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Best Trauma Assessment System for Trauma Patients in Papua, Indonesia

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A B S T R A C T

Indonesia's economic growth increases work and transportation accidents. In 2018, Riskesdas reported 10.1% injury prevalence in Papua Province, compared to 9.2% nationally. To reduce trauma-related disability and death, an ideal trauma assessment system needs to assess trauma severity, predict patient prognosis, and improve reaction time and decision-making. The combined trauma scoring system was established to solve the shortcomings of the anatomical and physiological scoring systems This study aims compared TRISS and ASCOT's trauma patient mortality prediction accuracy. The study's design is an observational, retrospective, analytic investigation. Systematic sampling yielded 269 trauma patient reports. Statistical evaluation utilizing the Receiver Operating Characteristics (ROC) and Area Under the Curve (AUC) diagnostic tests. The results indicated that the accuracy of TRISS in predicting mortality in trauma patients had an AUC value of 0.90 (strong), p=0.000, 92% sensitivity and 76% specificity, with a sensitivity of 92% and a specificity of 76%. The AUC value for ASCOT's ability to predict mortality in trauma patients is 0.93 (very strong), p=0.000, with 96% sensitivity and 82% specificity. ASCOT predicts mortality in trauma patients more accurately than TRISS.

Kata kunci:

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A B S T R A K

Perkembangan industri dan perekonomian yang terus meningkat di Indonesia berbanding lurus dengan peningkatan kasus kecelakaan kerja dan transportasi. Riskesdas melaporkan prevalensi cedera pada tahun 2018 di Provinsi Papua cukup tinggi yakni 10,1% dari rerata nasional 9,2%. Sangat penting untuk membangun sistem penilaian trauma yang ideal, yang dapat dimanfaatkan untuk mengukur keparahan trauma, memprediksi prognosis pasien, peningkatan respon time dan pengambilan keputusan agar dapat meminimalisir kecacatan bahkan kematian akibat trauma. Sistem penilaian trauma kombinasi merupakan kombinasi sistem penilaian anatomis dan fisiologis, yang disusun untuk mengatasi kekurangan kedua sistem penilaian trauma yang sudah ada sebelumnya. Tujuan penelitian ini untuk mengetahui perbandingan efektivitas sistem penilaian kombinasi yakni TRISS dan ASCOT dalam memprediksi mortalitas pada pasien trauma. Desain penelitian secara observasional analitik dengan pendekatan retrospektif study. Jumlah sampel 269 rekam medis pasien trauma yang diambil secara purposive sampling. Analisis statistik dengan uji diagnostik Receiver Operating Characteristics (ROC) dan Area Under the Curve (AUC). Hasil penelitian menunjukkan akurasi TRISS dalam prediksi mortalitas pasien trauma memiliki nilai AUC 0.90 (kuat), p=0.000, sensitivitas 92% dan spesifisitas 76%. Akurasi ASCOT dalam prediksi mortalitas pasien trauma memiliki nilai AUC 0.93 (sangat kuat), p=0.000, sensitivitas 96% dan spesifisitas 82%. ASCOT lebih baik memprediksi mortalitas pada pasien trauma dibandingkan TRISS

INTRODUCTION

The prevalence of trauma is significantly increased in emerging nations as a result of the increasing usage of motor vehicles, which causes an increase in traffic accidents (Gunawan et al., 2018). The high number of trauma cases in developing nations is influenced by a number of factors, including the limited number of trauma case service centers, the limited number of trained medical professionals, and the lack of experience among medical personnel in the use of instruments for trauma assessment (Jung et al., 2016). Indonesia is one of the development countries, and the growth in occupational and transportation accidents is related to the expansion of industry and the economy (Alfiansah et al., 2020). Based on a comparison of the results of Riskesdas 2007, 2013, and Riskesdas 2018, the prevalence of reported injuries in Indonesia increased from 7.5% to 8.2% and then to 9.0% (Tim Riskesdas, 2019).

The World Health Organization (WHO) reports that at least five million deaths occur annually from trauma, with 90% of these mortality happening in emerging nations (Perez et al., 2022; Rikken et al., 2022). In 2018, Indonesia ranked fifth in the world for the number of traffic-related deaths resulting from trauma, with 31,282 victims (Hulwah et al., 2021). The increased death rate due to trauma may be the result of less rapid and effective care for trauma patients. Although triage assessment in emergency services tries to determine the patient's state and care priorities, it is not uncommon for nurses to make errors in triage assessment (Gustia & Manurung, 2018). According to the findings of Evie, Wihastuti, and Suharsono's study, at the emergency room of Type C Hospital Malang, 27 (77.1%) of the 35 nurse respondents were not qualified to do triage (Evie et al., 2016). Herawati, Gustina, and Utami (2019) report that at the emergency room of Lembang Regional Hospital, 55% of nurses perform triage correctly, whereas 45% of nurses perform it poorly (over triage or under triage assessment). Considering it has the ability to measure the severity of trauma and predict patient prognosis, it is crucial to create and employ an optimal and consistent trauma assessment system during the implementation of triage (Jung et al., 2016).

The purpose of trauma assessment systems is to quantify the severity of injuries in order to estimate the chance of survival (Camilo et al., 2016). There are three types of trauma assessment systems, the first of which is based on damage description and anatomy, including the Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), and Anatomy Profile (AP). The second type is based on the physiology of observation and evaluation of vital signs, such as the Revised Trauma Score (RTS) and the Glasgow Coma Scale (GCS), to detect physiological damage due to injury. The third type combines anatomical and physiological evaluation methods, such as Trauma and Injury Severity Score (TRISS) and A Severity Characterization of Trauma scoring systems (ASCOT). The combination type in the claim was created to overcome the inadequacies of both previous scoring systems (Sahin & Batln, 2020).

Research on the effectiveness of the TRISS assessment system has been conducted frequently, whereas research on the usefulness of the ASCOT trauma assessment system is quite uncommon. Several countries in Western Europe, Eastern Europe, Australia, and South Africa have examined the ASCOT effectiveness assessment (de Munter et al., 2017). To the extent that researchers have found related to ASCOT effectiveness assessment except for research in Taiwan and in Iran, there are no other studies conducted in other Asian developing countries. On the basis of the previous description, the researcher deemed it necessary to conduct research on the TRISS and ASCOT trauma assessment system using the population of Indonesia, as one of the developing countries in Asia with a population (race and characteristics) distinct from that of the United States and Europe.

Indonesia is an island nation comprised of provinces. Papua is one of Indonesia's 34 provinces (Kemenkes RI, 2021). Papua province is located in Indonesia's eastern region. The prevalence of injuries in Papua province is significantly higher than the national average of 9.2%, at 10.1%. The majority of reported occurrences of injury happened in the house (49.7%) and on roadways (20%), among those aged 75 and older and those aged 15 to 24 years (Tim Riskesdas Papua, 2019). This study aims to determine the comparison of the effectiveness of TRISS assessment system with ASCOT in predicting mortality in trauma patients in Papua Indonesia.

METHODS

Participant characteristics and research design

This study employed an observational analytic technique and a retrospective study design. This study used the medical records of trauma patients treated in the emergency room of Yowari hospital, Jayapura regency, Papua, between March 2021 and March 2022. The inclusion criteria were as follows: 1) medical record data of trauma patients who received treatment at the YOWARI hospital emergency room from March 2021 to March 2022; 2) trauma patients with an AIS score of 1; 3) age of 15 years; and 4) complete patient medical record. Data including values for Glasgow Coma Scale (GCS), Systolic Blood Pressure (SBP), Respiratory Rate (RR), severity and location of trauma, type of trauma, age, patient condition 24 hours, 48 hours, 72 hours after treatment, and patient status after discharge from hospital (KRS). Exclusion criteria include medical records of patients with degenerative sequelae including pneumonia, coronary heart disease, hypertension, diabetes, cancer and stroke.

Sampling procedures

Samples were taken by purposive sampling method according to inclusion and exclusivity criteria that have been determined by the researcher.

Sample size, power, and precision

The population of this study was the medical records of trauma patients in the emergency room of Yowari Hospital, Jayapura regency, Papua in the period March 2021 to March 2022. The sample size was determined using the Isaac and Michael formula, the results of the sample amounted to 269 medical records of trauma patients.

Measures and covariates

The data were obtained by researchers from August 3 - September 9, 2022. The instrument employed in the form of observation sheet to summarize the data sample of trauma patient medical records. From the data acquired, the researchers then calculated the Predicted death rate (Pdr) TRISS score using the calculator application from the MDApp online website and the calculation of Predicted death rate (Pdr) ASCOT score using the calculator application from the

French Society of Anaesthesia Critical Care and Perioperative Medecine (SFAR) online website.

MDApp has 5 years of experience in creating applications as tools in the medical/clinic field with the aim of facilitating access to medical professionals and contributing to the improvement of clinical decision making. The French Society of Anaesthesia Critical Care and Perioperative Medicine (SFAR) is the largest community of Anaesthesiologists in France. SFAR in collaboration with the European Society of Anasthesiology and Intensive Care (ESAIC) and the World Federation of Societies of Anesthesiologists (WFSA) has issued guidelines, measurement tools, research support, and journals for anesthesiologists and nurses specializing in anesthesia, emergency and critical care.

Data analysis

Data analysis was performed using Receiver Operating Characteristics (ROC) and Area Under the Curve (AUC) diagnostic tests. Cut-off point, sensitivity and specificity of TRISS and ASCOT were determined using Youden Index (YI). Data analysis were analyzed with the aid of SPSS 26.0 program

RESULTS AND DISCUSSION

Table 1 demonstrates that the majority of trauma patients at ER Yowari hospital in Jayapura regency were male, including 194 respondents (72.1%), with the majority suffering blunt trauma, 208 respondents (77.3%) due to traffic accidents 162 respondents (60.2%). The condition of trauma patients who were respondents when the bulk of KRS were alive was 241 respondents (89.6%), with 162 respondents (60.2%) receiving 24-hour therapy.

Table 1. Characteristics of respondents by gender, type of Trauma, patient condition and length of treatment (n = 269)

Characteristics		f	%
Gender	Men	194	72.1
	Girls	75	27.9
Types of Trauma	Sharp	61	22.7
	Blunt	208	77.3
Patient Condition	Life	241	89.6
	Died	28	10.4
Duration of Treatment	24 hours	162	60.2
	48 hours	16	5.9
	72 hours	28	10.5
	> 72 hours (KRS)	63	23.4
Causes of Trauma	Traffic Accident	162	60.2
	Fall	28	10.4
	Hardness	37	13.8
	Work Accident	28	10.4
	Animal Bites	9	3.3
	Thermal	5	1.9

Table 2.
Characteristics of respondents by Age, GCS, Respirasi, Blood Pressure (Sistolik) TRISS and ASCOT Score

Characteristics	N	Mean	Median	Min-Max	SD
Age	269	29.07	25.00	16-65	12.099
GCS	269	12.49	14.00	3-15	3.418
Respirasi	269	14.87	16.00	8-31	3.238
Blood Pressure (Sistolik)	269	107,74	110,00	70-130	14.885

Table 2 demonstrates that, the average age of the responders is 29 years, with the youngest being 16 years old and the oldest being 65 years old. The average respondent had a GCS of 12-13, a breathing frequency of 14-15 times per minute, and a systolic blood pressure of 107-108 mmHg.

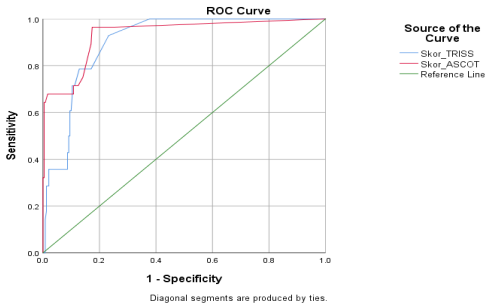

Figure 1. Kurva ROC TRISS dan ASCOT

Figure 1 illustrates the ROC TRISS and ASCOT mortality prediction curves for respondents. The area of the ASCOT Curve is bigger (away from the diagonal line / reference line) than the area of the TRISS Curve. Table 3 describes in detail the area under the curve (AUC) for TRISS and ASCOT.

Table 3. Description of TRISS and ASCOT Area Under Curve (AUC) Values

	AUC	Std. Error	P-Value	IK 95% LB	IK 95% UB
Score TRISS	0.903	0.021	0.000	0.861	0.944
Score ASCOT	0.933	0.026	0.000	0.881	0.984

Table 4. *Cut off Point*, Sensitivity and Specificity of TRISS and ASCOT

	Cut off Point	Sensitivitas	Spesifisitas
Score TRISS	2.50	0.929	0.768
Score ASCOT	2.50	0.964	0.826

Table 3 reveals that ASCOT has a value of p=0.000 and an AUC of 0.933, whereas TRISS has a value of p=0.000 and an AUC of 0.903. This explains why ASCOT has a significantly higher predictor/suspect mortality accuracy in trauma patients than TRISS.

According to Table 4, the cutoff value for the TRISS score is 2.50, with a sensitivity of 0.92 and a specificity of 0.76. A sensitivity rating of 0.92 suggests that 92% of trauma patients can be predicted to die based on the TRISS test. Specificity value of 0.76 suggests a 76% ability for TRISS to predict non-mortality (survival) in trauma patients. While the ASCOT score cutoff value is 2.50, it has a sensitivity of 0.96 and a specificity of 0.82. A sensitivity score of 0.96 suggests that ASCOT could predict mortality in trauma patients with an 96% accuracy rate. Specificity rating of 0.82 implies a 82% capacity for ASCOT to predict non-mortality (survival) in trauma patients.

This study revealed that the majority of patients who experienced trauma were male (72.1%), with a mean age of 29. According to Helen et al, trauma is more prevalent among men of reproductive age (75%). After enduring extreme trauma, some people develop mental and physical health conditions and a decline in quality of life. As most of them are permanently incapacitated, this might be a burden on society or government (Helen et al., 2022). According to the World Bank, the productive age is 15 to 64 years old (Zuhan et al., 2016). The third of the top five causes of death in people aged 5 to 29 years, according to the World Health Organization (WHO) in 2021, is injury due to road traffic, homicide, and suicide. High rates of injury among teens and young people in their productive years can be attributed to vehicle use and physical activity, and ignorance of traffic laws and the use of sharp objects is on the rise.

Traffic accidents became the highest cause of blunt trauma in most of the samples of this study. According to the Indonesian National Police Road Corps (Korlantas POLRI), the number of traffic accidents in Indonesia increased by an average of 3.30% per year between 2014 and 2018 (Hulwah et al., 2021). The high death rate in accidents, especially those involving two-wheeled vehicles, is a result of inadequate safety among motorists, especially those operating two-wheeled vehicles, and low awareness among two-wheeled motor vehicle users on the wearing of helmets. In Jayapura regency alone reported the proportion of habit of using a helmet while riding and riding a motorcycle that is always: 27.2%, sometimes: 34.0%, and never: 38.6% (Tim Riskesdas Papua, 2019).

Age, GCS value, respiration rate, and systolic blood pressure are factors that influence the patient's condition. In 2016, research conducted at the Sanglah Bali hospital found that age variables of over 60 years, hyperoxic circumstances, low GCS (3-5), and Traumatic Subarachnoid Hematome (SAH) can be risk factors for death within 14 days in head injury patients. Seliverstov and Shapkin argue that the mortality index of polytrauma patients is positively connected with age. In addition, the likelihood of mortality for trauma patients aged 55, 60, and 65 years is successively 41%, 31-50%, and 57%. Another study revealed that the greater the initial GCS score, the greater the TRISS value or the likelihood of survival for injured patients (Seliverstov & Shapkin, 2017).

The average respondent had a respiration rate between 14 and 15 times per minute. According to the findings of Saadat's research published in Santoso & Rahma, head injury patients with a respiration frequency of 25-30 x/min are 33% more likely to die than those with a respiration frequency of >40 x/min (Santoso & Rahma., 2020). There is a substantial correlation between respiratory diseases (both due to inhalation trauma, respiratory failure, and pulmonary trauma), burn area, sepsis, and patient age and death in burn patients, according to (Caesarani., 2019). Every 1% increase in oxygen saturation will be followed by a decrease in the risk of death by 8% (Arifiannoor et al., 2018). This may occur because the frequency of breathing influences oxygen saturation, tissue perfusion, and the brain's oxygen intake. The term for this situation is cerebral hypoxia. Lack of oxygen in brain tissue will result in anaerobic metabolism, which generates lactic acid as a waste product. Since the increase in lactic acid in the brain leads to the development of lactic acidosis, cerebral edema and an increase in ICT are the results. Thus, worsening the status of the majority of people with head injuries.

ASCOT had a stronger predictor than TRISS for predicting the mortality of trauma patients treated in the emergency department of Yowari Papua hospital. ASCOT has a predictor/suspect mortality accuracy that is very good (0.93) in trauma patients compared to TRISS, which has a predictor/suspect mortality accuracy that is good in trauma patients (0.90). The clinical sensitivity of ASCOT to predict the presence of death in trauma patients was 96%, as measured by the sensitivity value. Clinically, the ASCOT specificity value indicates a 82% capacity to predict no mortality (patient survival) in trauma patients. While the value of TRISS sensitivity demonstrated clinically TRISS's 92% capacity to predict mortality (patient death) in trauma patients, this value was not statistically significant. Clinically, the specificity value of TRISS shown a 76% ability to predict no mortality (patient survival) in trauma patients. The difference in the value of sensitivity and specificity of TRISS by 16 and the difference in the value of sensitivity and specificity of ASCOT 14. This demonstrates that ASCOT's capacity to forecast the presence of mortality (patients die) and the absence of mortality (patients live) is more evenly balanced than TRISS. For screening purposes, the chosen cut-off point should yield a greater sensitivity value, whereas for diagnostic reasons, the specificity value should be greater (Sastroasmoro & Ismael, 2014).

This study's findings are consistent with Hou and Tsai's assumption that ASCOT is superior to TRISS in predicting cases of serious head trauma. In addition, Hou and Tsai advocated for the use of ASCOT to predict the mortality of trauma patients in Taiwan (Hou & Tsai, 1996). Another study conducted in the Netherlands by Frankema et al, found that the ASCOT model was more accurate than TRISS in estimating survival probabilities, with the difference being most pronounced for trauma patients with predicted survival probabilities between 60 and 90% (Frankema et al., 2002). ASCOT has been utilized in triage, in assessing injury severity in trauma Resuscitation centers, and was deemed superior to other trauma assessment ratings in predicting death and morbidity in situations of blunt trauma (Alonge et al., 2021).

Numerous study have throughly investigated the effectiveness and limitations of the TRISS method, and it has been determined that TRISS has significant limitations in the treatment of severe trauma. The following system, ASCOT was designed to increase accuracy and reduce the frequency of TRISS faults (Seliverstov & Shapkin, 2017). Injury Severity Score (ISS) used in the assessment of trauma severity in TRISS has limits, mainly the collection of limited data and only taking the most severe injuries in each part of the body; hence, the ISS assessment should not be used when there are numerous injuries in one area of the body (Ristanto, 2017). ASCOT, which uses a different anatomical grading system

than TRISS, has demonstrated greater accuracy in assessing total injury severity (Lam et al., 2016).

A Severity Characterization of Trauma (ASCOT) scoring method, unlike TRISS, specifies five age groups and replaces the ISS component in TRISS with the Anatomy Profile (AP) parameter in the anatomical injury severity evaluation (Seliverstov & Shapkin, 2017). ASCOT incorporates an evaluation of injury severity by body area and an updated classification that takes the patient's age into consideration. In addition, it employs a distinct set of coefficients for blunt and penetrating damage (Camilo et al., 2016). ASCOT was more accurate at predicting survival than TRISS (Seliverstov & Shapkin, 2017). The most significant difference between ASCOT and TRISS is that ASCOT considers injuries to all traumatized body parts (Camilo et al., 2016). The AP assessment permits the evaluation of all trauma to a body location.

A Severity Characterization of Trauma (ASCOT) has a higher sensitivity than TRISS, but its computation process is significantly more complex (Seliverstov & Shapkin, 2017). Currently, ASCOT score computation may be performed using the calculator program located at the link https://sfar.org/scores2/ascot2.php. This is a medical application from the website of the French Society of Anaesthesia Critical Care and Perioperative Medicine (SFAR), the largest anesthesia and critical care community in France. SFAR collaborates actively with the European Society of Anaesthesiology and Intensive Care (ESAIC) and the World Federation of Societies of Anaesthesiologists (WFSA) to develop guidelines, measurement tools, research support, and journals for anaesthetists and nurses specializing in anaesthesia, emergency, and critical care. Therefore, it is certain that this calculator application is useful, as it has undergone testing.

LIMITATION OF THE STUDY

Limitations in this study included due to the retrospective study design (medical records), the researchers were unable to revalidate the data on GCS levels, respiration, and systolic blood pressure. In addition, the majority of trauma patients evaluated got advanced care in the intensive care unit (ICU) and surgical treatment rooms; hence, it cannot be ruled out that the patient's death was the result of trauma or care-related issues.

CONCLUSIONS AND SUGGESTIONS

This study concludes that the ASCOT trauma assessment system is superior to TRISS in predicting the mortality of trauma patients. ASCOT has a high predictor/suspect mortality accuracy (AUC = 0.93), 96% sensitivity, and 82% specificity. Health care professionals might utilize ASCOT to measure and acquire information on the state or degree of a patient's trauma. There is an increase in patient response time and decision making refer to the above type of hospital, to get a comprehensive and optimal examination and treatment. In addition, the results of the evaluation have the potential to improve efforts to prevent or reduce trauma-related mortality.

For further study, a bigger sample size, alternative techniques, and consideration of other variables that potentially influence trauma-related mortality could be utilized. Then, researchers could perform prospective research to conduct a direct evaluation and revalidation of the outcomes of the GCS, respiration, and blood pressure assessments (systolic).

ETHICAL CONSIDERATIONS

This study was conducted by upholding the principles and ethics of research. This study was conducted after obtaining ethical Clearance from the Health Research Ethics Commission of the Faculty of Health Sciences Universitas Brawijaya Malang with No. 3336 / UN10.F17. 10 / TU/2022. Protocol number: 22F171121065.

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Conflict of Interest Statement

The researcher stated that this study has no conflict of interest or ethical issues.

REFERENCES

Alfiansah, Y., Kurniawan, B., & Ekawati, E. (2020). Analisis Upaya Manajemen K3 Dalam Pencegahan Dan Pengendalian Kecelakaan Kerja Pada Proyek Konstruksi PT. X Semarang. Jurnal Kesehatan Masyarakat (Undip), 8(5), 595-600.

Alonge, O., Agrawal, P., Khatlani, K., Mashreky, S., Hoque, D. E. M., & Hyder, A. A. (2021). Developing a Systematic Approach for Population-based Injury Severity Assessment (PISA): A million-person survey in rural Bangladesh. BMJ Open, 11(5). https://doi.org/10.1136/bmjopen-2020-042572

Arifiannoor, R. T., Wahid, A., & Hafifah, I. (2018). Respiration Rate as An Outcome Predictor of Head Injuries Patients. Dinamika Kesehatan, 9(1), 681–689. https://ojs.dinamikakesehatan.unism.ac.id/index.php/dksm/article/view/316

Caesarani Kristel, N. (2019). Faktor Resiko Prediktif Angka Kematian pada Pasien Luka Bakar di Burn Centre RSUD Dr. Soetomo Surabaya (Doctoral dissertation, Universitas Airlangga).

Camilo, Restrepo-Álvarez, A., Valderrama-Molina, C. O., Giraldo-Ramírez, N., Constain-Franco, A., Puerta, A., León, A. L., & Jaimes, F. (2016). Revista Colombiana de Anestesiología Colombian Journal of Anesthesiology Trauma severity scores. Revi Colomb Anestesiol, 4(44), 317–323.

de Munter, L., Polinder, S., Lansink, K. W. W., Cnossen, M. C., Steyerberg, E. W., & de Jongh, M. A. C. (2017). Mortality prediction models in the general trauma population: A systematic review. Injury, 48(2), 221–229. https://doi.org/10.1016/j.injury.2016.12.009

Evie, S., Wihastuti, T, A., Suharsono, T. (2016) Analisis Faktor yang Berhubungan dengan Pelaksanaan Triase Perawat Pelaksana di Ruang IGD Rumah Sakit Tipe C Malang.Program Studi Magister Keperawatan Universitas Briwijaya. Jurnal Ilmiah Kesehatan Keperawatan, 12(3), 73-81

Frankema, S. P. G., Edwards, M. J. R., Steyerberg, E. W., & Van Vugt, A. B. (2002). Predicting Survival After Trauma: A Comparison of TRISS and ASCOT in the Netherlands. European Journal of Trauma, 28(6), 355–364. https://doi.org/10.1007/s00068-002-1217-9

Gunawan, B., Dumastoro, R., & Kamal, A. F. (2018). Trauma and Injury Severity Score in Predicting Mortality of Polytrauma Patients. EJournal Kedokteran Indonesia, 5(3), 161–168. https://doi.org/10.23886/ejki.5.8148.161-68

Gustia, M., & Manurung, M. (2018). Hubungan Ketepatan Penilaian Triase Dengan Tingkat Keberhasilan Penanganan Pasien Cedera Kepala Di IGD RSU HKBP Balige Kabupaten Toba Samosir. Jurnal Jumantik, 3(2), 98–114.

Helen, A., Rudiman, R., Suryani, M., Lukman, K., Wijaya, A., & Nugraha, P. (2022). Prediction of Mortality in Trauma Patients with Insufficient Training Data Using Deep Learning. International Journal on Electrical Engineering and Informatics, 14(2), 276–290. https://doi.org/10.15676/ijeei.2022.14.2.2

Herawati, T., Gustina, D. S., & Utami, D. S. (2019). Pelaksanaan Triage Oleh Perawat Di Instalasi Gawat Darurat RSUD Lembang. Jurnal Kesehatan Aeromedika, V, 59–64. https://jurnal.poltekestniau.ac.id/jka/article/view/22

Hou, L. F., & Tsai, M. C. (1996). Comparison between of TRISS and ASCOT methods--in Tainan area. Trauma and Injury Severity Score. A Severity Characterization of Trauma. The Kaohsiung journal of medical sciences, 12(12), 691-698.

Hulwah, K. N., Nugraheni, W. P., Bunga, A. S., Sari, K., Pujiyanto, P., & Hidayat, B. (2021). Hubungan Konsumsi Alkohol dengan Cedera Disebabkan Kecelakaan Lalu Lintas di Indonesia Tahun 2018. Buletin Penelitian Sistem Kesehatan, 24(1), 57–67. https://doi.org/10.22435/hsr.v24i1.3707

Jung, K., Lee, J. C.-J., Park, R. W., Yoon, D., Jung, S., Kim, Y., Moon, J., Huh, Y., & Kwon, J. (2016). The Best Prediction Model for Trauma Outcomes of the Current Korean Population: a Comparative Study of Three Injury Severity Scoring Systems. The Korean Journal of Critical Care Medicine, 31(3), 221–228. https://doi.org/10.4266/kjccm.2016.00486

Kemenkes RI. (2021). Profil Kesehatan Indonesia 2020. Jakarta: Kementerian Kesehatan RI.

Lam, S. W., Lingsma, H. F., van Beeck, E. F., & Leenen, L. P. H. (2016). Validation of a Base Deficit-Based Trauma Prediction Model and Comparison with TRISS and ASCOT. European Journal of Trauma and Emergency Surgery, 42(5), 627–633. https://doi.org/10.1007/s00068-015-0592-y

Perez, C. F., Xi, K., Simha, A., Shah, N. S., Huang, R. J., Palaniappan, L., Chung, S., Au, T., Sharp, N., Islas, N., & Srinivasan, M. (2022). Leading causes of death in Asian Indians in the United States (2005-2017). PLoS ONE, 17(8 August), 1–15. https://doi.org/10.1371/journal.pone.0271375

Rikken, Q. G. H., Chadid, A., Peters, J., Geeraedts, L. M. G., Giannakopoulos, G. F., & Tan, E. C. T. H. (2022). Epidemiology of penetrating injury in an urban versus rural level 1 trauma center in the Netherlands. Hong Kong Journal of Emergency Medicine, 29(1), 38–45. https://doi.org/10.1177/1024907920904190

Ristanto, R. (2017). Deskripsi Klien Cedera Kepala Yang Mengalami Trauma Mayor 1. Jurnal Kesehatan Hesti Wira Sakti, 31(1), 48–54.

Sahin, T., & Batln, S. (2020). A Descriptive Study of Orthopaedic Injuries Due to Parachute Jumping in Soldiers. BMC Emergency Medicine, 20(1), 1–12. https://doi.org/10.1186/s12873-020-00354-7

Santoso, B. R., & Rahma, M. (2020). Hubungan Tekanan Darah Sistolik Dan Frekuensi Napas Dengan Mortalitas Pada Pasien Cidera Kepala Di IGD. CNJ: Caring Nursing Journal, 4(1), 15-20.

Sastroasmoro, S., & Ismael, S. (2014). Dasar-dasar Metodologi Penelitian Klinis Ed 5. Jakarta: Sagung Seto

Seliverstov, P. A., & Shapkin, Y. G. (2017). Assessment of severity and prognosis of polytrauma outcome: The current state of the problem. Sovremennye Tehnologii v Medicine, 9(2), 207–216. https://doi.org/10.17691/stm2017.9.2.25

Tim Riskesdas. (2019). Laporan Nasional Riskesdas 2018. Jakarta: LPB

Tim Riskesdas Papua. (2019). Laporan Provinsi Papua Riskesdas 2018. Jakarta: LPB

WHO. (2021). Injuries and Violence. Tersedia online: https://www.who.int/news-room/fact-sheets/detail/injuries-and-violence

Zuhan, A., Rahman, H., & Januarman, J. (2016). Profil Penanganan Luka pada Pasien Trauma di Instalasi Gawat Darurat Rumah Sakit Umum Provinsi Nusa Tenggara Barat. Jurnal Kedokteran, 5(3), 21-24.