African Journal of Emergency Medicine 14 (2024) 506–511

Contents lists available at ScienceDirect

African Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/afjem

Triage implementation audit at the adult emergency department of Debre Tabor Comprehensive Specialized Hospital in Ethiopia

Belayneh Dessie Kassa [a,*], Mebratu Libanos [b], Kumlachew Geta [c], Natnael Moges [d]

[a] Department of Emergency and Critical Care Medicine, Debre Tabor University, Debre Tabor, Ethiopia
[b] Department of Internal Medicine, Debre Tabor University, Debre Tabor, Ethiopia
[c] Department of Anesthesia, Debre Tabor University, Debre Tabor, Ethiopia
[d] Department of Pediatrics and Child Health Nursing, College of Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia

ARTICLE INFO

Keywords:
Triage
Implementation
Debre Tabor Comprehensive Specialized Hospital
Under-triage

ABSTRACT

Introduction: In an emergency room, triage is a crucial element that determines the clinical urgency of patients. Triage can dictate important decisions on the use of resources and the treatment that patients need. Many patients are seen later than necessary, wasting resources and time, and some may even be discharged without being seen, risking their lives. This study aimed to determine whether the triage tool was fully completed, properly measured, and documented, the triage early warning score (TEWS) was calculated, and whether patients were examined, distributed, and managed in appropriate areas.

Methods: An institution-based cross-sectional study with a retrospective chart review was conducted at Debre Tabor Comprehensive Specialized Hospital by selecting patients' charts using simple random sampling among patients who visited the adult Emergency Department from January 1, 2021, to December 31, 2023. The descriptive statistics were presented to characterize individual variables, and cross-tabulation was used to see the relationship between individual patient-related factors and their final triage status.

Results: From the randomly selected 345 patients' charts, 67 (19.4 %) didn't contain a triage sheet. The total triage early warning score was correctly calculated for only 21 (7.6 %) patients and properly triaged. Most of the patients were improperly triaged (92.4 %, $n = 257$), of which 253 (91 %) were under-triaged and four (1.4 %) were over-triaged. Fischer's exact test revealed a statistically significant relationship between patients' color-coding category, triage early warning score documentation, and the use of clinical discriminators and final triage assessment ($p = 0.007$, $p = 0.000$, and $p = 0.000$ respectively).

Conclusion: The status of our triage implementation is alarming and specifically the level of under-triage. There is a significant gap regarding the application of clinical discriminators and TEWS calculations.

African Relevance

- Though there is an increasing amount of interest in Africa in creating standards for triage acuity and other Emergency Department data items to support clinical treatment, monitoring, evaluation, and research, not much has been done regarding the implementation of triage and its correlates.
- Even though triage is crucial to patient treatment, patients face obstacles to receiving its benefits, which can lead to many problems that put their lives in danger and an unnecessary loss of time and money.
- Gaps regarding the implementation of triage in this study will reflect the gaps in many other African Emergency Departments.
- The results of this study will help improve the quality of care. Furthermore, it would provide a starting point for future multicenter research on triage for quality improvements in Africa.

Introduction

Regardless of their arrival order or other criteria, triage is the practice of classifying emergency department (ED) patients according to their need for care. In comparison to patients with non-urgent illnesses who can wait longer to be treated or who need a referral to a more

* Corresponding author at: Debre Tabor University, Debre Tabor, Ethiopia.
E-mail address: belayneh_dessie@yahoo.com (B.D. Kassa).

https://doi.org/10.1016/j.afjem.2024.10.001
Received 11 June 2024; Received in revised form 6 August 2024;

appropriate healthcare environment, it is necessary to prioritize patients who need immediate care based on clinical severity and time of urgency [1].

The term "triage," which is derived from the French verb trier, or "to sort," was first applied to the classification of agricultural products. The term "triage" is now nearly always employed in certain healthcare contexts. On the battlefield, triage was used to treat wounded soldiers by their level of injury and readiness to resume service. Trauma centers in the United States of America (USA) are to receive credit for the development of triaging because they used the triage criteria to shift injured patients to trauma centers in 1986 [2,3].

Following its release and adoption of a formal triage strategy in 1993 by the Australian College of Emergency Physicians, Canada developed the Canadian Triage Acuity scale in 1999 [4,5]. In 1996, the United Kingdom launched its triage system known as the Manchester Triage System. In 2003, the USA adopted and created the Emergency Severity Index (ESI). They are all five-category scales. Procedures for classifying patients according to their level of triage depend on their complaints, their vital signs, and their level of competence [3]. Additionally, South Africa developed the South African Triage Scale (SATS) in 2006 [6].

Triage is typically used in ED, inpatient and intensive care units (ICU), and in the field. It can be used as Simple Triage and Rapid Transport (START) and Sort, Assess, Life-Saving Intervention, Treatment, and Transport (SALT) models in pre-hospital settings. There are other types of triage, such as for mass casualty triage when the number of patients exceeds the institution's capacity and the institution must prioritize patients whose lives or limbs are in danger [2,7].

In an ED, triage is a crucial job that determines the clinical urgency of patients. By assesing the acuity of their medical condition, it attempts to reduce patient waiting times. It dictates important decisions on the use of resources and the treatment that patients need [2,8]. When using the South African triaging system (SATS), the triaging nurse assesses the patient's mobility and level of consciousness using the AVPU scale (A = alert, V = responds to voice, P = responds to pain, U = unresponsive), according to the general SATS flowchart, and then calculates a triage early warning score (TEWS). They also make use of serial clinical discriminators. Clinical decisions that must be made quickly during triage entail clinical judgments [6,9,10].

Even though triage involves an assessment to determine which ED patients need immediate care based on clinical severity and time urgency, the majority of patients are seen later than necessary, wasting resources and time, and some may even be discharged without being seen, risking their lives [5,11]. In 2010, only 18 % of the 123.8 million US emergency department patients underwent a triage evaluation, leaving the rest waiting in the waiting room [9,10].

Sorting the correct patient to the right place at the right time is crucial. If it is not used, errors in over- or under-triage will occur. Patients who are under-triaged but assigned as non-critical have life-threatening injuries, which may delay medical interventions and/or hospital discharge, especially in settings with limited resources, whereas patients who are over-triaged are triaged as severely injured, leading to rapid hospital evacuation [12].

In 2014, the American College of Surgeons Committee on Trauma (ACS-COT) set a target of 5 % under triage and 25–35 % over triage in settings with plenty of resources [13]. Errors in triage, both under and over, can raise the risk of morbidity and/or fatality [14,15]. Evidence also indicated that the triage routine wasn't adequately followed by the triage staff. More than 5 % of patients were found to have been incorrectly triaged in an expert comprehensive evaluation in Ghana and over-triaged patients made up over 95 % of this [16]. Numerous patients were not properly triaged, according to studies done in several provinces of South Africa [1,16–18].

Without triage, ED patients squander on average 61 US dollars (3420 Ethiopian Birr). Incorrect triage would result in an increase of 15.3 % to 17.3 % in overall ED expenses while proper triage would result in a 55.4 % decrease in ED crowding [19].

A study in northern Ethiopia revealed that a significant percentage of patients in the ED were admitted without proper vital signs, triage forms, and differentiating criteria being properly applied [20]. This study aimed to determine whether the triage tool was fully completed, properly measured, and documented, the TEWS was calculated, and whether patients were examined, distributed, and managed in appropriate areas.

Methods and materials

Study setting, period, and design

The study was conducted at Debre Tabor Comprehensive Specialized Hospital (DTCSH) Adult Emergency Department (ED), a government tertiary teaching hospital working in partnership with Debre Tabor University. It is the largest hospital in the south Gondar zone of the Amhara region of Ethiopia, serving around three million people, established in 1931 [21]. The functional areas of the ED currently include a triage area, a red area (the stabilization and monitoring room), and orange, yellow, and green rooms (where stabilized patients are kept, managed, and observed). Data were collected by reviewing the selected patients' charts who visited the adult ED of DTCSH during the study period. An institution-based cross-sectional study with a retrospective chart review was conducted at DTCSH.

Population

Study population: All patients who visited the adult emergency triage office of DTCSH from January 1, 2021, to December 31, 2023.

Eligibility criteria

All adult patients who visited were triaged using an adapted SATS triage algorithm (Figure 2 data supplement) at the ED of DTCSH during the study period were included. Patients whose charts did not contain the triage form or were not available in the card room at the time of data collection were excluded.

Sample size calculation and sampling technique

The sample size was calculated using a single population proportion formula with the following assumptions: p (prevalence of under-triage in Mekelle Ayder referral hospital [20] in a prior study on a similar topic): 31 %, 95 % CI with the level of precision z@/2 = 1.96, p-value 0.05, the margin of error 0.05. The calculated sample size was 329. By adding a 5 % non-response rate, the sample size was 345. A simple random sampling technique was used to select the patients' charts from the registry during the study period.

Study variables

Triage implementation (properly triaged or incorrectly triaged) was the dependent variable and socio-demographic data, timing related to triage, mode of arrival, origin of referral, chief complaints, history of chronic illness, history of allergy, TEWS, color-coding category of patients, investigation at triage, treatment at triage, and triage sheet completeness were independent variables.

Data sources and measures

The data were collected from the patient's charts by using a structured checklist. Trained data collector (medical interns during the data collection period) filled out the prescribed formats, and the principal investigator (PI) reviewed the data daily to ensure accuracy and consistency. The data collection tool was pre-tested, and modifications were made based on the results.

Statistical analysis

Data were analysed using Epi-Data version 4.2.0.0 and SPSS version 26. The descriptive statistics of the data were summarized using frequency, mean, median, and standard deviation or interquartile range (IQR), and the data were presented using tables and graphs. Cross-tabulation analysis was performed to examine the relationship of the factors with the dependent variable individually. Variables found to be associated with the dependent variable (p-value less than or equal to 0.05) were considered patient-related associated factors with the dependent variable.

Ethical approval

The study was carried out following approval by the institutional review board of Debre Tabor University (reference number: CHS/133/2023). To protect confidentiality, names and other personal identifiers were not used during data collection and analysis. The data collectors were instructed to keep the patient's information confidential.

Results

Participants and sociodemographic results

From the randomly selected 345 patients' charts, 67 (19.4 %) didn't contain a triage sheet. Of the 278 patients' charts included in the study, 147(52.9 %) were female and the median age of patients was 35 years (IQR=24–53.5; maximum age was 90 years). Most patients were aged between the range of 25–64 years (58.3 %, $n = 162$). Most patients were self-referred (57.9 %, $n = 161$), and their mode of arrival was walking (45.3 %, $n = 126$) (Table 1). There was no statistically significant relationship between sex and the final triage assessment, X^2 (1, $N = 278$) $=0.02$, $P = 0.962$. The results of Fischer's exact tests indicated that there was no statistically significant relationship between age, mode of arrival, source of referral, and the final triage assessment (Fischer's exact test, $P = 0.662$, $P = 0.921$, and $P = 0.182$, respectively).

Time to triage after patient arrival and duration of illness or accident

The average waiting time for the triage decision was 1.536 min (mean ± SD, 1.614 min). Most of the patients (56.83 %, $n = 158$) were triaged within 5 min, and 5 (1.8 %) patients stayed for >5 min at triage.

Table 1
Sociodemographic results based on their final triage status for patients who visited the Emergency Department at Debre Tabor Comprehensive Specialized Hospital.

Variable		Final triage assessment		Total Frequency (%)
		Incorrectly triaged (%)	Correctly triaged (%)	
Sex	Females	136 (92.5)	11(7.5)	147 (52.9)
	Males	121(92.4)	10 (7.6)	131 (47.1)
Age	≤24 years	63 (90)	7 (10)	70 (25.2)
	25–64 years	151(93.2)	11(6.8)	162 (58.3)
	≥65 years	43 (93.5)	3 (6.5)	46 (16.5)
Mode of arrival	Ambulance	22(95.7)	1 (4.3)	23 (8.3)
	Private car	14 (100)	0	14 (5)
	Carried	74 (92.5)	6 (7.5)	80 (28.8)
	Walking	115 (91.3)	11(8.7)	126 (45.3)
	Not documented	32 (91.4)	3 (8.6)	35 (12.6)
Source of referral	Self	149 (92.5)	12 (7.5)	161 (57.9)
	District hospital	14 (93.3)	1 (6.7)	15 (5.4)
	Private clinic or hospital	9 (81.8)	2 (18.2)	11 (4)
	Health center	33 (100)	0	33 (11.9)
	Not documented	52 (89.7)	6 (10.3)	58 (20.9)

Table 2
presenting complaints during triage based on their final triage status for patients who visited the adult Emergency Department at Debre Tabor Comprehensive Specialized Hospital.

Presenting main complaints	Final triage assessment		Frequency (%)
	Incorrectly triaged (%)	Correctly triaged (%)	
Fever	33 (89.2)	4 (10.8)	37 (13.3)
Headache	34 (97.1)	1 (2.9)	35 (12.6)
Respiratory complaints	30 (88.2)	4 (11.8)	34 (12.2)
Headache & fever	28 (93.3)	2 (6.7)	30 (10.8)
Abdominal pain	26 (96.3)	1 (3.7)	27 (9.7)
Diarrhea & Vomiting	15 (83.3)	3 (16.7)	18 (6.5)
Chest pain	16 (100)	0	16 (5.8)
Hemiparesis	7 (100)	0	7 (2.5)
Generalized body swelling	6 (100)	0	6 (2.2)
Headache & vomiting	4 (80)	1(20)	5 (1.8)
Abdominal pain, diarrhea & vomiting	4 (80)	1 (20)	5 (1.8)
Gunshot	4 (80)	1 (20)	5 (1.8)
Sudden collapse	4 (100)	0	4 (1.4)
Poisonings	4 (100)	0	4 (1.4)
Abnormal body movement	3 (100)	0	3 (1.1)
Fall accident	3 (100)	0	3 (1.1)
Stab injury	2 (100	0	2 (0.7)
Burn	2 (100)	0	2 (0.7)
Road traffic accident	2 (100)	0	2 (0.7)
Vaginal bleeding	2 (100)	0	2 (0.7)
Headache & neck stiffness	2 (100)	0	2 (0.7)
Fighting	1 (100)	0	1 (0.4)
Others	18 (94.7)	1 (5.3)	19 (6.8)
Not recorded	7 (77.8)	2 (22.2)	9 (3.2)

However, the triage decision time was not recorded for 115 (41.4 %) patients. The duration of illness or accident was not recorded in 146 (52.5 %) patients. Forty-three (15.5 %) patients arrived within 24 h, 69 (24.8 %) within 1 week, 6 (2.2 %) within 2 weeks, and 14 (5 %) visited the ED after 2 weeks. There was no statistically significant relationship between time to triage after the patient arrived at the ED and the duration of illness or accident with the final triage assessment (Fischer's exact test, $P = 0.496$, and $P = 0.306$).

Presenting complaints during triage

The common presenting complaints were fever (13.3 %, $n = 37$), headache (12.6 %, $n = 35$), respiratory complaints (12.2 %, $n = 34$), and

Table 3
History of chronic illnesses and Allergies based on their final triage status for patients who visited the adult Emergency Department of Debre Tabor Comprehensive Specialized Hospital.

		Final triage assessment		Frequency (%)
		Incorrectly triaged (%)	Correctly triaged (%)	
History of chronic illness	Bronchial Asthma	10 (90.9)	1 (9.1)	11 (4)
	Hypertension	6 (85.7)	1 (14.3)	7 (2.5)
	Cardiac illnesses	5 (100)	0	5 (1.8)
	Diabetes Mellitus	3 (100)	0	3 (1.1)
	Diabetes Mellitus & Hypertension	2 (100)	0	2 (0.7)
	HIV/AIDS	2 (100)	0	2 (0.7)
	Epilepsy	2 (100)	0	2 (0.7)
	No chronic illness	155 (94.5)	9 (5.5)	164 (59)
	Chronic illness status not documented	72 (87.8)	10 (12.2)	82 (29.5)
History of allergy	Yes	0	0	0
	No	159 (94.1)	10 (5.9)	169 (60.8)
	Status of allergy not documented	98 (89.9)	11 (10.1)	109 (39.2)

headache and fever (10.8 %, $n = 30$) (Table 2). There was no statistically significant relationship between the presenting complaints and the final triage assessment (Fischer's exact test, $P = 0.707$).

History of chronic illnesses and allergies

Most patients (59 %, $n = 164$) had no chronic illness, and chronic illness status was not documented in 82 (29.5 %) patients. A history of allergy was not documented in 109 (39.2 %) patients; the remaining 169 (60.8 %) patients had no history of allergy (Table 3). There was no statistically significant relationship between a history of chronic illness and the presence of allergy with the final triage assessment (Fischer's exact test, $P = 0.534$, and $P = 0.246$ respectively).

Triage- related Interventions

Blood glucose levels were measured in only one patient and were not documented in the remaining 277 (99.6 %) patients. None of the triage sheets was filled out or contained the necessary information. There was no documentation of either prehospital treatment or treatment during triage. No investigation was performed at triage, and none of the patients were re-triaged.

Patient category and use of clinical discriminators

Nearly half (51.1 %, $n = 142$) of the patients were categorized as yellow of which 132 of them were incorrectly triaged as yellow, and 21 (7.6 %) were categorized as red. A statistically significant relationship was found between patients' color-coding category and final triage assessment (Fischer's exact test, $P = 0.007$). Clinical discriminators were used in only 6 (2.2 %) patients, with a statistically significant relationship between the use of clinical discriminators and final triage assessment (Fischer's exact test, $P = 0.000$) (Table 4).

Triage Early Warning Score (TEWS) documentation

Systolic blood pressure (SBP), heart rate (HR), and arterial oxygen saturation (SPO2) were recorded in 107 patients (38.5 %). None of the TEWS components was documented in 49 patients (17.6 %). Fischer's exact test revealed a statistically significant relationship between TEWS documentation and the final triage assessment (Fischer's exact test, $P = 0.000$) (Table 5).

Total TEWS calculations

The total TEWS was correctly calculated for only 21 (7.6 %) patients and properly triaged. Most of the patients were improperly triaged (92.4 %, $n = 257$), of which 253 (91 %) were under-triaged and four (1.4 %) were over-triaged (Fig. 1).

Table 5
Triage Early Warning Score components based on their final triage status for patients who visited the adult Emergency Department at Debre Tabor Comprehensive Specialized Hospital.

TEWS components	Final triage assessment		Frequency (%)	Statistical test
	Improperly triaged (%)	Properly triaged (%)		
HR, SBP, SPO2	105 (98.1)	2 (1.9)	107 (38.5)	$P = 0.000$
HR, SBP, SPO2, Mobility pattern, CNS/AVPU, and Trauma	78 (97.5)	2 (2.5)	80 (28.8)	
HR, SBP, SPO2, RR, T, Mobility pattern, AVPU, and Trauma	18 (52.9)	16 (47.1)	34 (12.2)	
HR and SBP	7 (87.5)	1 (12.5)	8 (2.9)	
Not recorded	49 (100)	0	49 (17.6)	

HR heart rate, SBP systolic blood pressure, SPO2 oxygen saturation, RR respiratory rate, T temperature, AVPU awake/ verbal/ pain/ unresponsive.

Discussion

In this study, 92.4 % of the patients were improperly triaged, of which 91 % were under-triaged and 1.4 % were over-triaged. The under-triage rate was significantly higher than that in a study conducted in Durban, South Africa (14 %) [22], a South African rural hospital (19.5 %) [18], a tertiary hospital emergency room in Gauteng Province, South Africa (55.6 %) [17], Ghana Teaching Hospital (19 %) [16], and Mekelle, Ayder referral hospital, Ethiopia (31 %) [20]. This result was also higher than the accepted range of under-triage set by the ACS-COT (5 %) [13]. The over-triage rate was lower than that in a study conducted in South African rural hospitals (12.6 %) [18], a tertiary hospital emergency room in Gauteng Province, South Africa (44.4 %) [17], Durban, South Africa (66.7 %) [22], and Mekelle, Ayder referral hospital (21.9 %) [20]. This variation might be due to the triage nurses being either not familiar with the triage algorithm or not considering the elements of the triage sheet to be relevant in their fast-paced working environment. One of the most alarming gaps was the lack of thorough nursing documentation regarding all the necessary information that should have been documented on the triage sheet.

From the selected charts, 67 (19.4 %) didn't contain a triage sheet. None of the triage sheets were filled out; the triage sheet did not contain either part of the sociodemographic variables, TEWS miscalculated or not calculated at all, or did not contain the patients' triage placement. This result is almost consistent with a study conducted in Mekelle at Ayder Referral Hospital, Ethiopia in which none of the triage sheets were filled out [20]. The triage sheet should be attached to the top of the patients' charts but during our survey, it was difficult to find it. Triage sheet incompleteness indicates that the triage nurse did not consider it an integral part of the patient's medical records and the habit of poor documentation, which indicates the compromised quality of care at the ED.

Table 4
Patients' color-coding categories and use of clinical discriminators based on their final triage status for patients who visited the adult Emergency Department at Debre Tabor Comprehensive Specialized Hospital.

		Final triage assessment		Frequency (%)	Statistical test
		Improperly triaged (%)	Properly triaged(%)		
Color coding category	Red	15 (71.4)	6 (28.6)	21(7.6)	$P = 0.007$
	Orange	33 (91.7)	3 (8.3)	36 (12.9)	
	Yellow	132 (93)	10 (7)	142 (51.1)	
	Green	16 (94.1)	1 (5.9)	17 (6.1)	
	Not recorded	61 (98.4)	1 (1.6)	62 (22.3)	
Clinical discriminators	Used	1 (16.7)	5 (83.3)	6 (2.2)	$P = 0.000$
	Not used	256 (94.1)	16 (5.9)	272 (97.8)	

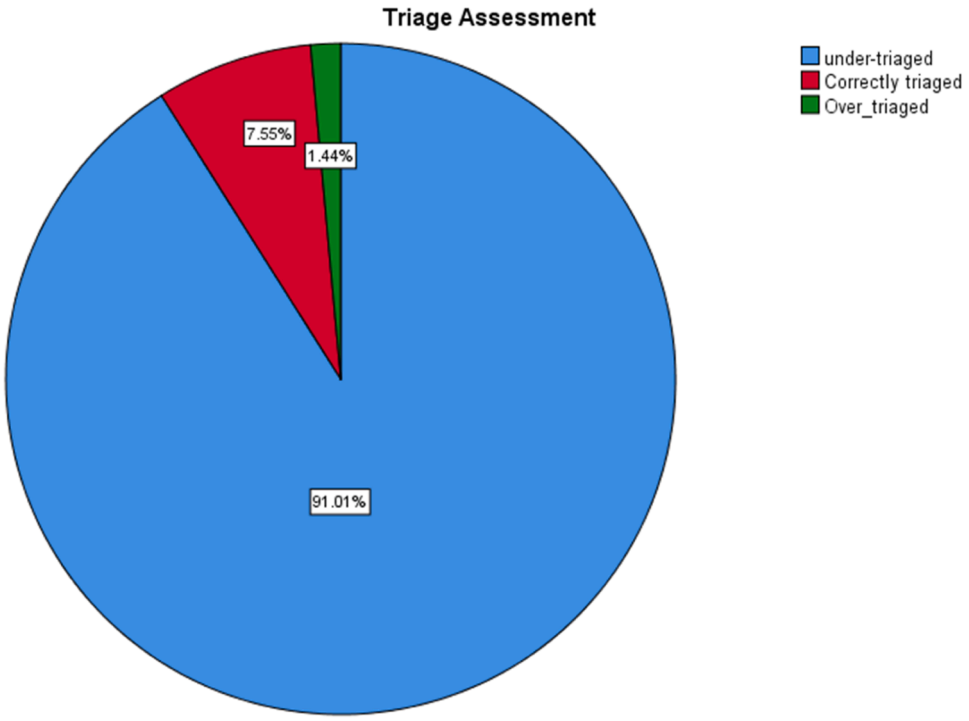

Fig. 1. final triage assessment status for patients who visited the adult Emergency Department of Debre Tabor Comprehensive Specialized Hospital.

The mean decision time to triage in this study was 1.5 min which is almost consistent with a study conducted in Botswana (3 min) for emergency cases [23]. The study found that 15.5 % of patients arrived within 24 h of symptom onset, compared to 80 % in Somalia, despite the duration of illness not being documented [24]. Fever, headache, and respiratory complaints were the most common complaints in our study as compared with a study conducted at Hitit University, Orum Education and Research Hospital ED, Turkey in which upper respiratory system disease, gastrointestinal system complaints, and myalgia were the most common reasons for ED visits [25]. Asthma, hypertension, and cardiac illnesses were the top three comorbid illnesses in our study as compared to a study conducted at Tikur Anbessa Specialized Hospital, Ethiopia in which the most common comorbidities were neurologic and cardiovascular diseases [26].

More than half (51.1 %) of the patients were triaged with yellow coding. This result is consistent with a study conducted in Haiti (47 %) [27], but higher than that reported in studies conducted in South African rural hospitals (30 %) [18], Mekelle Ayder Referral Hospital (33.3 %) [20], and Tikur Anbessa Specialized Hospital Emergency Department (12 %) [28], and lower than that reported in a study conducted in Ghana (61 %) [16]. These differences might be due to differences in patient characteristics, the ability of the nurse in charge of triage decisions, or individuals' adherence to the triage sheet checklist.

In this study, the most consistent vital signs recorded were systolic blood pressure (SBP), heart rate (HR), and arterial oxygen saturation (SPO2) (38.5 %) as part of the TEWS. A study at Mekelle Ayder Referral Hospital revealed that although individual vital signs were better recorded, 24.4 % of cases did not have their final TEWS calculated [20]. A study at a Durban hospital in South Africa revealed that while most parameters were accurately documented, 18.4 % of cases had incorrect TEWS calculations [22]. This difference might be due to a lack of proper training for the triage staff, a shortage of human power, or negligence.

Clinical discriminators were used in 2.2 % of patients, as compared to a study in Mekelle, Ayder referral Hospital (46.7 %) [20]. But despite the use of TEWS score to triage the patients, clinical discriminators are used to place the patient immediately into a higher triage category based on the severity and acuity of their illness.

Conclusion

The triage implementation is underperforming. The study revealed a significant relationship between color-coding category, clinical discriminators, and TEWS in patients' final triage assessment, but further research is needed to include health facility and personnel-related factors. The nature of the study design being cross-sectional will be one of the limitations to establishing a cause-effect relationship. In addition, secondary data may miss important information and affect the quality of the study and some aspects of the analysis.

Dissemination of the results

The findings of this study were presented to the Emergency Department staff and the hospital administrators.

Authors' contribution

Authors contributed as follows to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: BDK 50 %; NM 20 %; and ML and KG 15 % each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declared no conflict of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.afjem.2024.10.001.

References

[1] George S, Read S, Westlake L, Williams B, Pritty P, Fraser-Moodie A. Nurse triage in theory and in practice. Arch Emerg Med 1993;10(3):220–8.

[2] Iserson KV, Moskop JC. Triage in medicine, part I: concept, history, and types. Ann Emerg Med 2007;49(3):275–81.

[3] ElGammal ME. Emergency department triage. Why and How? Saudi Med J [Internet] 2014;35(8):789–90 [cited 2022 Oct 26]Available from, https://smj.org.sa/content/35/8/789.

[4] FitzGerald G, Jelinek GA, Scott D, Gerdtz MF. Emergency department triage revisited. Emerg Med J EMJ 2010;27(2):86–92.

[5] Jiménez JG, Murray MJ, Beveridge R, Pons JP, Cortés EA, Garrigós JBF, et al. Implementation of the Canadian Emergency Department Triage and Acuity Scale (CTAS) in the Principality of Andorra: can triage parameters serve as emergency department quality indicators? CJEM 2003;5(5):315–22.

[6] Twomey M, Wallis LA, Thompson ML, Myers JE. The South African triage scale (adult version) provides valid acuity ratings when used by doctors and enrolled nursing assistants. Afr J Emerg Med [Internet] 2012;2(1):3–12 [cited 2022 Oct 26] Available from, https://www.sciencedirect.com/science/article/pii/S2211419X11000887.

[7] Ärzteblatt DÄG Redaktion Deutsches. Deutsches Ärzteblatt. [cited 2022 Oct 26]. Modern Triage in the Emergency Department (17.12.2010). Available from: https://www.aerzteblatt.de/int/archive/article?id=79788.

[8] Nasim Farrohknia, Maaret Castrén, Anna Ehrenberg. Emergency Department Triage Scales and Their Components: a Systematic Review of the Scientific Evidence - PMC [Internet]. 2011 [cited 2022 Oct 26]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3150303/.

[9] Roberto Forero, Peter Nugus. Australasian College for Emergency Medicine (ACEM) Literature Review on the Australasian Triage Scale (ATS) - Google Search [Internet]. [cited 2022 Oct 26]. Available from: http://www.acem.org.au/media/media_releases/2012_-_ACEM_Triage_Literature_Review.pdf.

[10] Key_Medical_Home_Study_-_Triage_in_Emergency_Department_Using_ESi_(5_Levels)_Self_Study_8.2015_in_PDF_Format_for_email_and_posting.pdf. - Google Search [Internet]. [cited 2022 Oct 28]. Available from: http://www.ahrq.gov/professionals/systems/hospital/esi/index.html.

[11] Ramesh P Aacharya, Chris Gastmans, Yvonne Denier. Emergency department triage: an ethical analysis | BMC Emergency Medicine | Full Text [Internet]. [cited 2022 Oct 26]. Available from: https://bmcemergmed.biomedcentral.com/articles/10.1186/1471-227X-11-16.

[12] Lampi M, Junker JPE, Tabu JS, Berggren P, Jonson CO, Wladis A. Potential benefits of triage for the trauma patient in a Kenyan emergency department. BMC Emerg Med 2018;18(1):49.

[13] Cioffi J. Triage decision making: educational strategies. Accid Emerg Nurs 1999;7(2):106–11.

[14] Qureshi NA. Triage systems: a review of the literature with reference to Saudi Arabia. EMHJ - East Mediterr Health J 16 6 690-698 2010 [Internet] 2010 [cited 2022 Oct 26]; Available from, https://apps.who.int/iris/handle/10665/117941.

[15] Frykberg ER. Triage: principles and practice. Scand J Surg SJS Off Organ Finn Surg Soc Scand Surg Soc 2005;94(4):272–8.

[16] Rominski S, Bell SA, Oduro G, Ampong P, Oteng R, Donkor P. The implementation of the South African Triage Score (SATS) in an urban teaching hospital, Ghana. Afr J Emerg Med Rev Afr Med Urgence 2014;4(2):71–5.

[17] Goldstein LN, Morrow LM, Sallie TA, Gathoo K, Alli K, Mothopeng TMM, et al. The accuracy of nurse performance of the triage process in a tertiary hospital emergency department in Gauteng Province. South Africa. South Afr Med J Suid-Afr Tydskr Vir Geneeskd. 2017;107(3):243–7.

[18] Rosedale K, Smith ZA, Davies H, Wood D. The effectiveness of the South African Triage Score (SATS) in a rural emergency department. South Afr Med J Suid-Afr Tydskr Vir Geneeskd 2011;101(8):537–40.

[19] Fateha BE, Hamza AY. Impact of triage in accident and emergency departments in Bahrain. EMHJ - East Mediterr Health J 7 4-5 812-818 2001 [Internet] 2001 [cited 2022 Oct 29]; Available from, https://apps.who.int/iris/handle/10665/119093.

[20] Abdelwahab R, Yang H, Teka HG. A quality improvement study of the emergency center triage in a tertiary teaching hospital in northern Ethiopia. Afr J Emerg Med [Internet] 2017 Dec 1;7(4):160–6 [cited 2022 Oct 26]Available from, https://www.sciencedirect.com/science/article/pii/S2211419X16302099.

[21] Eyasu A, Molla M, Kefale B, Sisay W, Andargie Y, Kebede F, et al. Prevalence and associated risk factors of endoparasites among under-five children in debre Tabor comprehensive specialized hospital, Debre Tabor, Northwest Ethiopia: a Cross-Sectional Study. J Parasitol Res 2022;2022:6917355.

[22] Soogun S, Naidoo M, Naidoo K. An evaluation of the use of the South African Triage Scale in an urban district hospital in Durban, South Africa. South Afr Fam Pract [Internet]. 2017;59(4):133–7. https://doi.org/10.1080/20786190.2017.1307908 [cited 2022 Oct 26]Available from.

[23] Tshitenge ST, Ogunbanjo GA, Mbuka DO. Corrigendum: the effectiveness of the South African Triage Tool use in Mahalapye District Hospital - Emergency Department, Botswana. Afr J Prim Health Care Fam Med 2017;9(1):1695.

[24] Sunyoto T, Van den Bergh R, Valles P, Gutierrez R, Ayada L, Zachariah R, et al. Providing emergency care and assessing a patient triage system in a referral hospital in Somaliland: a cross-sectional study. BMC Health Serv Res 2014;14:531.

[25] Erenler AK, Özel İ, Ece Y, Karabulut M, Oruçoğlu A, Çiftçi E. Analysis of Triage Application in Emergency Department. Open J Emerg Med [Internet] 2015;03(03):13 [cited 2022 Oct 30]Available from, http://www.scirp.org/journal/PaperInformation.aspx?PaperID=58945-bstract.

[26] Sultan M, Mengistu G, Debebe F, Azazh A, Trehan I. The burden on emergency centers to provide care for critically ill patients in Addis Ababa. Ethiopia. Afr J Emerg Med Rev Afr Med Urgence. 2018;8(4):150–4.

[27] Massaut J, Valles P, Ghismonde A, Jacques CJ, Louis LP, Zakir A, et al. The modified South African triage scale system for mortality prediction in resource-constrained emergency surgical centers: a retrospective cohort study. BMC Health Serv Res [Internet] 2017;17(1):1–8 [cited 2022 Oct 30]Available from, https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-017-2541-4.

[28] Hunchak C, Teklu S, Meshkat N, Meaney C, Puchalski Ritchie L. Patterns and predictors of early mortality among emergency department patients in Addis Ababa, Ethiopia. BMC Res Notes 2015;8:605.