Trauma Monthly 2023; 28(4): 859- 866

10.30491/tm.2023.384965.1578

Trauma Monthly

Research Article

Comparison of Kampala Trauma Score and Trauma Injury Severity Score in Predicting Mortality in Trauma Patients

Chalana NR[1], Prakash Dave[1*], Sreeramulu PN [1], Krishnaprasad K [1], Shashirekha CA[1]

[1] Department of General Surgery Sri Devraj Urs Medical College Tamaka Kolar 563101, India.

*Corresponding Author: Prakash Dave,Professor, Department of General Surgery, Sri Devaraj Urs Medical College And Research Centre, Kolar, Karnataka, India, Tel:+919980096096 Email:prakdave@rediffmail.com

Received 2023-03-15; **Accepted** 2023-06-16; **Online Published** 2023-08-27

Abstract

Introduction: Trauma is one of the leading causes of mortality and morbidity worldwide. The mechanism of trauma is classified as either blunt or penetrating. Blunt trauma is due to motor vehicle-related injuries, falls, and assaults, whereas firearms and stabbings account for most penetrating injuries. Fifty percent of deaths occur within minutes of injury, resulting from massive bleeding or severe neurologic damage. This study aims to assess the Kampala Trauma Score and Trauma Injury Severity Score system with the outcome, i.e., mortality.

Methods: It is a prospective descriptive cohort study. A total of 285 patients were involved in the study. All patients suspected of having trauma were scored using TRISS and KAMPALA SCORES at arrival time. Clinical assessment, relevant blood investigations, and radiological investigations were done in the emergency department at the time of presentation in a tertiary care teaching hospital and repeated after 24 hours. The follow-up for mortality till the 30th post-trauma day was recorded. Physiological parameters at the time of initial assessment were recorded, including Systolic Blood Pressure (SBP), Glasgow Coma Scale (GCS) score, respiratory rate (RR), heart rate (HR), and oxygen saturation2. Chest X-ray, CT scan, USG abdomen and pelvis, and blood investigation were done when indicated.

Results: Of the 285 patients eligible for the study, mortality was 21(13.57%). The area under the curve for TRISS and KTS were 0.951 and 0.980, respectively, at the time of admission and 0.955 and 0.989 after 24 hours. The diagnostic accuracy of KTS was higher than the TRISS, indicating that KTS was better at predicting mortality in trauma patients than the complex TRISS.

Conclusion: The Kampala Trauma Scoring System is better at predicting mortality than the Trauma Injury Severity Scoring System in trauma patients. It predicted early and late mortality better with better diagnostic accuracy than the TRISS.

Keywords: Kampala Trauma Score(KTS), Trauma Injury Severity Score(TRISS), Rural, Trauma, Mortality.

Introduction

Trauma is one of the leading causes of mortality and morbidity worldwide. The mechanism of trauma is classified as either blunt or penetrating. Fifty percent of deaths occur within minutes of injury, resulting from massive bleeding or severe neurologic damage.[1] Predicting survival following injury is a fundamental issue in trauma research. If correct, such predictions enable valid comparisons of outcomes between alternative therapies, institutions, and trauma systems.[2] Trauma scores were created to describe the severity of injuries or a patient's prognosis with a single number value. These triage scores could potentially be used to set standards and procedures for the care process.[3] Multiple injury scoring systems have been used in high-income countries (HICs) since the 1970s for triage, injury description and outcome, and mortality prediction, such as injury severity score(ISS), revised trauma score (RTS), and the trauma and injury severity score (TRISS).[4-5] Mature trauma systems in North America, Europe, and Australia have proven to save lives and reduce morbidity following severe trauma.[6]

Of the 4.4 million trauma-related deaths, unintentional injuries take the lives of 3.16 million people yearly, and violence-related injuries kill 1.25 million people annually. Roughly one in three deaths result from road traffic crashes, one in six from suicide,

one in ten from homicide, and 1 in 61 from war and conflict.[7] Economic growths in Low and Middle-Income Countries (LMICs) is associated with a rapidly growing trauma burden, with projections that Road Traffic Collisions will be the third leading cause of death globally by 2030.[8] India has one-sixth (16%) of the world's population but more than one-fifth (21%) of the world's trauma mortality.[9]

Early presentation to the hospital is unusual after traumatic injury, and diagnostic imaging remains scarce, worsening the prognosis in LMICs. RTS is the current standard physiologic scoring used in a trauma setting and research in HICs and LMICs, which is based on physiologic parameters of systolic blood pressure (SBP), respiratory rate (RR), and Glasgow coma scale (GCS).[10] As compared to HICs, in-hospital trauma mortality is higher in LMICs. The scoring systems used in quantifying the severity of the injury in HIC settings have been dependent upon anatomical measures, while those in LMICs have relied more on physiological measures. The anatomical scoring systems depend upon imaging technologies, such as Computed Axial Tomography (CT) scans, pre-hospital care, access to surgical intervention, intraoperative documentation quality, and autopsy reports, which may be unavailable in many LMIC trauma care facilities, thus preventing the accurate calculation of ISS.[11-12]

The trauma and injury severity score (TRISS), introduced in 1981, is a combination index based on Trauma Score (RTS), Injury Severity Score (ISS), and patient's Age. Champion et al. (1981) showed that the physiological index, anatomic index, and age are powerful predictors of outcomes in trauma patients.[13] The TRISS is the most widely used tool to predict the outcome of trauma patients. These include careful consideration of the missing data [14], recalibration of the variables and co-variables [15], and using new or modified scores such as the New Injury Severity Score (NISS).[16] Taking all these together, the TRISS model is still the most commonly used tool for determining the outcome of trauma patients worldwide.[17]

The Kampala Trauma Score (KTS) was developed and tested in 2000 by Kobusingye and Lett to create an injury severity score for resource-limited settings that require minimal data collection and recording. KTS—which relies on a patient's number of serious injuries, Age, systolic blood pressure, respiratory rate, and neurologic status—was highly predictive of the need for admission or death.[18] KTS has been highlighted in several articles as a viable, validated alternative that predicts mortality similarly to RTS and ISS. [18-20] A systematic review on the feasibility, appropriateness, and applicability of trauma scoring systems in low and middle-income countries reported that among the studies that evaluated the predictive performance of KTS 68% said it to be among the main predictors of mortality.[21-22, 11, 18, 23-27] Gardner and Weeks from their studies noted that KTS equally predicted mortality compared with other scores, such as RTS, ISS, AIS, TRISS, and GCS.[22,11]

Objectives of Study:

· Studying and calculating the scores of trauma patients using the TRISS trauma scoring system and the Kampala Trauma Scoring system

· Comparing and correlating the outcome (mortality) of the trauma patients between the two scoring systems.

Methods

Study site: This study was conducted in the Department of General Surgery at Sri Devaraj Urs Medical College Tamaka, Kolar, India, and it is attached to the teaching hospital R L Jalappa Hospital, Tamaka, Kolar, Karnataka, India.

Study population: All patients presented with trauma during the study period of December 2020 and August 2022 following various mechanisms of injury admitted as an inpatient, treated in RL JALAPPA Hospital, and followed up till the 30th post-trauma day were considered the study population.

Study design: The current study was a prospective descriptive cohort study

Sample size: 285

The sample size was calculated assuming the difference to be tested between the diagnostic accuracy of two tests using area Under the ROC curve (AUC). The AUC of TRISS and KTS was considered as 0.82 and 0.74 as per the reference study by Roy N et al.1. The other parameters considered for sample size calculation were 80% power of the study, two-sided alpha error of 0.1, correlation in outcome positive and negative groups as 0.7 and 0.5 respectively. The approximate proportion of outcome positive and negative groups was considered as 1:4. Sample size was calculated using Medcalc statistical software after

feeding the above parameters. 2 The required sample size as per the above calculation was 285. A single simple formula cannot be provided for this study.

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size was reached.

Study duration: The data collection was done between December 2020 and August 2022 for one year and 6months.

Inclusion Criteria:

1.All patients of age group > 12 years. 2. All patients with a history and clinical evidence of trauma

Exclusion criteria:

1. The patient was brought to the hospital after 24hrs of the occurrence of the injury

2. Patient is treated on an OPD basis.

Data collection tools: All the relevant parameters were documented in a structured study proforma.

Source of Data: All patients above 12 years with trauma treated in the RL JALAPPA Hospital between the study periods of December 2020 and august 2022.

Collection of data: All patients who were suspected of having trauma were scored using TRISS and KAMPALA SCORES at the time of arrival, and clinical assessment, relevant blood investigations, and radiological investigations were done in the emergency department at the time of presentation and repeated after 24hrs in R L Jalappa Hospital by the primary investigator under the guidance of the consultant. The follow-up for mortality till the 30th post-trauma day was recorded. The primary outcome of interest was in-hospital mortality till the 30th post-trauma day. The mortality was classified as follows:

1. Mortality within 24 hours of admission 2. Mortality between 24 h and seven days 3. Mortality between 7 and 30 days.

Each specific factor, including Age, sex, injury, and pre-hospital treatment factors such as transfer status, mode of transport, and mechanism of injury, were collected and analyzed. Physiological parameters at the time of initial assessment were recorded. Chest X-ray, CT scan, USG abdomen and pelvis, and blood investigation were done when indicated.

Analysis & Statistical Methods:

'X' was considered the Primary variable; 'Y' was regarded as the Secondary outcome variable; 'Z' was considered the Primary explanatory variable.

Descriptive analysis was carried out by mean and standard deviation for quantitative variables and frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagrams, pie diagrams, and cluster bar charts. Categorical outcomes were compared between study groups using the Chi-square test. Mortality was considered the gold standard. Trauma injury severity score (Baseline) and Kampala trauma score (Baseline) was considered a screening test. The sensitivity, specificity, predictive values, and diagnostic accuracy of the screening test, along with their 95% CI, were presented. P value < 0.05 was considered statistically significant. Data were analyzed using coGuide software: BDSS Corp. Released 2020—coGuide Statistics software, Version 1.0, India: BDSS Corp.

Results

A total of 285 subjects were included in the final analysis.

Among the study population, 31 (10.88%) participants were aged less than equal to 20 years, 88 (30.88%) were aged between 21 to 30 years, 70 (24.56%) were aged between 31 to 40 years, 55 (19.30%) were aged between 41 to 50 years, 25 (8.77%) were in 51 to 60yrs and 16 (5.61%) were of more than 60 years' age.

Most trauma cases were in the age group between 21 and 30 years (Table 1).

Table 1: Descriptive analysis of Age in the study population (N=285).

Age	Frequency	Percentage
<=20 years	31	10.88%
21-30 years	88	30.88%
31-40 years	70	24.56%
41-50 years	55	19.30%
51-60 years	25	8.77%
>60 years	16	5.61%

Among the study population, mortality was noted in 8 (38.10%) participants within <=24 Hrs, in 7 (33.33%) in 1-7 days and in 6 (28.57%) in 8-30 days.

Mortality pertaining to trauma more death were before 24hrs after occurrence of trauma (Table 2).

The Trauma injury severity score (TRISS) (Baseline) had a sensitivity of 85.71% (95% CI 63.66% to 96.95%) in predicting Mortality. Specificity was 85.61% (95% CI 80.78% to 89.61%), false positive rate was 14.39% (95% CI 10.39% to 19.22%), FNR was 14.29% (95% CI 3.05% to 36.34%), PPV was 32.14% (95% CI 20.29% to 45.96%), probability of not an actual disease (NPV) was 98.69% (95% CI 96.22% to 99.73%), and the total diagnostic accuracy was 85.61% (95% CI 80.99% to 89.47%) (Table 3).

Table 2: Descriptive analysis of Mortality Time in the study population (N=21).

Mortality Time	Frequency	Percentage
<=24 Hrs	8	38.10%
1-7 days	7	33.33%
>7 days	6	28.57%

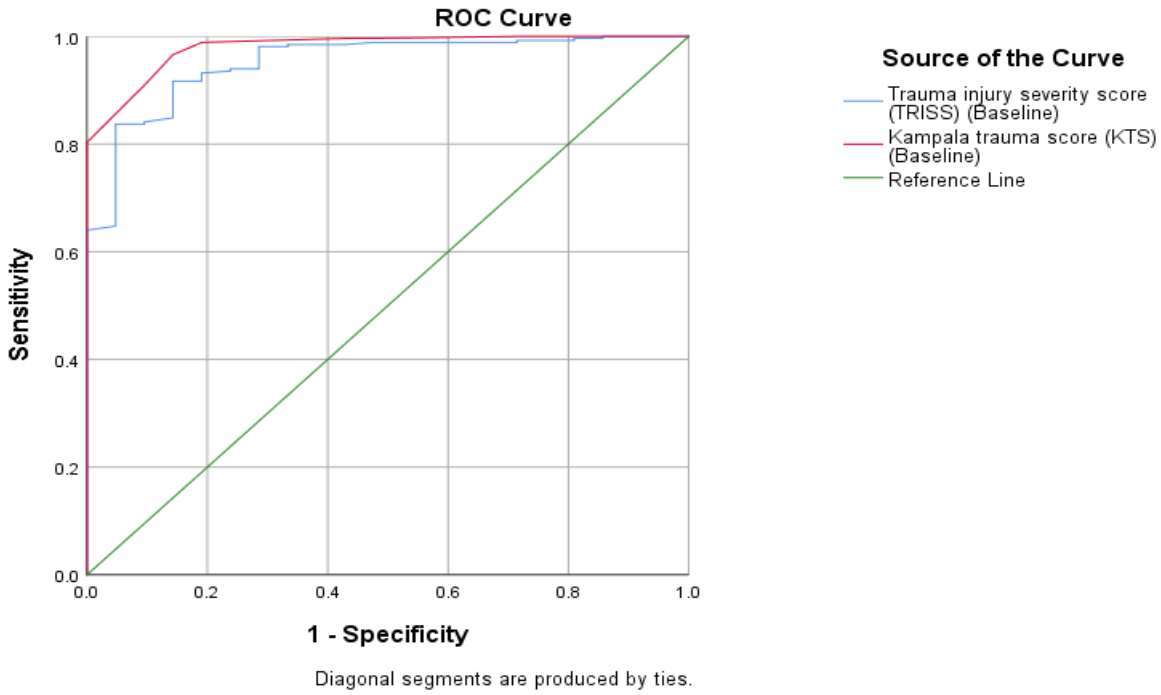

Figure 1: Receiver operating curve for base line KTS and TRISS in predicting Mortality (N=285).

Table 3: Predictive validity of Trauma injury severity score (TRISS) (Baseline) in predicting Mortality (N=285).

Parameter	Value	95% CI	
		Lower	Upper
Sensitivity	85.71%	63.66%	96.95%
Specificity	85.61%	80.78%	89.61%
False positive rate	14.39%	10.39%	19.22%
False negative rate	14.29%	3.05%	36.34%
Positive predictive value	32.14%	20.29%	45.96%
Negative predictive value	98.69%	96.22%	99.73%
Diagnostic accuracy	85.61%	80.99%	89.47%

The Kampala trauma score (KTS) (Baseline) had a responsiveness of 90.48% (95% CI 69.62% to 98.83%) in predicting Mortality. Precision was 90.91% (95% CI 86.78% to 94.09%), false positive rate was 9.09% (95% Confidence interval 5.91% to 13.22%), (FNR) false negative rate was 9.52% (95% CI 1.17% to 30.38%), (PPV) probability of actual disease was 44.19% (95% CI 20.08% to 60.12%), probability of not a real disease was 99.17% (95% CI 97.05% to 99.90%), and the total diagnostic accuracy was 90.88% (95% Confidence interval 86.92% to 93.95%) (Table 4).

The Trauma injury severity score (TRISS) (After 24 Hrs) had a responsiveness of 92.31% (95% confidence interval 63.97% to 99.81%) in predicting Mortality. Precision was 91.67% (95% confidence interval 87.66% to 94.70%), false positive rate was 8.33% (95% CI 5.30% to 12.34%), FNR was 7.69% (95% CI 0.19% to 36.03%), PPV was 35.29% (95% CI 19.75% to 53.51%), probability of not an actual disease was 99.59% (95% confidence interval 97.73% to 99.99%), and the total diagnostic accuracy was 91.70% (95% CI 87.80% to 94.66%) (Table 5).

The Kampala trauma score (KTS) (After 24 Hrs) had a responsiveness of 92.31% (95% confidence interval 63.97% to 99.81%) in predicting Mortality. Precision was 92.05% (95% CI 88.10% to 95.01%), the false positive rate was 7.95% (95% CI 4.99% to 11.90%), false negative rate (FNR) was 7.69% (95% Confidence interval 0.19% to 36.03%), PPV was 36.36% (95% CI 20.40% to 54.88%), probability of not an actual disease was 99.59% (95% confidence interval 97.74% to 99.99%), and the total diagnostic accuracy was 92.06% (95% CI 88.22% to 94.96%) (Table 6).

Table 4: Predictive validity of Kampala trauma score (KTS) (Baseline) in predicting Mortality (N=285).

Parameter	Value	95% CI	
		Lower	Upper
Sensitivity	90.48%	69.62%	98.83%
Specificity	90.91%	86.78%	94.09%
False positive rate	9.09%	5.91%	13.22%
False negative rate	9.52%	1.17%	30.38%
Positive predictive value	44.19%	29.08%	60.12%
Negative predictive value	99.17%	97.05%	99.90%
Diagnostic accuracy	90.88%	86.92%	93.95%

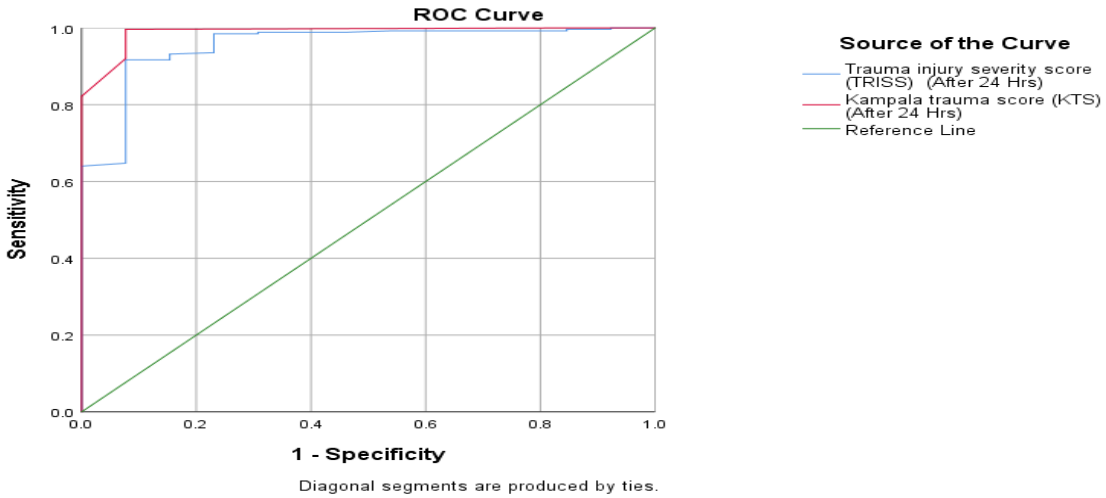

Figure 2: Receiver operating curve for After 24 Hrs KTS and TRISS in predicting Mortality (N=277).

Table 5: Predictive validity of "Trauma injury severity score (TRISS)" (After 24 Hrs) in Mortality prediction (N=277).

Parameter	Value	95% Confidence interval	
		Lower	Upper
Sensitivity	92.31%	63.97%	99.81%
Specificity (true negative rate)	91.67%	87.66%	94.70%
False positive rate	8.33%	5.30%	12.34%
False negative rate	7.69%	0.19%	36.03%
Positive predictive value	35.29%	19.75%	53.51%
Negative predictive value	99.59%	97.73%	99.99%
Diagnostic accuracy	91.70%	87.80%	94.66%

Table 6: Predictive validity of Kampala trauma score (KTS) (After 24 Hrs) in Mortality prediction (N=277).

Parameter	Value	95% CI	
		Lower bound	Upper bound
Sensitivity (true positive rate)	92.31%	63.97%	99.81%
Specificity (True negative rate)	92.05%	88.10%	95.01%
False positive rate	7.95%	4.99%	11.90%
False negative rate	7.69%	0.19%	36.03%
Positive predictive value	36.36%	20.40%	54.88%
Negative predictive value	99.59%	97.74%	99.99%
Diagnostic accuracy	92.06%	88.22%	94.96%

Discussion

Trauma is a pervasive health concern that most likely has a massively higher force in less and medium economy nations". Disability & death from trauma are mostly attributable to the injuries' severity.[19] Several grading techniques have been developed to compute an accurate probability of death due to trauma. Diverse results were used to evaluate the precision of trauma ratings, with variable results. For example, "ISS" forecasted hospitalization more severely than "TRISS and RTS." It also showed subject fatality in incidences of bullet wounds. The "Trauma and Injury Severity Score (TRISS)" is a complex "trauma score" advanced through the "coefficients from the Major Trauma Outcome Study." The "RTS," "ISS," and measurement of age are used.[5] The aggregated trauma score called KTS was developed by "Kobusingye and Lett" .[18] This research analyzes the precision of KTS to that of TRISS, a more extensively utilized trauma scoring system, for patients admitted as inpatients at R.L. Jalappa Hospital with trauma. The major result of concern is death. The screening tests are TRISS and KTS at baseline and after 24 hours.

The overall result included 285 participants, of which 10.88% were under the age of 20, 30.88% were aged between 21 and 30, 24.56% were from the age ranges of 31 and 40, 19.30 percent were aged between 41 and 50, 8.77 percent were between the age ranges of 51 and 60, and 5.61 percent were over 60. The research featured an 84.91% male population and a 15.09% female population. In the study by Mukonkole et al., the average age of the subjects was 28 years, and 83.6% were men. Patients' mean lifespan varied from 18 to 65 in the Akay et al. study, with 4.1% being below 18 and 25.8% over 65; men made up 62.9 percent of the population, with an average lifespan of 45.8 years (Table 7,8). Following the Ariaka et al. study, the 18 to 34 age range generated the most incidences with 67.9 percent, trailed by the 35-50 and >50 age range with 25.3 percent and 6.8 percent, respectively. Furthermore,

the survey included 78.4 percent men and 21.6 percent women.[29]

Table 7: Receiver operating curve for KTS and TRISS in predicting Mortality across studies.

Study	TRISS	KTS
Current study	0.955	0.989
Hung et al.[23]	0.895	0.871
Roy et al.[30]	0.82	0.75
Week et al. [11]		0.77

Table 8: Predictive validity of TRISS and KTS in predicting mortality across studies.

Study	TRISS		KTS	
	Sensitivity	Specificity	Sensitivity	Specificity
Current	92.31%	91.67%	92.31%	92.05%
Mukonkole et al.			83.7%	82.2%
Ariaka et al.[29]			75.45%	74.68%
Aspelund et al.	80%	69%	90%	51%

This study tests the injury scoring system Kampala Trauma Score and Trauma Injury Severity Score in Indian trauma patients in rural setups. The main finding was that the Kampala Trauma Score was better at predicting mortality than TRISS and had better diagnostic accuracy than the TRISS, as described in the results above. KTS is cheaper, involves fewer variables than TRISS, and can be calculated upon patient arrival. However, TRISS can be calculated after a detailed clinical examination, and findings are more complex and require expertise.

The patient's blood pressure, pulse rate, saturation, respiratory rate, and GCS were recorded on arrival and repeated after 24 hours. Early mortality was predicted based on the initially assessed score in the trauma patient. For the calculation of TRISS, detailed investigations are required, like a CT scan and MRI, to determine the severity of the injury and the analysis of the final score. TRISS was introduced in the USA for trauma patients and is not applicable in lower and mid-income countries (LMIC). KTS was introduced for lower-middle-income countries to determine mortality in trauma patients. Trauma is one of the leading causes of death worldwide. In LMIC, KTS can be used to strengthen trauma systems. Thirty-seven studies showed that the KTS system's ability to predict outcomes such as mortality was superior to another scoring system. Over 80% of these studies reported the KTS was special than the more complicated scores at predicting mortality.[28]

There were limitations for this study as the data collected at the time of arrival may be diverse as the pre-hospital transport and medical support during transport or after the trauma is still not as appropriate and advanced as compared to the High-income countries and the many critical steps which might be required to save the patient immediately after trauma may be delayed which might lead to their demise.

Conclusion

Kampala Trauma Scoring System is better at predicting mortality than the Trauma Injury Severity Scoring system in trauma patients. It predicted early and late mortality better with better diagnostic accuracy than the TRISS. KTS is a simple scoring system compared to TRISS as the calculation is less complex than TRISS and is more suitable for low-middle income countries. It is a beneficial trauma scoring system that can be used in resource-limited settings.

Acknowledgments

Not applicable.

Conflict of Interest Disclosures

None.

Funding Sources

None.

Authors' Contributions

All the authors contributed in designing, collecting, analyzing editing the final manuscript.

Ethical Statement

The study was approved by Institutional Human Ethics Committee. Informed written consent was obtained N0. SDUMC/KLR/IEC/618/2020-21 from all the study participants, and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study

and the voluntary nature of participation were explained to the participants before obtaining consent. The confidentiality of the study participants was maintained.

References

1. Maerz LL et.al. Trauma. Int Anesthesiology Clin. 2009;47(1):25-36.

2. Osler TM, Rogers FB, Badger GJ, Healey M, Vane DW, Shackford SR. A Simple Mathematical Modification of TRISS Markedly Improves Calibration. J Trauma Acute Care Surg. 2002;53(4). Available from: https://journals.lww.com/jtrauma/Fulltext/2002/10000/A_Simple_Mathematical_Modification_of_TRISS.2.aspx

3. Lefering R. Trauma scoring systems. Curr Opin Crit Care. 2012;18(6):637-640.

4. Champion Hr, Sacco Wj, Copes Ws, Gann Ds, Gennarelli Ta, Flanagan Me. A Revision of the Trauma Score. J Trauma Inj Infect Crit Care. 1989;29(5):623-629.

5. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma. 1987;27(4):370-378. Available from: http://www.ncbi.nlm.nih.gov/pubmed/3106646

6. Mock C, Joshipura M, Arreola-Risa C, Quansah R. An Estimate of the Number of Lives that Could Be Saved through Improvements in Trauma Care Globally. World J Surg. 2012;36(5):959-963.

7. World Health Organization (WHO). Injuries and Violence.; 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/injuries-and-violence

8. Wong EG, Gupta S, Deckelbaum DL, Razek T, Kamara TB, Nwomeh BC, et al. The International Assessment of Capacity for Trauma (INTACT): an index for trauma capacity in low-income countries. J Surg Res. 2014;190(2):522-527.

9. Roth GA, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2018;392(10159):1736-1788.

10. Manoochehry S, Vafabin M, Bitaraf S, Amiri A. A Comparison between the Ability of Revised Trauma Score and Kampala Trauma Score in Predicting Mortality; a Meta-Analysis. Arch Acad Emerg Med. 2019;7(1): e6. Available from: http://www.ncbi.nlm.nih.gov/pubmed/30847441

11. Weeks SR, Juillard CJ, Monono ME, Etoundi GA, Ngamby MK, Hyder AA, et al. Is the Kampala Trauma Score an Effective Predictor of Mortality in Low-Resource Settings? A Comparison of Multiple Trauma Severity Scores. World J Surg. 2014;38(8):1905-1911.

12. Laytin AD, Kumar V, Juillard CJ, Sarang B, Lashoher A, Roy N, et al. Choice of injury scoring system in low- and middle-income countries: Lessons from Mumbai. Injury. 2015;46(12):2491-2497.

13. Champion Hr, Sacco Wj, Carnazzo Aj, Copes W, Fouty Wj. Trauma score. Crit Care Med. 1981;9(9):672-676.

14. Schluter PJ, Nathens A, Neal ML, Goble S, Cameron CM, Davey TM, et al. Trauma and Injury Severity Score (TRISS) Coefficients 2009 Revision. J Trauma Inj Infect Crit Care. 2010;68(4):761-770.

15. Schluter PJ. Trauma and Injury Severity Score (TRISS): Is it time for variable re-categorizations and re-characterizations? Injury. 2011;42(1):83-89.

16. Osler T, Baker SP, Long W. A Modification of the Injury Severity Score That Both Improves Accuracy and Simplifies Scoring. J Trauma Inj Infect Crit Care. 1997;43(6):922-926.

17. Mohtasham-Amiri Z. Comparison of Revised Trauma Score, Injury Severity Score, and Trauma and Injury Severity Score for Mortality Prediction in Elderly Traumatic Patients. Turkish J Trauma Emerg Surg. Published online 2016.

18. Kobusingye OC, Lett RR. Hospital-Based Trauma Registries in Uganda. J Trauma Inj Infect Crit Care. 2000;48(3):498-502.

19. Haagsma JA, Charalampous P, Ariani F, Gallay A, Moesgaard Iburg K, Nena E, et al. The burden of injury in Central, Eastern, and Western European sub-region: a systematic analysis from the Global Burden of Disease 2019 Study. Arch Public Heal. 2022;80(1):142.

20. Owor G, Kobusingye OC. Trauma registries as a tool for improved clinical assessment of trauma patients in an urban African hospital. East Cent African J Surg. 2001;6(1).

21. Feldhaus I, Carvalho M, Waiz G, Igu J, Matthay Z, Dicker R, et al. The feasibility, appropriateness, and applicability of trauma scoring systems in low and middle-income countries: a systematic review. Trauma Surg Acute Care Open. 2020;5(1): e000424.

22. Gardner A, Forson PK, Oduro G, Stewart B, Dike N, Glover P, et al. Diagnostic accuracy of the Kampala Trauma Score using estimated Abbreviated Injury Scale scores and physician opinion. Injury. 2017;48(1):177-183.

23. Hung YW, He H, Mehmood A, Botchey I, Saidi H, Hyder AA, et al. Exploring injury severity measures and in-hospital mortality: A multi-hospital study in Kenya. Injury. 2017;48(10):2112-2118.

24. Haac B, Varela C, Geyer A, Cairns B, Charles A. The Utility of the Kampala Trauma Score as a Triage Tool in a Sub-Saharan African Trauma Cohort. World J Surg. 2015;39(2):356-362.

25. Chalya PL, Mabula JB, Giiti G, Chandika AB, Dass RM, Mchembe MD, et al. Splenic injuries at Bugando Medical Centre in northwestern Tanzania: a tertiary hospital experience. BMC Res Notes. 2012;5(1):1-9.

26. Boniface R, Museru L, Kiloloma O, Munthali V. Factors associated with road traffic injuries in Tanzania. Pan Afr Med J. 2016;23.

27. MacLeod JBA, Kobusingye O, Frost C, Lett R, Kirya F, Shulman C. a Comparison of the Kampala Trauma Score (KTS) with the Revised Trauma Score (RTS), Injury Severity Score (ISS), and the TRISS Method in a Ugandan Trauma Registry. Eur J Trauma. 2003;29(6):392-398.

28. Rosenkrantz L, Schuurman N, Hameed MS, Boniface R, Lett R. The Kampala Trauma Score: A 20-year track record. J Trauma Acute Care Surg. 2022 Jun 1;92(6): e132-e138. doi: 10.1097/TA.0000000000003567. Epub 2022 Feb 21. PMID: 35195097.

29.Ariaka H, Kiryabwire J, Hussein S, Ogwal A, Nkonge E, Oyania F. A Comparison of the Predictive Value of the Glasgow Coma Scale and the Kampala Trauma Score for Mortality and Length of Hospital Stay in Head Injury Patients at a Tertiary Hospital in Uganda: A Diagnostic Prospective Study. Pesavento T, ed. Surg Res Pract. 2020; 2020:1-9.

30.Roy N, Gerdin M, Schneider E, Kizhakke Veetil DK, Khajanchi M, Kumar V, et al. Validation of international trauma scoring systems in urban trauma centres in India. Injury. 2016;47(11):2459-2464