

# Sudanese emergency departments: a study to identify the barriers to a well-functioning triage

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## Research Article

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# Abstract

## Background:

Triage system is a sorting system that categorizes patients on the basis of the severity of their condition and the availability of the resources in the emergency department. There has been little attention in the public literature to triage systems in Sudan. The aim of this study was to explore the triage system and identify the barriers in its application in hospitals in Sudan.

## Methods:

A cross-sectional hospital based study was conducted at eight hospitals in Khartoum during December 2020. A multi-stage cluster sampling was applied. Data were obtained by interviewing emergency department staff using a structured questionnaire. The data were analyzed using statistical package for social sciences to find the association between various variables by chi-square test.

## Results:

Most of the respondents stated that the triage system was deficient. Most of the participants of this study agreed that the role played by the administration in taking legislative decisions is crucial in improving the triage system. Among the factors found to be significant to a well-functioning triage system were, the need for substantial capital expenditure, p-value: 0.026, prudent legislative decisions, p-value: 0.026, adequate training of staff on means of performing efficient triaging, p-value: 0.017 and raising the awareness of the staff on the correct application of triage guidelines, p-value: 0.007.

## Conclusion:

Currently there is no formal triage system in the State of Khartoum and has yet to be established. Policy making by administrators will play an important role in its implementation. It is suggested that prompt executive orders on improving the current triage system in Khartoum, should be carried out sooner than later, as the ripple effects of a well-functioning triage will decrease the average length of stay, mortality and morbidity rates and will eventually increase the patient's satisfaction.

## Background

The Emergency Department (ED) is a medical services facility specialized in emergency medicine, urgent care for patients who are present without prior appointment, either through their own means or by an ambulance, otherwise known as an accident and emergency department, an emergency room (ER), emergency ward or a casualty department. In a hospital or other primary care facility, the ER is normally located [1, 2]

Triage system is an important component in an ED [1]. It is a sorting system that categorizes patients on the basis of the severity of their condition and the availability of the resources in the department; this guarantees that the quality and level of treatment rendered in the ER suits the acuity of patients' disease, acting as a basis for further initiation and management of patient evaluation, where patients with life threatening conditions are seen immediately; as seriously ill/injured patients are treated first, triage also speeds up the flow of the ER and increases family and patient satisfaction [1–3].

Triage have been developed and introduced in several countries since the early 1990s. The seminal work of FitzGerald impacted the development of triage scales in some countries in the 1990s and 2000s being designed as 5-level scales, of these, the Australian Triage Scale, Canadian Emergency Department Triage and Acuity Scale (CTAS), Manchester Triage Scale, and Emergency Severity Index have had the greatest influence on modern ED triage [4, 5].

Upon the arrival of the patient into the Emergency Department the patient should be evaluated by a trained nurse. Triage is an abrupt assessment thus patients should not wait to be triaged [1]. Triage is the first point of contact when a person arrives at an ED, and the urgency of their condition is decided at this point [6].

Generally, the patients are triaged into one of the three categories in the EDs: critical, high risk and non-critical [2, 7]. The number of actions taken during the triage varies from a basic visual evaluation to a more in-depth assessment where vital signs such as temperature, heart rate, respiratory rate, blood pressure, pulse oximetry can be detected [2, 5, 8]. Ideally, the triage assessment will be performed in 2-5 minutes [8]. Triage documentation is the first recorded medical evaluation sought by the patient upon arrival at the ED. These few recorded sentences reflect the clinical impression of an experienced nurse and are essential to the diagnosis of a patient's illness. It should represent the physiological evaluation that has been completed [9].

Triage occurs in two steps, first, assessment and allocation of a triage category and the subsequent processing of the patient; and secondly, initiation interventions that facilitate emergency care to reduce patient's discomfort. Three possible outcomes arise in respect to the decision made: "correct" or "expected" triage, "over-triage" and "under-triage". Over-triage is known as the assignment of a triage category that is greater than the real measure of urgency whereas, as in under-triage, the assignment is lower than actual measure of urgency [2, 10–12].

Emergency Departments (EDs) are a high-risk environment for workplace violence (WPV) and health care workers are among those at the greatest risk for WPV from patients and visitors to staff members. The factors contributing to this include 24-hour accessibility, a high-stress climate and a shortage of visible or qualified security personnel. Patients and associated family members or visitors are the most common perpetrators of aggression, for reasons including pain, tension, loss of privacy, and long wait times. With fear, anxiety, substance abuse, or mental illness, the ED can create a volatile environment [13, 14].

Length of stay over time (LOS) is used as a time comparison standard. It also reflects the crowding experience of the patient. Long waits to be seen and long waits for ED hospital admission are a global problem associated with poor patient outcomes [15–19]. Time intervals are from ED entry (registration) to disposition from the ED (i.e., admission vs. discharge). Admitted patients are not considered to have departed from the ED until they are physically transported out of the ED to the hospital inpatient ward or another patient care facility [19].

In high-income nations, triage has been widely implemented at EDs. While several triage tools have been developed, only a few have been specifically designed for resource-constrained areas. The World Health Organization reports that the development of robust and efficient emergency care services could prevent a large proportion of deaths and injuries in low- and middle-income (LMIC) countries. In most LMICs, where demand for emergency treatment far outstrips the material and human resources available, initial triage and emergency care provision are poorly handled. It is therefore critical that EDs have, depending on the urgency of their situation, frameworks for prioritizing patients [20–22].

Although the triage system is known worldwide and was established in Sudan many years ago there's a general opinion that there is no formal triage system in Sudan [7]. In 2001, the Federal Ministry of Health introduced triage-based emergency treatment to the three largest hospitals in the country (Khartoum Teaching Hospital, Khartoum North Teaching Hospital and Omdurman Teaching Hospital) as a potential response to the increased morbidity and mortality found in non-triaged patients. In the former scheme, all emergency and non-urgent patients were seen directly by junior doctors (house officers) in the same clinic. In the current triage-based system, patients are initially assessed by the nurse who conducts the primary triage and then assigned to the required various levels of treatment [7]. Khartoum North Hospital established the first model for emergency care in Sudan in 2002. The system sorts and classifies patients to either special care, urgent care or non-emergency care [7].

The aim of this study was to explore the triage system and identify the barriers in its application in hospitals in Sudan.

## **Methods And Materials**

This cross-sectional study conducted to explore the triage system and identify the barriers in its application was carried out at EDs of eight public hospitals dispersed across the seven localities of Khartoum State-Republic of Sudan during December 2020. Ibrahim Malik and Al-Tamayouz Teaching Hospitals both locate at Khartoum locality, Al-Nau Teaching Hospital locates at Karrari locality, Khartoum North Teaching Hospital locates at Bahri, Omdurman Teaching Hospital at Omdurman, Alban Jadeed Teaching Hospital at El-Haj Yousif, Turkish Teaching Hospital in Jabal-Awleya and Ombada Teaching Hospital at Ombada locality. The above hospitals were chosen by simple random sampling from all around Khartoum state, therefore, it is considered representative for the study in the state overall.

## **Participants**

Multi-stage cluster sampling was carried out with a sample size of 200 participants calculated using Slovin's formula. Study sampling was done in two stages, first, hospitals were selected using simple randomization sampling then, using a cluster size of 25 from each hospital, data were collected from the ED staff. All doctors, including, house officers, medical officers, registrars, specialists, consultants, nurses as well as matrons and receptionists working in the EDs in the assigned hospitals, were included in the study.

A total of 56 nurses, 53 medical officers, 42 house officers, 19 receptionists, 6 registrars, 4 matrons and 2 consultants that participated in the study (response rate=92.5%) were interviewed.

## **Instrument**

A written informed consent was attained. Data were obtained through a structured questionnaire by a trained research assistant. The questionnaire was translated into Arabic. A pilot survey was conducted to test for the questionnaire's practicality and acceptability, correct tools' errors and check for sampling procedures acceptability.

The questionnaire was designed using existing guidelines [23–27] for triage. It contained 20 close-ended questions and it consisted of 3 sections: Sociodemographic attributes, assessment of the current triage system (if present) and the perceived barriers to the application or improvement of the triage system.

The sociodemographic attributes included the gender, age, job qualification, income and residence. Questions assessing the triage system were composed of participants responses about whether they acknowledged the presence of a triage system in the hospital, they are working at or not and for those that answered yes, their responses regarding whether they perceive that the system is well-functioning or not, the assessment of whether the patient is triaged immediately upon arrival, triage assessment time, possibility of mis-triage or incorrect assignment of patients, if they were aware of the presence of a triage scale or any guidelines and if present if they were adhering to the given guidelines, whether the documentation and reporting of cases was proper, the safety during triage and the average length of stay in the hospitals' ED.

The section that explored the perceived barriers and ways to improve the system was a multiple answers question where participants were allowed to choose more than one option consisted of: the need for substantial capital expenditure and adequate provision of resources to the ED, the fundamental role played by the administration and legislative measures to be taken, adequate training of the staff on means of effective triage and raising the awareness amongst the staff on the importance of the correct application of triage guidelines.

## **Data analysis and statistical methods**

After the data was collected and entered on Microsoft Excel 2016. It was then verified and analyzed using IBM Statistical Package for Social Sciences software (version 23). The effect of several factors on staffs' perception of whether the current triage system (if present) is well-functioning and efficient were studied.

Sociodemographic attributes and participants' responses from every hospital about the current triage system were all studied and analyzed. The effect of the perceived barriers by the participants on their perspective of whether the triage system was effective or not was also studied.

Categorical data were summarised using frequency counts and proportions (%) and figures were generated. Continuous data were summarised using measures of central tendency, with mean and standard deviation. Cross tabulation was formulated. Chi-square analysis and regression analysis were conducted to reflect the association between the presence of an efficient and well-functioning triage and the aforementioned factors. Statistical significance was set as a p-value < 0.05.

Ethical approval was obtained from the Faculty of Medicine, University of Khartoum.

## **Results**

### Demographic data and participants' qualifications

The study included 185 participants from 8 public hospitals. The mean age was 30.05 and with a standard deviation of 9.15 (ranging from 21-65 years). The income of the participants ranged from 0 up to 75000 SDG with a mean of 7470 and a standard deviation of 8943.

In regards to the participants' job qualification, most were nurses, followed by medical officers, house officers, receptionists, registrars, matrons, specialists and consultants. The qualification of participants along with the rest of their demographics are shown in Table 1.

Table 1  
Sociodemographic characteristics  
and qualification of participants  
(n=185)

Item	Count	%
Gender		
Male	52	28.1%
Female	133	71.9%
Residence		
Khartoum	87	47.0%
Bahri	36	19.5%
Omdurman	60	32.4%
Other	2	1.1%
Qualification		
House Officer	42	22.7%
Medical Officer	53	28.6%
Registrar	6	3.2%
Specialist	3	1.6%
Consultant	2	1.1%
Nurse	56	30.3%
Matron	4	2.2%
Receptionist	19	10.3%

The number of participants from each hospital are shown in Table 2.

Table 2  
Number of Participants from each hospital  
(n=185)

Hospital	Frequency	Percent (%)
Ibrahim Malik	25	13.5
Al-Nau	20	10.8
Khartoum North	25	13.5
Omdurman	25	13.5
Al-Tamayouz	25	13.5
Alban Jadeed	25	13.5
Turkish	25	13.5
Ombada	15	8.1

## ED triage system assessment

Out of the 185 participants, 57% acknowledged the presence of a triage system at their respective hospitals; however of those only 50% perceived it as being efficient and effective.

## Triage Assessment

81.0% of the participants claimed that patients are immediately triaged upon their arrival to the EDs. 46.7% of the participants reported that the standard time for assessing the patient and assigning them to a category is 2-5 minutes and 63.8% stated that adequate documentation of the patient's signs and clinical parameters takes place.

## Presence of Triage Guidelines and Mis-triage

Only two of the eight hospitals had an established triage protocol, namely, Ibrahim Malik and Omdurman teaching hospitals, of those 72.0% of the former and a mere 50.0% of the latter were aware of the presence of a triage scale; of those, only 50.0% claimed to be adherent to the provided guidelines at Ibrahim Malik hospital and 85.7% at Omdurman teaching hospital.

60.0% of the participants claimed that patients are faced with a great possibility of being incorrectly assigned or mis-triaged by the triage staff.

## Safety at Triage

A mere 19.5% stated that front-line staff of the ED receives training on minimization of aggression when dealing with patients or co-patients with challenging behaviors and only 21.6% reported that there are protocols and guidelines followed when dealing with such behaviors.

# Length of Stay at the ED

Only 21.6% of the candidates stated that the average LOS does not exceed four hours, while 71.9% claimed that the LOS exceeded the four hours target of those 50.7% claimed that it could extend up to 24 hours.

The results of participants' responses from each hospital respectively, are all displayed in more details in an additional file [see Supplementary Table 1, Additional file 1].

# Perceived Barriers and Ways to Improve the Triage System

Most participants (78.8%) agreed that there is a fundamental role played by the administration and legislative measures to be taken for the improvement of the triage system followed by the need for substantial capital expenditure (63.0%) and adequate provision of resources to the ED, followed by, adequate training of the staff on means to performing an effective triage (48.9%) and raising the awareness amongst the staff on the importance of correct application of triage guidelines (28.3%).

The results of the chi-square test conducted to reflect the association between the participants' perception of the presence of an efficient and well-functioning triage and the aforementioned factors are all shown in detail in an additional file [see Supplementary Table 2, Additional file 1]. The variables that had a significant association (p-value <0.05) were:

1. The hospital they worked at. p-value: 0.007
2. Residence. p-value: 0.001
3. Immediate triage upon arrival time. p-value: 0.00
4. Substantial capital expenditure. p-value: 0.026
5. Administrative role. p-value: 0.026
6. Increasing staff's awareness on correct application of guidelines. p-value: 0.017
7. Adequate Training on correct means of triage. p-value: 0.07
8. Minimization of Aggression Training. p-value: 0.00
9. Protocols for dealing with Aggressive Patients. p-value: 0.03

The variables above were further analyzed by logistic regression. See Supplementary Table 3, Additional File 1 for further information. The following were significant:

1. Triage upon arrival time. p-value: 0.005
2. Legislative Issues. p-value: 0.020

# Discussion

To the best of our knowledge this is the first study conducted to assess the triage system and identify barriers in its application in hospitals in Sudan. Our study clearly demonstrated that Sudan has a

deficient formal triage system. This finding, is no surprise, as a previous study conducted back in 2001 involving seven developing countries revealed that 14 of 21 hospitals lacked an adequate system for emergency triage and also showed that methods for initial patient assessment led to delayed treatment [28, 29]. In comparison to high income countries, where triage had been broadly implemented across EDs ever since the 1990s [4, 5] and in Sudan, the system was only introduced in 2001 [7].

Nurses made up most of the participants in our study (30.3%). It is widely accepted that the triage is generally done by a triage nurse but it can also be performed by physicians and receptionists [30–33]. Nurses and registrars had the most positive perception amongst the staff while specialists, consultants and matrons had a negative perception on the triage system in the hospital they work at, this might be justified by the fact their perception is quite likely to be based on their years of experience and their comparison to prior practice.

A significant association was found between the staffs' residence and their perception of a well functioning triage system, where the residents of Omdurman expressed the most positive perception of the triage system in the hospitals they were working in. This finding can be explained by the fact that the where they reside might determine the hospital they are employed at and this coincides with the positive association this study has found in accordance to the perception of the healthcare workers of the hospitals within the vicinity of Omdurman locality (i.e.: Al-Nau hospital).

All the staff working at Ibrahim Malik hospital believed that there was an existing triage system at their hospital of employment. Meanwhile the percentages of staff that shared a similar view were 90% from Al-Nau, 80% from Omdurman, 64% from both Khartoum North and Al-Tamayouz, 36% from Alban Jadeed, 4% (1 participant) from the Turkish Hospital and none from Ombada. Furthermore, a significant association had been found between the hospital the staff worked at and their perspective of a well-functioning and efficient triage (at a p-value of 0.007) in chi-square analysis. This may be explained by the fact that staff from different hospitals had different perspectives on what a triage system should constitute based on their knowledge and experience at other hospitals. Staff at Al-Nau hospital (77.8%) mentioned that the triage system is well-functioning while it might have not been competent, one explanation is that they might have worked at a less qualified hospital and they considered their ED triage as sophisticated. While those at Khartoum North hospital (75.0%) perceived it as poorly functioning and this is perhaps due to the fact that they worked at a more advanced hospital. This might also be due to the differences in the hierarchy of administration, capacity of the hospitals, funding and the tools used in each hospital.

A significant association was found between the staffs' perception of a well-functioning triage with certain hindrances to the application/improvement of the triage system on chi-square analysis. The most important barrier being the role played by the administration and legislative measures taken by authorities (p-value of: 0.026), which was supported by a significant association on logistic regression (p-value of: 0.020). This is because most of the participants of this study (78.8%) agreed that proper administration is of essence in improving the triage system. Several studies described that improving

access to emergency care in Africa calls for careful examination of the processes of governance. There is a need for legislation in order to provide a legal assurance of access to emergency services irrespective of the capacity to pay. The potential effect of legislative assurances of access to emergency care in Africa is demonstrated by constitutional and statutory rules and other governance frameworks [20–22, 31].

Other barriers were the need for substantial capital expenditure and adequate provision of resources (p-value of: 0.026), adequate training of the staff on means to performing an effective triage (p-value of: 0.017) and raising their awareness on the importance of the correct application of triage guidelines (p-value of: 0.007). In regards to the other barriers, up to 63.0% of our respondents stated that there is a need for substantial capital expenditure and adequate provision of resources to the ED. This was coincident with the findings of a study conducted in Ghana with the purpose of assessing the capacity for care of emergency patients. It stated that emergency treatment, given the growing burden of medical, surgical and traumatic emergency conditions, is an integral component of health systems and is of increasing significance. This burden is inappropriately highest in low-and middle-income countries (LMICs), which are least equipped to assess and treat emergency situations due to organizational and planning failures, skilled staff and physical resources [34]. Another study conducted in Australia suggests adjusting the triage area to make triage agents more accessible and at the first point of contact would promote adherence to evidence-based guidelines. Nevertheless, they stated that this requires substantial capital expenditure [6].

Lastly, the participants in our study asserted the necessity of adequately training the staff on means of performing an effective triage (48.9% of the responses) and raising their awareness on the importance of the correct application of triage guidelines (28.3% of the responses). This was highlighted in our study by the fact that several participants lacked the knowledge of how triaging is performed at their respective hospitals. The closest we found to our results were those of several studies that emphasized the importance of training and educating the staff. In Malaysia, paramedic medical officer assistants and registered nurses, both of whom have completed 3 years of training, become eligible to perform triage roles in the ED [30]. Meanwhile, in Iran, the various performance challenges that were identified affecting the quality of triage units in ED were the lack of clinical competency of the triage nurses, encouragement to motivate staff by the administration, specific instructions and policies for triage patients and specialist training workshops to motivate triage nurses [35].

In another study exploring the emergency nurses' assessment of the triage, it was identified that the lack of trained and experienced staff compromises decision making at the initial patient encounter [31]. A review that evaluated literature from Saudi Arabia and the Eastern Mediterranean Region on triage, emphasized on capacity-building and recruitment of nurses. It stated that the initial issue of implementing triage can be solved by hiring professional nurses with advanced expertise in triage and yielding them in the education of other nurses [2]. In a randomized control trial that was conducted in Malaysia that identifies the effect of training triage officers on the accuracy of triaging adult trauma patients, concerning the accuracy of triage decisions, the effect was significantly different between the

control group and the intervention group ( $p < 0.001$ ). It was concluded that the triage training improved the skills of the participants and the accuracy of triaging [30].

On assessment of the performance of the triage it was found that as per existing guidelines patients should be immediately triaged upon arrival and the assessment time should take about 2 to 5 minutes [23–27]. Fortunately, 81.0% of our staff reported that the patient is immediately triaged upon his arrival to the ED which is consistent with the findings of a study conducted in Sweden [5]. A significant association had been found between immediate assessment ( $p$ -value of 0.000) in chi-square analysis and ( $p$ -value of 0.005) by logistic regression and staffs' perception of a well-functioning triage, similar to an audit conducted in Australia ( $p$ -value of 0.005) [6]. Overall, 46.7% of the participants reported that the triage assessment normally took 2 to 5 minutes. The lowest percentages among all the hospitals were 40.0% and 33.3%, these were obtained from Ibrahim Malik Hospital and Alban Jadeed Hospital respectively, where respondents reported that it takes place in the ideal time. In retrospect, the range of triage time was found to be 0.5-11.1 minutes in a study conducted at a trauma center [36]. Upon arrival to the ED the patient has to be assessed immediately as this is the most critical period spent in the ER.

Mis-triaging was reported to be a very likely outcome by approximately two thirds (60%) of the participants in our study. On the contrary to these findings, only 5.8% of patients were judged to have been mis-triaged by expert review in a study conducted in Ghana [37]. This might indicate that it has a better triage system, although the system has been implemented around the same time, Ghana is now more advanced. Incorrect assignment of triage codes can lead to adverse consequences on patient outcome. An experienced triage officer that uses a consistent triage scale should be present at the triage desk. This can ensure better outcomes, less adverse events, reduced overcrowding and increase patients' satisfaction.

In the two hospitals with a triage scale, namely Ibrahim Malik Hospital and Omdurman hospital, 72.0% and 50.0% were aware of the presence of a scale in their hospitals, respectively. Only 50.0% from those were adherent to the guidelines in the former and 85.7% were adherent in the latter. Likewise, it was stated by a systemic review that triage wasn't performed by the staff at all in some instances [20].

As for the rest of the hospitals in our study there was no objective triage or a triage scale in first place for the staff to follow which was also reported in a study conducted in Iran [35].

Nearly a third of our respondents stated that documentation is inadequate. Previous studies have indicated that missing data is common in emergency medicine [8]. Maintaining a high quality of documentation can assist in producing evidence for legal purposes and assessing the adequacy of clinical care provided for the patients.

As demonstrated by an internal survey of emergency nurses and patient care assistants, violence is a continuing problem within the ED [14]. According to the Australasian College of Emergency Medicine guidelines for triage [24] the front line staff should be trained on dealing with challenging behavior on part of the patients and their relatives and protocols should be implemented to provide a safe

environment for the staff and patients which is crucial to ensure an efficient ER triage. Our study concluded that there is a significant association between both pillars of the safety at triage area (minimisation-of-aggression training and protocols and procedures for dealing with challenging behaviour) and the staffs' perception of a well-functioning triage (both had a p-value of 0.000 and 0.003, respectively). Interestingly, staff that described the triage as inefficient, also reported the lack of proper safety measures provided at the EDs. In another study one of the challenges related to emergency management was the inadequacy of the security section in the triage area [35].

More than half of the participants stated that the average length of stay exceeds four hours regardless of the presence of a triage system; and may often extend up to 24 hours. This is beyond the four hour target for the maximum length of stay at the ED that mandates discharge or admission of 98% of patients within 4 hours of arrival. Following the introduction of a four-hour target strategy, a reduction in waiting time had been achieved in England. Similar waiting time targets have been set in Australia (4 h) and New Zealand (6 h) with some beneficial effects observed on patient outcomes [17, 18].

In some cases triage offers a moderate decrease in the LOS at EDs which was seen in a hospital with a triage system where the daily mean length of stay during the entire study period was approximately, 4 hours [38]. In Canada in a hospital that implemented the CTAS, the mean ED LOS was approximately, 4.5 hours [16]. However, the four hour target is still exceeded sometimes. Hence, implementing a triage on its own is not sufficient to decrease the LOS and further measures should be taken. This is supported by a study done in a university hospital in America, where patients categorized without faculty triage had a mean LOS of approximately, 7.4 hours while patients categorized with faculty triage had a mean LOS of approximately, 6 hours. Mean difference in LOS was only 82 minutes [39]. In the Netherlands, the total LOS did not differ prior to and after the implementation of the triage system; with the minimum LOS being 0.04 hours and the maximum LOS 12.55 hours [40].

Therefore, the success of a triage demands undertaking a holistic integral approach in order to improve the system. The heart of this approach is a reformation in administration. Legal and infrastructure frameworks are required to approve the system's operation and ensure that it is properly performed. In the context of LMICs, triage can necessitate additional equipment and space in the ER, hence requiring adequate resource allocation by administrations. Emergency administrators can also improve the quality of triaging patients by empowering triage nurses since they should have professional capabilities, including adequate knowledge about how to triage patients. These reforms are vital in improving patient survival and other health-related outcomes as well as gaining patient satisfaction. Moreover, it reduces overall health related expenditure.

The study had certain limitations. One of which is the modest sample size of participants as data was not collected from 15/200 (7.50%) of ED staff who refused to participate in the study, which may have underpowered this study for the detection of additional associations. The methods were designed to identify an association, but not a direct causative effect, between the dependent and independent variables. The study was based on what participants viewed as hindrances to an effective triage, further

studies are required for identifying specific causes. The mean length of stay is an imperfect measure as it was an estimation by the ED staff. Other limitations included interviewer effect which was minimized by using a standard set of questions, as well as confounding bias associated with using a cross-sectional study design which was controlled by running a multiple logistic regression.

## Conclusion

The study clearly demonstrates a desperate need for a formal triage system to be established in the State of Khartoum. Policy making by administrators will play an important role in implementing a well-functioning triage, as its implementation will be cost-effective and will require proper allocation of resources, which is lacking in low-income countries, including Sudan. Prompt executive orders on improving the current triage system in Khartoum should be carried out sooner than later, as the ripple effects of a well-functioning triage will decrease the average LOS, mortality and morbidity rates and will eventually increase the patient's satisfaction.

## Abbreviations

ED: Emergency Department

ER: Emergency Room

CTAS: Canadian Emergency Department Triage and Acuity Scale

WPV: Workplace Violence

LOS: Length of Stay

LMIC: Low- and Middle-Income Countries

## Declarations

### Ethics approval and consent to participate

Technical and Ethical approval was taken from the Department of Community Medicine, Faculty of Medicine, University of Khartoum, Khartoum, Sudan.

Ethical clearance was obtained from the Federal Ministry of Health, Khartoum, Sudan.

Permission was taken from hospital administrators.

Informed written consent from each participant was guaranteed before participating in the study questionnaire.

Confidentiality of the participants was secured.

#### Consent for publication

Not applicable

#### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

#### Competing interests

The author declares that they have no competing interests.

#### Funding

There was no funding for this research.

#### Authors' contributions

BI contributed in the study design, data collection, data analysis, data interpretation and writing of the manuscript. The author read and approved the final manuscript.

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