project team and the ophthalmology administration. Data for one month between January and February were collected for post implementation analysis. During this period, 824 self-referred patients were seen at the OER. Out of these 824 patients, 319 (38.7%) patients were found to have non-urgent conditions and were discharged from the OER directly following the triaging. Comparing pre- and post- intervention proportions of non-urgent ophthalmic conditions, the reduction was found to be statistically significant ($p=0.005$). Following implementation of the triaging

system, the mean waiting time between registration and screening including triaging decreased from 22 minutes to 15 minutes ($p=0.052$). The median waiting time between registration and screening including triaging decreased from 13 minutes to 9 minutes ($p=0.090$). The mean waiting time between triaging and examination by OER doctors for urgent patients was 29 minutes. The median waiting time between triaging and examination by OER doctors for urgent patients was 14 minutes. The mean waiting time between triaging and examination by OER doctors for semi-urgent patients was 35 minutes. The median waiting time between triaging and examination OER doctors for semi-urgent patients was 24 minutes (Figure 2). Completing the triaging form for each patient took less than 2 minutes.

Discussion. Triaging is an important process in any ER setting. It provides the patients with information regarding their ophthalmic complaints; whether they are urgent or non-urgent, and also how to obtain the appropriate treatment.^{11,12} This type of service helps the OER staff to identify patients with potentially urgent conditions ahead of time and prioritize them for emergency eye treatment.

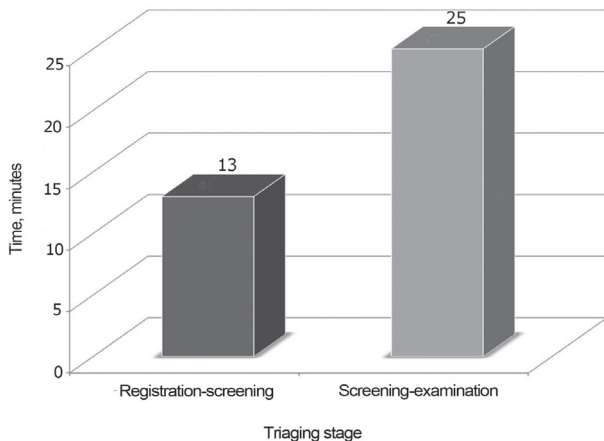


Figure 1 - Median time consumed between registration-screening and screening-examination at the pre-triaging stage.

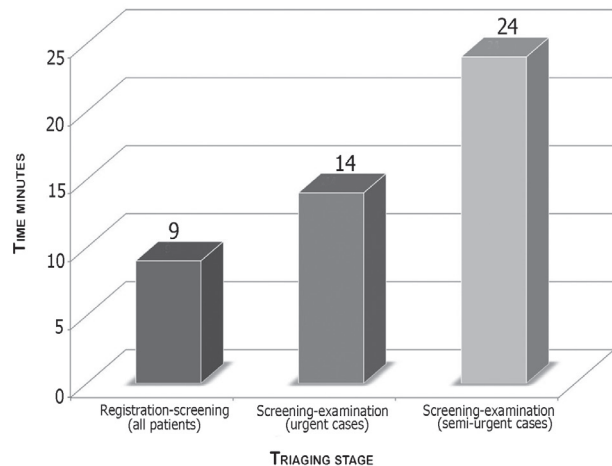


Figure 2 - The median waiting time between triaging and examination for semi-urgent patients.



Figure 3 - An image of an eye with A) mild redness and B) an eye with severe redness.

Rome Eye Scoring System for Urgency and Emergency can be considered the first structured ophthalmic triaging system that is specifically designed for acute ophthalmic conditions. It was published in 2007 and aimed to triage walk-in patients coming to the OER. This triaging system was based on simple ophthalmic signs and symptoms for accurate and timely identification of the urgency of an ophthalmic condition (Figure 3).⁹ This system; in fact, showed 90.7% sensitivity, and 97.2% specificity.¹³ However, a sensitivity of 90.7% indicates considerable chances of missing some patients with some very urgent emergency conditions. The sensitivity of our triage system was 98.7%. This indicates that our system has a better ability to detect urgent and semi-urgent conditions. On the other hand, the specificity of our system was 87% compared with specificity of 97.2% for the previously published one. This indicates that our system has less ability to rule out patients with non-urgent conditions. It was very acceptable for our medical administration to see more patients at the expense of a significant decrease in the chance of missing patients with urgent or semi-urgent condition, as safety is our priority. The sensitivity of our triaging system in separating urgent from semi-urgent or non-urgent conditions was 99%, and the specificity for urgent conditions was 90%. This was found to be very encouraging by the ophthalmology administration. With the demonstrated reliability and safety of our triaging system, we have limited the service of our OER between 12:00 am to 8:00 am to patients with urgent conditions only. This helps the on-call doctor to be undisturbed late at night unless there is a patient with an urgent condition.

A study was carried at our OER in July 2011 on the outcome of ocular emergencies.⁸ In this study, 1,094 self-referred patients were seen during that month. Out of those 1,094 patients, 712 (65.1%) were found to have non-urgent conditions after they were examined by the OER doctors. The implementation of the modified triaging system helped in decreasing the unnecessary load of patients in our OER. In the month of January 2014, for example, 824 self-referred patients were seen at OER. Out of these patients, 319 (38.7%) patients were discharged immediately after triaging without the need to have them examined by OER doctors after finding them to have non-urgent conditions through the triaging system. Due to the 87% specificity of our triaging system, only 40 patients were found to have non-urgent conditions after examination by OER doctors during the month of January. This huge decrease in the number of non-urgent patients examined by the OER doctors from 712 patients (65% of self-

referred patients) in July 2011 to 40 patients (4.8% of self-referred patients) is considered a remarkable achievement of the current organizational development project. Dividing the patients into urgent, semi-urgent, and non-urgent categories is a form of segmentation.¹⁴ This change in the OER operation did not lead to delaying the treatment delivery for patients who needed to be treated at OER. The mean waiting time between screening and examination by the OER before the implementation of the triaging system was 39.32 minutes, and this decreased to 29 minutes for urgent conditions, and 35 minutes for semi-urgent conditions after the implementation of the triaging system. More emphasis was given to decreasing the waiting time especially for patients with urgent conditions. This has been carried out by frequent reminders for OER staff on prioritizing urgent conditions and encouraging the OER doctor to spend the least possible time with the patients inside the exam room to facilitate seeing more patients.¹⁵

Triage was an additional part of the screening stage of the patient's journey in the OER. It was a concern for us that implementing this additional part would increase the waiting time between registration and screening.¹⁶ It was an unexpected finding to find that the mean waiting time between registration, and screening after implementing the triaging decreased by 5 minutes. One explanation for this surprising decrease in the mean waiting time between registration and screening after implementing triaging is the increased OER nurses awareness of the importance of the time factor. It was made clear to the nurses that one of the most important objectives of implementing the triaging system is to decrease the patients' waiting time after implementation.

Currently, the registration time, time between registration, and screening, time between screening and examination by OER doctors, and the time patients are discharged from OER are recorded. Keeping track of waiting times information helps to facilitate the patients' service and suggest improvement solutions. In this project, there was no discussion on the time between starting to examine the patient and the time the patient is discharged from the OER. This was carried out intentionally due to the huge variability in the time needed to complete the examination by an OER doctor.

The current study faced a number of limitations of which, while adopting the RESCUE; there was a potentiality to miss patients with serous ophthalmic conditions in addition to exclusion of important clinical parameters that are considered as serious indicators for ophthalmic emergency conditions. Moreover, adopting

and implantation of a new monitoring system requires a lot of serious efforts to implant this system within the routinely implemented system. Additionally, at both stages, nurses needed repeated awareness sessions and close follow-up to assure quality of time assessment and adequate form completion.

In conclusion, the newly modified ophthalmic triaging system was found to be safe and effective. It may help in prioritizing patients with urgent ophthalmic conditions along with slightly expediting the service for patients with semi-urgent conditions and decreasing the overall waiting time in the OER.

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