Profile and Triage Appropriateness of Trauma Patients Triaged Green: A Prospective Cohort Study from a Secondary Care Hospital in India

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Research Article

Keywords: Trauma, Triage, Cape Triage Score, LMIC, Emergency Medicine, Emergency Department, India

Posted Date: March 22nd, 2022

DOI: https://doi.org/10.21203/rs.3.rs-847363/v2

Abstract

Introduction: Triage is an important component of in-hospital trauma care for adequate patient management and to avoid overcrowding in emergency departments (ED). Prioritising the evaluation of non-urgent patients may result in the diversion of workforce from patients requiring immediate care. However, not evaluating these patients may result in missed injuries and poor outcomes. We aimed to evaluate the profile of these non-urgent patients triaged 'green', as part of a triage-trial in a secondary-care hospital in India and validate this against the Cape Triage Score (CTS).

Methods: We analysed data of patients triaged green in a prospective single-centre cohort study between July 2016 to November 2019. Clinicians at this triage-naive ED were introduced to a triage trial who then assigned a triage category to trauma patients, aged 18 years and above, on initial evaluation. Telephonic follow-up was performed for all patients included in the study. Triage appropriateness was retrospectively analysed using the CTS.

Results: We included 4135 trauma patients triaged green. The mean age of patients was 32.8 (±13.1) years, 77% males. The median (IQR) length of stay of admitted patients was 3 (13) days. Half the patients had a mild Injury Severity Score (3-8), with the majority of injuries being blunt (98%). Of the patients triaged green, 97% came in as direct arrivals and 94.4% were discharged from the ED after initial evaluation. As per CTS, nearly three-quarters (74%) of patients were undertriaged 'green' by the clinicians in a triage-naive ED.

Conclusion: Three-fourths (74%) of the patients triaged green by clinicians in a secondary care hospital in Mumbai were mistriaged when retrospectively analysed using CTS. This highlights the need for implementation and evaluation of trauma triage training for the in-hospital first responders (clinicians, nurses and other paramedical staff) in the EDs.

Introduction

Globally, each year, 4.5 million people die from trauma, with India contributing to 20% of this burden.(1) Trauma represents the second most common cause of death after age five in India.(2) Furthermore, India also has the highest rank in the number of deaths attributable to road traffic-related deaths in the world.(3) Approximately 50% of trauma deaths occur in the hospitals, highlighting the need for strengthening in-hospital care.(4) Trauma care is highly time-sensitive, and the early identification of injuries is important for survival.(5) Establishment of hospital triage systems can ensure that critically ill patients are identified and receive care promptly.(6) For this purpose, several triage scores are used across different countries and hospital settings.(7, 8)

In India, the high population density, poorly developed prehospital care and a lack of appropriate referral systems leads to overcrowding in the emergency departments (EDs).(9–12) Most EDs lack triage protocols and the level of emergency patient care is decided by clinicians who are not trained specifically in trauma care.(13, 14) Trauma management trainings are also not incorporated as a separate subject in

the medical training of clinicians. Inappropriate triage is known to have contributed to a surge in non-urgent patients, exacerbating the problem of overcrowding in the ED.(14–17) This may be due to prioritising the evaluation of patients with low urgency, which results in the diversion of workforce and resources from serious patients requiring immediate care. Nonetheless, not evaluating these patients could result in missed injuries and poor outcomes.

In our study, clinicians at a triage-naive ED were introduced to a triage-trial, as part of a multicentre triage project which compared prediction models for triage in adult trauma patients presenting to various emergency departments across India.(15) The patients were designated one of the four trauma triage categories by clinicians, based on their understanding of trauma triage; into red, orange, yellow, green, with red and green denoting the most and least urgent patient status respectively. We aimed to evaluate the profile of the non-urgent patients who were triaged green by clinicians and the validity of this category in comparison to the Cape Triage Score (CTS). CTS is a mixed score based on physiological parameters and the pathology of the patient and has been effectively used at various settings in South Africa and Low- and Middle-Income Countries (LMIC) since 2006.(18) It is a comprehensive triage score with a low undertriage rate capable of predicting patient disposition.(19)

Methodology

Study Design

This single-centre prospective cohort study is part of the Trauma Triage Study in India (TTRIS) which compares prediction models for triage in adult trauma patients presenting to various emergency departments across India. Data was collected in the study site from July 2016 to November 2019.

Study Setting

The study site was the ED of Khurshedji Behramji Bhabha Hospital (KBBH), a 436 bedded regional secondary healthcare centre located in Mumbai, India, catering to approximately 350 patients each day in the ED. It is a secondary-care public hospital with free or nominal fees, providing access to low socio-economic groups and receives patients from across the city. At KBBH, trauma care is imparted as a subspeciality along with medical, surgical, and obstetric care. The hospital has an intensive care facility but there is no neurosurgery department, so patients in need of neurosurgical management are referred to tertiary care centres. Plain radiography and ultrasonography are available round the clock; however computerized tomography (CT) is only available in-house from 7am to 6pm. The patients arriving at the ED are first seen by a casualty medical officer (CMO) largely on a first-come, first-served basis without a formalised system of triaging patients at the ED.

Clinician Triage

As part of data collection of TTRIS, the triage-naive clinicians were informed about the trauma triage categories, without provision to any formal tool or training about the same. The clinicians involved have a minimum of 2 years clinical experience, however, they are neither trained in trauma care as a speciality

nor are they necessarily trained in trauma management courses like ATLS. Medical training of the clinicians include aspects such as triage systems in theory however not put in practise due to lack of formal triage protocols. After their initial on-arrival assessment of each patient, clinicians were asked by the research officers to categorise the patient as per their understanding of how urgently the patient requires treatment into the aforementioned colour-coded triage groups; red, orange, yellow, green, with red and green denoting the most and least urgent patient status respectively,(15) henceforth referred to as the triage levels. The clinicians were allowed to use all available information that was extracted by them during initial routine assessment (such as wound assessment) along with patient vitals that were collected by the research officer for determining the urgency of treatment required and thereby the triage level. The triage levels were not used to determine treatment decisions in the ED as there was no formalised tool or protocol in place for assigning the triage and coupling it with patient management. The clinicians were individually informed about the aim and methodology used for the TTRIS study at the start of their respective posting at the ED, however, the clinicians were neither involved in the conception nor were they part of the research team analysing the results.

Participants

Inclusion Criteria

We included all the patients aged 18 years and above presenting to the KBBH ED with a history of trauma and triaged green by clinical triage on initial evaluation irrespective of their injury severity. A history of trauma was defined here as having any of the external causes of morbidity and mortality listed in block V01-Y36, chapter XX of the International Classification of Disease version 10 (ICD-10) online codebook, with some exclusions (see online supplementary material).(20) Only patients with above mentioned causes of trauma as their primary complaint were included. For example, patients with a history of fall due to dizziness were not included in the study.

Exclusion Criteria

Patients with one or more vital parameters missing among the variables used for analysis or who did not consent to follow-up were excluded from the analysis.

Source and methods of selection of participants and follow-up

The research officer at KBBH observed morning, evening and night shifts (6-hour observational shifts). These shifts were not aligned with the working hours of the clinical staff to reduce bias and accounting for shift fatigue of the clinicians. Data were collected from the first 10 consecutive patients only, irrespective of their triage, during each shift. Due to the large patient load and time and budgetary constraints of the project, data collection of only the first 10 patients was considered feasible for follow-up.

Follow-up was performed by the research officer at 24-hours, 30-days and 6-months after arrival at the ED. The time frame of the study was chosen to ensure that all included patients had completed 6 months of follow-up to minimise the loss to follow-up. The follow-up was completed in-person or by telephone, depending on whether the patient was still hospitalised or if the patient had been discharged. The phone numbers of one or more contact persons, mostly relatives, were collected on enrolment and those people were contacted if the participant did not reply to the follow-up telephone calls. The outcome was recorded as missing if neither the patient nor the relative were available for follow-up at the specified time-points.

Variables

The outcome measures were mortality within 24-hours, 30-days and 6-months.

Additionally, for each participant, age, sex, transfer status, time of injury, mechanism of injury, injury-related details, number of serious injuries, and the assigned informal triage category were collected. Physiological measures including systolic blood pressure (SBP), respiratory rate (RR), heart rate (HR), peripheral capillary oxygen saturation (SpO_2), Glasgow Coma Scale (GCS) and Alert Verbal Pain unresponsive scale (AVPU) were recorded.

A serious injury was defined as an injury that warrants hospitalisation.(21) GCS was categorised into no or mild traumatic brain injury (TBI) (13–15), moderate TBI (9–12), severe TBI (3–8).(22) ED-length of stay (ED-LoS) was calculated using the date and time of arrival and the date and time of discharge from the ED, either to be sent home or admitted in the hospital. Length of stay in the hospital (LoS) was calculated using the data and time of admission in the hospital to the data and time of discharge alive from the hospital, mortality, Leave against medical advice (LAMA) or abscond. Injury severity score (ISS) was allocated retrospectively with ‘mild’ (3–8), ‘moderate’ (9–15), ‘severe’ (16–25) and ‘profound’ (> 25) categories. Patients for whom ISS could not be coded, for example when there were no recorded injuries, were assigned ‘no defined ISS’.(23) The revised trauma score (RTS) was computed and categorised as RTS < 4 and RTS > 4.(23, 24)

Injuries were recorded and coded using ICD-10 in the TTRIS dataset. Patients were divided into categories with respect to the most critical injury namely, crush injury, injury to internal organs, blood vessel injury, amputation, fracture, dislocation, burn, multiple injury, unspecified injury, open wound, superficial injury.(20) Injury characteristics of patients that presented to the ED with no injuries were categorized as ‘no defined injury’. For patients with multiple injuries, the more critical one was considered for categorising patients as per injury.

Triage as per Cape Triage Score (CTS) System

The CTS has three versions, the adult version (those over 12 years of age or 150 cm in height), the child version (those between 3–12 years old or 95–150 cm) and the infant version (those less than 3 years of age or under 95 cm).(18) The adult CTS was used retrospectively to check for the appropriateness of the informal triage performed by the clinicians.(18) The physiological parameters were each scored against the adult Triage Early Warning Score (TEWS) scoring sheet, to calculate a total TEWS (Table 1). Each

patient was assigned a triage level that corresponds to the TEWS score as follows: 0–2 green, 3–4 yellow, 5–6 orange, 7 or more red as seen in Table 2. Each patient was further categorised into the four triage levels using the Cape Triage Group (CTG) list of discriminators, also known as the South African Triage Scale (SATS) colour code. If a patient was categorised into a higher level by the SATS colour code than the TEWS score, then the higher level was considered as the correct triage level. For example, if the SATS color code categorised a patient with closed fracture into yellow, the triage level assigned to the patient would be yellow even if the TEWS score categorised the patient into green. The physiological parameters are considered for assigning tirage and the discriminators are used as a safety net in case patients do not present with abnormal physiology.

Table 1
The Cape Triage Score depicting the TEWS (18)

	Adult Triage Score						
	3	2	1	0	1	2	3
Mobility				Walking	With help	Stretcher/ Immobile	
RR		Less than 9		9–14	15–20	21–29	More than 29
HR		Less than 41	41–50	51–100	101–110	111–129	More than 129
SBP	Less than 71	71–80	81–100	101–199		More than 199	
Temp.		Less than 35		35-38.4		38.5 or more	
AVPU				Alert	Reacts to Voice	Reacts to Pain	Unresponsive
Trauma				No	Yes		
Over 12 years / taller than 150 cm							

Table 2
The Cape Triage Score depicting the SATS color code (18)

Colour	Red	Orange	Yellow	Green
TEWS	7 or more	5–6	3–4	0–2
Target time to treat	Immediate	Less than 10 min	Less than 60 min	Less than 240 min
Mechanism of injury		High energy transfer		
Presentation		Shortness of breath - acute		All other patients
		Coughing blood		
		Chest pain		
		Haemorrhage uncontrolled	Haemorrhage - controlled	
	Seizure - current	Seizure-post ictal		
		Focal neurology - acute		
		Level of consciousness reduced		
		Psychosis/aggression		
		Threatened limb		
		Dislocation - other joint	Dislocation - finger or toe	
		Fracture - compound	Fracture - closed	
	Burn-face/ inhalation	Burn over 20%	Burn - other	
		Burn - electrical		
		Burn-circumferential		
		Burn-chemical		
		Poisoning/overdose	Abdominal pain	
	Hypoglycemia glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)	
		Vomiting - fresh blood	Vomiting - persistent	
		Pregnancy and abdominal trauma or pain	Pregnancy and trauma	

Colour	Red	Orange	Yellow	Green
			Pregnancy and PV bleed	
Pain		Severe	Moderate	Mild
Senior health care professional's discretion				

Quality assurance

There were three layers of quality control. First, data was entered using a dedicated electronic data collection instrument with extensive logical checks and prompts for unlikely but possible values. Second, the collected data were reviewed on a weekly basis and discussed during weekly online conferences with all project officers and the project leads throughout the duration of the data collection period. Third, on-site quality control sessions were conducted every 3–4 months. During these sessions, a second research officer collected data alongside the research officer who worked at the ED. The quality-controlled data was then compared with the standard data.

Data Analysis

Data analysis was performed using R version 4.04 statistical software.(25) Complete case analysis was performed to exclude all patients with missing data among the variables included for analysis. Descriptive statistics were generated for all variables. The results are presented as frequencies and percentages for categorical variables, mean and standard deviation (SD) for continuous variables and median and inter quartile range (IQR) for variables with abnormal distribution, for example LoS. The patients triaged green as per the clinician triage were further triaged as per the CTS, using the TEWS and SATS colour code into red, orange, yellow and green. The number of patients triaged green by the CTS was divided by the number of patients triaged green as per clinician triage (4135), the resultant proportion minus one was considered as the proportion of patients mis-triaged.

Results

In the study, 4151 patients were included of which 4135 (99.6%) patients were triaged green by the clinicians (Fig. 1). The mean age of patients was 32.8 ± 13.1 years with 3172 (77%) males. Table 3 shows the physiological parameters at the time of presentation and injury characteristics as per the ISS of the study population. Notably, of all patients triaged green, 10/4135 (0.24%) patients presented with moderate to severe GCS and 0.3% of patients did not have an AVPU of alert. Majority of patients triaged green (97%) presented to the study-site directly without a primary care hospital referral. Blunt injury (98.5%) was the most common injury presentation with penetrating injury found in only 1.4% of patients. The mean (SD) revised trauma score (RTS) of these patients triaged green was 8 (0.13) with all patients having an RTS > 4.

Figure 1: **Study Flowchart**

Table 3
Physiological and injury characteristics of patients triaged green (N = 4135)

Demographics	
Mechanism of Injury (%)	
Transport accidents	916 (22.2)
Assault	870 (21)
Fall	856 (20.7)
Other	852 (20.6)
Animal bite	641 (15.5)
Transfer status	
Direct	4006 (97)
Transferred	129 (3)
Vitals	
AVPU (%)	
Unresponsive	3 (0.1)
Pain	6 (0.1)
Verbal	3 (0.1)
Alert	4123 (99.7)
GCS (mean (SD))	14.98 (0.4)
GCS (%)	
Mild	4125 (99.8)
Moderate	4 (0.1)
Severe	6 (0.1)
Systolic blood pressure (mean (SD))	128.05 (18.9)
Diastolic blood pressure (mean (SD))	84.34 (13.3)
Heart rate (mean (SD))	88.88 (17)
Oxygen saturation (mean (SD))	97.79 (2.2)
Respiratory rate (mean (SD))	22.63 (3.7)
Need for oxygen support (%)	

Demographics	
Not on oxygen support	4135 (100.0)
RTS (mean (SD))	7.99 (0.13)
Injury characteristics	
Type of Injury (%)	
Blunt	4075 (98.5)
Penetrating	56 (1.4)
Blunt & penetrating	4 (0.1)
Number of serious injury (%)	
No serious injury	4112 (99.4)
Single	21 (0.5)
Multiple	2 (0.0)
ISS (%)	
No defined ISS	2048 (49.5)
Mild	2072 (50.1)
Moderate	15 (0.4)
Severe	0 (0.0)
Profound	0 (0.0)

Injury Characteristics

Of the total patients triaged green by clinicians, 46% of patients had only superficial injuries of which majority (30.8%) were due to animal bites. Further, 24% had no history or evidence of injuries on examination. Among those referred to other centers, the most common types of injury identified were superficial injuries (34) followed by open wounds (27) and patients with no documented injury (19). The reasons for referral to other centres were not documented. As per ISS, 50.2% of patients had ‘mild’ and 0.4% had ‘moderate’ score and the remaining 49.5% patients had ‘no defined ISS’. Figure 2 shows the different injury types as per mechanism of injury in the study population. Amongst those that had a transport accident, 881/916 (96.17%) were patients who had a road traffic injury.

Figure 2: **Percentage distribution of different injury mechanisms among injury types (N = 4135)**

Patient Outcomes

The ED disposition of all the patients is shown in Fig. 1. The median (IQR) length of stay (LoS) of those admitted to the hospital was 3 (13) days and seven patients required admission in the intensive care unit. Most admitted patients 62/74 (83.8%) were successfully discharged from the hospital while three were transferred to other centers for further management. Further, there were eight patients that left against medical advice and one who died during their hospital stay.

Patient Mortality

Follow up at 30 days was successful for 3832/4135 (92.7%) of patients. Three patients died during the first 30 days. The first patient who died while in-hospital was an 80-year-old woman, who arrived at the ED 7 days after injury following a fall at ground level. With a GCS of 7 on arrival, she was admitted to the ICU with an ED-LoS of 30 minutes. Documented injury of the patient was an old contused lacerated wound on the forehead and abrasion on arm. She died within 36 hours of admission. The patient was retrospectively triaged orange as per the CTS.

The second patient, a 60-year-old man with a GCS of 8 was triaged green by the clinician. The patient arrived at the ED within 45 minutes of injury due to a fall from height. The patient was transferred to another centre with an ED-LoS of 1 hour 50 minutes and was alive at 24-hour follow-up but not admitted at the transferred centre at the time of follow-up. He was reported dead at 30 days follow-up and the cause of death could not be deduced from the available data. The patient was retrospectively triaged yellow as per the CTS.

The third patient, an 80-year-old man arrived in the ED within an hour following injury due to fall (W18) with a complaint of pain in the hip. On arrival, the patient had a GCS of 15 and oxygen saturation of 98%. The radiological findings (X-ray chest and X-ray pelvis and both hips) were normal and he was discharged from the ED with an ED-LoS of less than 3 hours. On the 30-day follow-up, the patient had died. This patient was triaged yellow as per the CTS.

Follow up at 6 months was successful for 3597/4132 (87%) green-triaged patients. A 69 year old woman was reported dead. The patient arrived in the ED 6 days following a fall from the bed (W06) with a GCS of 15. The patient had no documented injuries and was discharged with an ED-LoS of 1 hour. The patient was retrospectively triaged yellow as per CTS. The cause of death could not be ascertained due to the non-availability of death records and autopsy findings.

Evaluation of triage appropriateness through retrospective Cape Triage Score (CTS)

We found that of the total number of patients that were triaged green by clinicians (N = 4135), 24 patients were triaged red, 448 patients were triaged orange and 2579 patients were triaged yellow as per CTS indicating that 73.8% patients were mistriaged by the ED clinicians. Of these, most patients (97%) were found to have been mistriaged after assessing their physiological parameters from TEWS while others due to the SATS color code for discriminators as seen in Table 4. The disposition of these patients from the ED as per their CTS is depicted in Fig. 3. Notably, of the total four documented deaths, one occurred in

a patient who was admitted in the hospital and triaged orange as per CTS, and one in a patient transferred to a different centre triaged yellow as per CTS.

Table 4
Patients mistriaged as per CTS (N = 4135)

	Green	Yellow	Orange	Red
Cape Triage Score	1084	2579	448	24
Triage Early Warning Score	1084	2513	433	19
South African Triage Scale	0	66	15	5

Figure 3: **Patients' disposition from ED as per retrospective triage using CTS (N = 4135)**

Discussion

Our study revealed that approximately three quarters (74%) of patients informally triaged green were effectively mistriaged when compared to a validated triage system and as per CTS only 1084/4135 (26.2%) were triaged green. Of the patients triaged green, 94.4% were discharged from the ED, apparently indicating that these patients may be coming in with presentations that do not require hospital admission. Also, most of these patients (97%) were coming in as direct arrival to this secondary-care hospital. This emphasises the need of on-scene triage and an effective referral system in order to prevent overburdening of the EDs of the secondary and tertiary-care hospitals.

Blunt trauma was seen as the most common mechanism of injury. A similar trauma mechanism was noted in a pilot implementation of a trauma registry study from Pakistan.(26) Superficial injury was the most frequent presentation and the predominant mechanism of injury was found to be transport accidents followed by assault. These findings are similar to a study describing the profile of patients presenting to the ED of a general hospital, similar to our setting, in southern Ethiopia.(27) The presentation of 15.5% of patients with animal bites was unique to our setting. These patients mainly presented for vaccinations following animal bites more frequently than for the treatment of bite injuries.

Only 2.6% of green-triaged patients were referred to other centers for further management. This referral rate is low in comparison to a study from southern Ethiopia that reported a rate of 5.2%.(27) However, in our study, it is worth noting that most patients who were referred to higher centres only had superficial, open wounds, or no defined injuries. So, it is difficult to assume if these transfers were genuinely warranted or could have been managed in the same hospital. Additionally, transfers due to overcrowding during specific hours of the day, overwhelming the existing infrastructure, resources or manpower at that particular time, may be a possibility.

Overcrowding of the ED, with limitation of resources, seems to be an important factor for inadequate trauma care.(28) This makes triaging crucial which enables intensifying the efforts towards patients

requiring immediate interventions and quick management and disposition of the less urgent patients. Physiological parameters are most frequently used by clinicians to triage patients in India owing to lack of access to investigations such as CT scan during all times of the day. These on-arrival parameters are also known to be the most effective in the case of low-resource settings in predicting patient outcomes.(28) Our study found that 10/4135 (0.24%) patients that reported GCS moderate to severe and 0.3% of patients did not have an AVPU of alert and were still triaged green. This indicates that among the green triaged patients with close to normal physiological parameters, there were patients that required urgent attention. Although the proportion of these patients is relatively low compared to our sample size, reasons for these patients being inappropriately triaged must be explored extensively to enhance healthcare delivery in Indian EDs. Although the reasons for mistriaging are multifactorial, in this case, the lack of appropriate training or standard, uniform protocol for patient management in the ED to quickly identify these patients among those that have normal physiological parameters is most evident. Additionally, these findings highlight the efficacy of physiological scores such as TEWS, a component of CTS in triaging patients accurately and the need to include GCS assessment for all patients presenting to the ED. Furthermore, vital signs-based prediction models have been found to be beneficial for busy resource-limited public hospitals in urban India, where access to imaging modalities is not available around-the-clock.(29)

This need for reinforcement of adequate formal triage training is strengthened by our finding that as per CTS, nearly three-quarters (74%) of patients were mistriaged green of which, most (97%) were ascertained by their Triage Early Warning Score (TEWS), that takes into account physiological parameters. In addition, of those admitted, seven required admission to the ICU indicating they may have required urgent management for their condition. On a closer look at the triage category denoted by clinicians at the three patients found dead on 30-day follow-up, it was seen that two of them were under triaged on initial evaluation of physiological parameters as they had a GCS < 8. Further, in our study, retrospective triage using a physiological score reveals its benefits if implemented in a low-resource setting as seen with TEWS, which identified the majority of patients mistriaged (Table 4). Including appropriate triage training for CMO's when implementing reforms in trauma management is a key step towards improving outcomes in trauma patients. This requires prioritisation of meticulous evaluation of the initial vital parameters by the ED staff to reduce errors and improve outcomes, in addition to addressing other contributing factors such as the low clinician to patient ratio in Indian EDs.

This prospective cohort study is one of the largest studies done in an LMIC setting, conducted for 3.5 years that provides robust data from a secondary care hospital in Mumbai. The hospital serves patients directly presenting to the ED and also patients that are referred from primary and other secondary care centres. This is also the first study from India that provides an in-depth profile and outcomes of patients triaged green in a low-resource hospital setting. However, this study has limitations. Firstly, the study provides data from a single secondary care centre, results of which may not be generalisable to other secondary care hospitals or other Indian healthcare settings, due to hospital bias. Secondly, to ensure feasibility, data of only 10 consecutive patients were collected in each shift. Due to which we do not have data of all the patients coming to the ED. Thirdly, we did not have data from autopsy reports of

individuals that died to ascertain their exact cause of death. Lastly, we have data only on mortality of the patients but no additional data documenting the morbidity. This is a limiting factor towards assessing the morbidity gains after implementation of triage training.

Conclusion

Three-fourths (74%) of the patients triaged green by clinicians in a secondary care hospital in Mumbai were mistriaged when retrospectively analysed using CTS. This highlights the need for implementation and evaluation of trauma triage training for the in-hospital first responders (clinicians, nurses and other paramedical staff) in the EDs. Also, direct admissions of the non-urgent patients to this secondary-care hospital warrants strengthening the referral systems to avoid overcrowding of the Indian EDs.

Declarations

Ethical clearance

Ethics committee approval for TTRIS was obtained from the ethics and scientific committee of KBBH (KBBH, HO/4982/KBB,12/08/2016). Informed consent for follow-up was taken from patients at the time of discharge from the hospital. In case the patient was unconscious, consent was obtained from a family member or the patient's legally acceptable representative.

Consent for publication

Not Applicable

Availability of data and materials

The data are available to whoever wants them by emailing the corresponding author. They can write their aims and objectives, and then, the authors can decide if that study can be done without duplication of the work.

Competing Interests

There is no conflict of interest to disclose from any of the authors

Funding

The data collection for TTRIS was funded by grants from the Swedish National Board of Health and Welfare, grant numbers 22464/2017 and 23745/2016.

Author's contribution

Authors AA, RD, BS, SD and MGW have conceptualized the study. AA analysed the data and AA, RD, BS were involved in the interpretation of the data. GR, NR, MK, JA, KDS, NS, MM, AG, NR, and MGW

contributed to the study design and editing of the manuscript. All authors have contributed to drafting the article and revising it. They also approved the final version of the manuscript. All authors agree to be responsible for all aspects of the work.

Acknowledgments

We thank the Thursday Truth Seekers (TTS) and the Trauma Triage Study in India (TTRIS), India, research team for their support.

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Figures

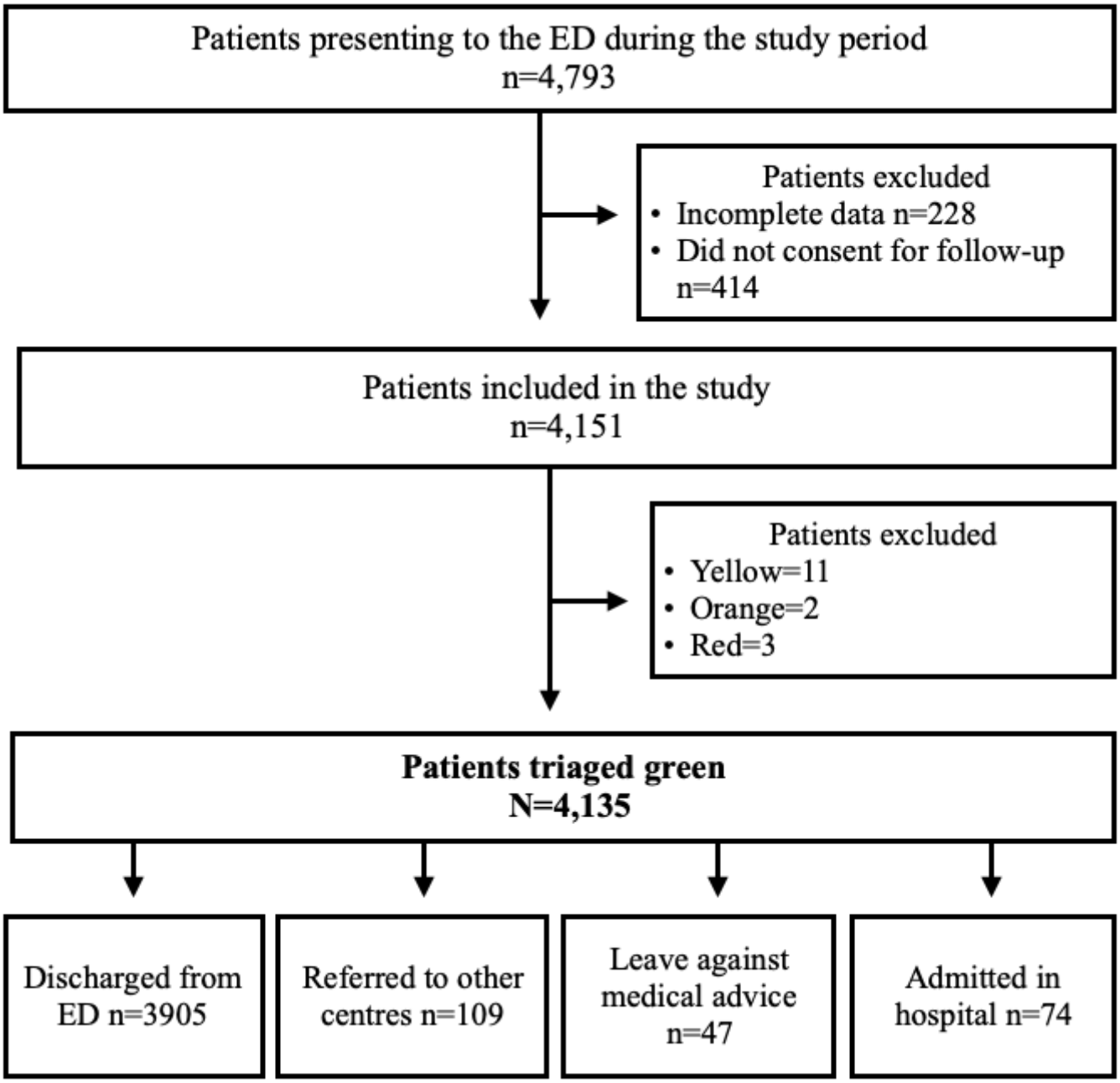

Figure 1

Study Flowchart

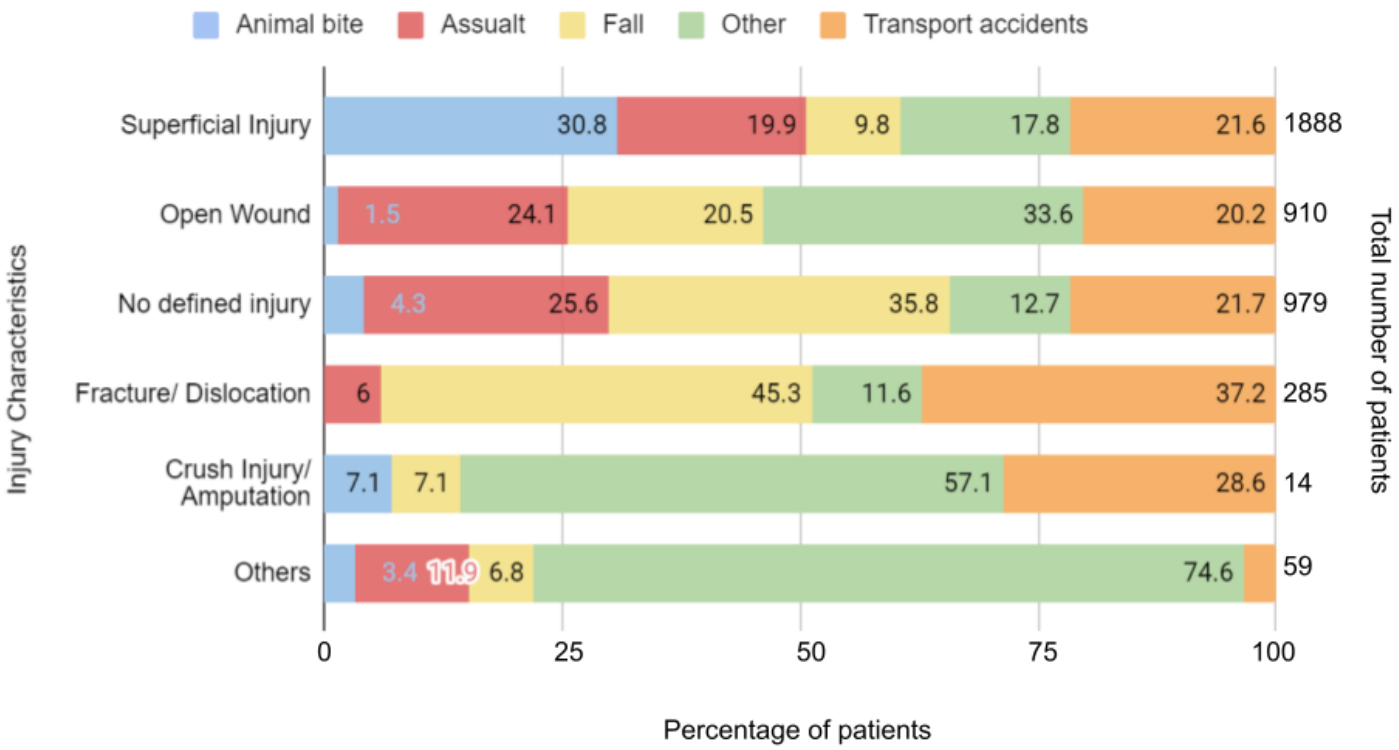

Figure 2

Percentage distribution of different injury mechanisms among injury types (N = 4135)

Figure 3

Patients' disposition from ED as per retrospective triage using CTS (N=4135)

Supplementary Files

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- SupplementarymaterialGreenTriage.pdf