# Comparison of Triage Early Warning Score and the Modified Rapid Emergency Medicine Score in predicting outcome of trauma patients in the ER: A systematic Review

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**ABSTRACT**

**Introduction**

Trauma still one of the biggest causes of death in the world, trauma scoring is needed which can provide a quick and accurate assessment in the ER so as to reduce morbidity and mortality. TEWS and MREMS are two trauma scoring that departed from previous scoring modifications, both of which claim as the most effective scoring in predicting patient outcomes in the ER.

**Methods**

Analysis of journal articles was conducted by searching journal articles relevant with the purpose of the systematic review, from electronic databases. The review emphasized on articles covering Scoring MREMS and TEWS to obtain description how effective both scoring in predicting the outcome of trauma patients in the ER.

**Results**

Total journal articles in electronic database search were 13 articles, consisting of 8 Science Direct articles and 5 Proquest articles. Five journal articles indicated as similar papers were excluded and two journal articles also not involved because no full text manuscript provided. So that the remaining six journal articles were included in accordance with the inclusion criteria that has been outlined.

**Conclusion**

TEWS and MREMS are considered as the effective tools easy to use by health personnel in ERs, even by unexperienced health workers. Further study implementing both scores is essential to be conducted for obtaining detail comparison which scores is better applied in trauma population.

**Keywords**

TEWS; MREMS; Outcome; Patient Trauma; Emergency

## BACKGROUND

Trauma is the leading cause of death for individuals under the age of 45 years. In addition, the trauma resulting in morbidity, disability, and social and financial costs., Deaths from injuries are projected to increase from 5.1 million to 8.4 million (9.2% of the overall mortality) and ranks third estimated disability adjusted life years (DALYs) in 2020. the injury problems contributed to the death of 15%, 25% of disease burden and economic losses of 5% growth development product (GDP). In Indonesia, the economic loss due to injury, especially for traffic estimated at 2.9% of gross domestic product (GDP). Traffic accidents are the most

common cause of injury in the whole world. Traffic accidents ranks 9th in DALY and is expected to rank 3rd in 2020. While in the developing world No.2. Injuries resulting from traffic accidents are the leading cause of death and disability in general, especially in developing countries (1).

Based on data Riskesdas in 2007, found that the results of the analysis showed that the proportion of injuries due to traffic nationally was 27.0%. According to the province shows that the proportion of injuries was highest in Yogyakarta province (44.7%) and the lowest in the province of East Nusa Tenggara (15.1%). There are 17 provinces which have a number of injury proportion exceeds the national average. By age group, injuries caused by traffic accidents experienced by the majority of the adult age group (15- 59 years) that is equal to 38.8% and for each age group. Followed by the proportion of injuries due to traffic accidents in the elderly (seniors) ie 13.3% of children and 11.3%. Injuries caused by traffic accidents is higher in males is 31.9% compared with women is about 19.8%. As for education levels, injuries from traffic accidents indicate that the higher the level of education, the greater the proportion of injuries. Based on employment status, the proportion of injuries due to traffic accidents most commonly found in working as an employee at 55%, self-employed about 46, 9% and approximately 42.7% of other workers. According to the type of area, the proportion of incidence of injuries resulting from transportation accidents is higher in urban areas is 30.4% compared to the countryside which is about 24.2%. According to the economic status based on the level of expenditure per capita shows higher economic status, the higher the proportion of injuries caused by traffic accidents (2).

The death rate from trauma depends on the severity of the injury, the time to vote, and the time to reach the appropriate treatment center. Quick and accurate assessment triage can reduce mortality and long-term disability. Trauma validated scoring system can quickly assess the severity of the injury and indicate prognosis. Some of the system as it has no developed. It differs in complexity, design, and accuracy (3). But no studies have compared the accuracy of commonly used scoring system in predicting.

There is an increasing demand on the effectiveness of triage, it would require a scoring system to facilitate triage decisions. Besides useful in predicting the survival of patients with trauma, the scoring system is also useful as an evaluation of the quality of service (4). Trauma systems currently rely on an imperfect tool and subjective to prioritize responses and resources, so that there is a critical need to develop a trauma severity scores are more accurate. Various system of scoring has been submitted to the triage hospital for trauma patients, one of which is TEWS (Triage Early Warning Score) or Score Triage Early Warning, which was developed in South Africa is a tool used to identify patients in the ER who are at risk of deterioration and need rapid handling (5) .

The aim of this systematic review is to see the effectiveness of the TEWS and MREMS scoring performance on the trauma patient population, as a predictor of patient output from the Emergency Department.

## METHODS

After preparing the study protocol, the authors conducted a systematic search through a systematic review carried out by finding and analyzing all eligible studies of electronic database such as Science Direct and Proquest. Furthermore, the authors evaluated the studies were found based on inclusion criteria as follows: (a) the type of research that uses quantitative methods to evaluate the use of scoring TEWS or MREMS, (b) the study involved only a sample of adults, (c) study to evaluate the effectiveness, simplicity and both scoring accuracy trauma to the output of ER. The authors check independently choose the articles on the basis of title and abstract in accordance with predetermined criteria before the second screening process. The collection of journal articles that are analyzed by the Systematic Review can be seen in the flowchart as follows:

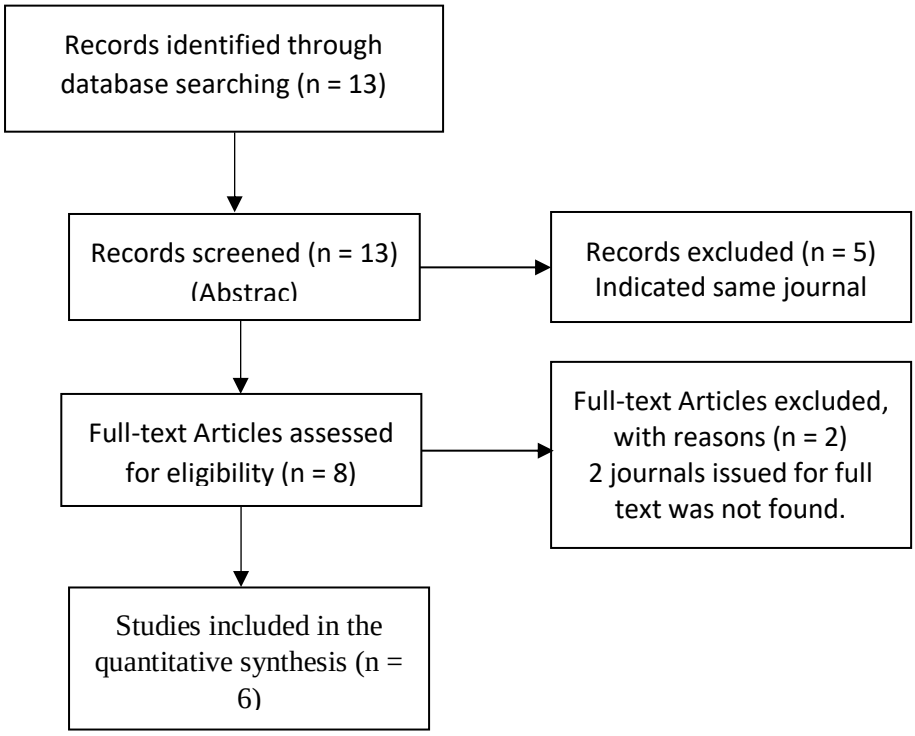


**Figure 1. Diagram of the electoral process journal article**

## RESULTS

The total journal articles that were obtained in the electronic database search were 13 articles, of which there was 8 Science Direct articles and 5 articles for Proquest. Five journal articles were issued because they indicated the same, and 2 journal articles were re-issued because they did not find the full paper. So that the remaining 6 journal articles are in accordance with the inclusion criteria that the author wants and then analyzed. From the search results the authors found six studies that met the criteria that authors wanted, two studies evaluated TEWS in two different hospital settings, one study evaluated the use of MREMS and compared with other trauma scoring namely RTS, ISS, MGAP and SI, one study comparing REMS and MEWS as the initial form of TEWS and MREMS before modification.

Furthermore, one study evaluated the use of SATS scoring with numerical values of TEWS, as well as the last REMS compared to RTS, ISS, and SI. This systematic review totals 440,192 subjects with trauma cases and in the emergency room who were assessed using TEWS and MREMS scoring. Analysis of the more complete six journal articles can be seen in the combining table below :

| **Tittle** | **Author** | **Year** | **Purpose** | **Method (Design, Sample, Data Analysis, Instument)** | **Major Finding** |
|---|---|---|---|---|---|
| An evaluation of the Triage Early Warning Score in an urban accident and emergency department in KwaZulu-Natal. | DK Naidoo, S Rangiah & SS Naidoo, | 2013 | Assessing the effectiveness of TEWS in identifying patients at risk of setbacks early to enable timely medical intervention | Retrospective observation study, sample medic record 265, Observation Sheet, Analysis using Pearson's chi-squared tests | TEWS is a scoring effective triage system to ensure that patients in need of emergency care more quickly and precisely |
| Value of triage early warning score for trauma in an emergency department. | Lingyun Tian, Fang Zhengqing, Xiao Hongling, Li Li, Li Yinglan | 2014 | To evaluate the accuracy (TEWS) in the prognosis and emergency care for trauma patients who were treated in the emergency department (ED) | An observational study A total of 456 trauma patients (> 12 years) who were treated in the ER, Observation Sheet, parametric test was used for comparison between groups: $\chi$ 2 test in the case of categorical variables and t test, t -tests' or Kruskal-Wallis test in the case of continuous variables. | TEWS is very effefektif in predicting prognosis and emergency treatment for trauma patients who were treated in the ER |

| **tittle** | **Author** | **year** | **purpose** | **Method (Design, Sample, Data Analysis, Instument)** | **Major Finding** |
|---|---|---|---|---|---|
| Evaluation of the implementation of the South African Triage System at an academic hospital in central Haiti | Shada A. Rouhani, Emily Aaronson Angella Jacques, Sandy Brice, Regan H. Marsh | 2016 | To evaluate the implementation of the SATS using TEWS score as a numeric value in the assessment of triage in the emergency department (ED) | An observational study, retrospective study with a sample of 400 patients with trauma in the form of record medic. Observation sheet, The analysis using Chi Square test. | SATS can be used in hospitals with limited human resources and infrastructure, with minimal training can use the novice nurse. But items discriminator used less familiar to officers contrary Numerical values TEWS easier to use and appropriate when combined with the criteria of SATS |
| The comparison of modified early warning score with rapid emergency medicine score: a prospective multicentre observational cohort study on medical and surgical patients presenting to emergency department | Mehtap Bulut, Huseyin Cebicci, Deniz Sigirli,Ahmet Sak, Oya Durmus, Ahmet Ali Top, Sinan Kaya,Kamil Uz | 2014 | To compare the efficacy of Modified Early Warning Score (MEWS) and Rapid Emergency Medicine Score (REMS) on in-hospital mortality, and as predictor of hospitalisation in general medical and surgical patients admitted to ED | A prospective, multicentre and observational cohort study. The study included general medical and surgical patients admitted to the EDs of three education and research hospitals during a period of 6 months, total patients were 2000 | REMS (area under the curve (AUC): 0.642) was found to have a better predictive strength than MEWS (AUC: 0.568) in discriminating in-patients and discharged patients. Additionally, REMS (0.707) was superior to MEWS (AUC 0.630) in terms of predicting inhospital mortality of patients presenting to ED. |

| **Title** | **Author** | **year** | **purpose** | **Method (Design, Sample, Data Analysis, Instument)** | **Major Finding** |
|---|---|---|---|---|---|
| The modified rapid emergency medicine score: A novel trauma triage tool to predict in-hospital mortality. | Ross T. Miller Niaman Nazir, Tracy McDonald, Chad M. Cannon | 2017 | To modify REMS against trauma patient population and examine MREMS accuracy against mortality predictors compared to other trauma scores. Like RTS, ISS, MGAP and SI. Such as RTS, ISS, MGAP and SI. | Divided into two parts, the first to validate REMS against Trauma population with modifications in the 3680 sample MAP item Record medic. The second part with 429 711 sample records validate medic MREMS against predictor of death compared to denagn RTS, ISS, MGAP, and IS. Retrosfektif, observational study. Parametric Chi square and T test and Pearson | In the traumatized population, mREMS is the most accurate predictor of mortality than other Trauma Scoring. Simple and objective, mREMS can function in a pre-hospital and emergency department to guide the team mererespon trauma. |

| Tittle | Author | Year | Purpose | Method (Design, Sample, Data Analysis, Instument) | Major Finding |
|---|---|---|---|---|---|
| , Rapid Emergency Medicine Score (REMS) in the trauma population: a retrospective study | Bryan F Imhoff, Nia J Thompson, Michael A Hastings, Niaman Nazir, Michael Moncure, Chad M Cannon | 2014 | To evaluate the REMS in predicting mortality in trauma patients and to compare REMS with other Scoring such as RTS, ISS, and SI in predicting mortality in trauma patients who entered the emergency room (ER) | A retrospective chart review of research studies with 3680 patients aged above 14 years of trauma for 4 years the patient medical record. On the Academic American College of Surgeons trauma center, Parametric Analysis Test using the test t test and Spearman's correlation test. | Predicts mortality in trauma patients showed very strong REMS. Where an increase in the value of REMS will be followed by an increase in the death rate and vice versa. REMS comparison with RTS is likely to have the same results in predicting mortality. Then when compared with the ISS and SI seems REMS still better in predicting mortality. |

## DISCUSSION

Results of research conducted by Naidoo et al in 2013 in South Africa are evaluating the use of scoring TEWS using retrospective observation at 265 medical records in an emergency department say that the TEWS is a system of triage scoring effective and can ensure that patients requiring emergency care faster and right, where patients with TEWS value <7 as much as 53.7% may be discharged home compared with those with a score of TEWS> 7 only 18.7% were allowed to go home. While the average score TEWS to four patients died in the study was 9.5 and the average score for the 3 patients admitted to the ICU was 8.2. This indicates that a significant increase in the value TEWS with the inclusion of the patient to the hospital (5). These results are consistent with other studies conducted by Tian et al in China in 2014 by the method of prospective observation of 456 trauma patients throughout the month of May to August 2013. Obtained result of which an increase of 1 point from the score TEWS be associated with an increase in value by 2.14 OR to the death of patients in the ER, and stated that the TEWS effective in predicting prognosis and treatment of emergency trauma patients in the ER. In this study is also said to use a very simple scoring TEWS making it easier for nurses in practice so that it can be a good means of communication between nurses and physicians in the patients in the ER containment procedures. The results

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TEWS has the following advantages: (i) enabling the earlier and more accurate assessment of the emergency patients; (Ii) TEWS scoring using the parameters measured a number that is easy to understand; (Iii) only use minimal equipment in measuring TEWS (blood pressure cuff, observation sheets and thermometers); (Iv) assessment of TEWS covers emergencies in cases of trauma or medical; (V) to facilitate uniform assessment, and also facilitate communication between medical personnel that enable appropriate disposition of patients; and (vi) user-friendly both at home pre-hospital and emergency department settings (Tian, 2014)(3)

Research conducted by Shada, (2016) using the method of retrospective observation where numeric TEWS in use in evaluating South Africa Triage System (SATS) to a population traumatized in Haitiet al with a sample of 400 people who entered the emergency room, show the results that the numerical value TEWS easier to use by emergency personnel than would otherwise have to use clinical discriminator in the same scoring. In this study also said that the scoring TEWS used in hospital settings with limited resources because it uses only medical devices used without invasive measures. In conclusion TEWS be scoring very easy to use even by novice health professionals (6).

Research on different scoring is MREMS show the same thing done by Ross in 2017 in Kansas, United States, when MREMS in the evaluation of the trauma population of 429 711 people shows the results of an increase of 1 point from scoring MREMS improve outcome OR 1.62 against death patients in the ER, and when compared with other scoring as RTS, ISS, and

MGAP demonstrated sensitivity values higher than other scoring in predicting the output of IGD. Research methods This retrospective study also discusses the differences in the mechanisms of blunt trauma and sharp trauma which if a patient with a sharp trauma mechanism provides increased value MREMS overall scores higher than patients with blunt trauma, but in the follow-up analysis found no significant difference between the mechanism of sharp and blunt trauma to the increase in the value of the predictors of mortality. Another specialty of scoring MREMS in this study is able to be used in pre-hospital or in the emergency department (7).

The same results were obtained by scoring REMS, which is the embryo scoring REMS MREMS before modification. Research conducted by Bryan, et al (4) in 2014 with retrospective method is to evaluate the REMS and compare with other scoring that RTS, ISS and SI at American College Of Surgeons trauma Center in the United States. In this study showed significant gains between the increase in the value of REMS will be followed by an increase in the death rate of patients and vice versa, when compared with the RTS in predicting mortality did not differ significantly. Another case when compared with the ISS and SI scoring REMS seems much better in predicting hospital mortality in the trauma population (4).

Studies comparing the two scoring between TEWS and MREMS in the study had never done, but at the time of scoring has not been modified are still in the form of MEWS and REMS there is a study that has compared the two is by Bulut, et al (8) in 2013 in Turkey where the number of samples used in this study as many as 2,000 people in a population of trauma or medical by using retrospective, showed that scoring REMS more powerful in predicting the outcome of patients in this regard will be taken care of or been deported, then REMS also better at predicting survival rate / the death of a patient while in the ER.

## CONCLUSIONS

From the analysis of several journal articles can be concluded that the scoring TEWS and MREMS equally as effective in predicting output trauma patients from the ER, both provide a significant number of the objectives of this Systematic Review. MREMS proved to be a simple and valid method as a predictor of mortality in the hospital quickly. Scores are performed similarly to MGAP and RTS yet proven superior to some other established trauma score, indicating that the trauma scoring more complex, subjective and may take longer time is not necessary. MREMS score can guide service providers in the stratification of severity of the injury and in clinical decision making, even in the setting of limited resources.

On the other hand TEWS is a useful risk management tools and appropriate and can optimize the quality and safety of patients in the emergency department. This allows for earlier intervention that can lead to improved quality of care, and reduced morbidity and mortality. The challenge is to ensure the success of the application remains in the acceptance of the system by health care workers, as well as the relevant authorities. The proper training to perform important physiological parameter measurement and use this measurement to determine the correct value will give added value to patient care in the emergency department.

All the research in this paper uses retrospective study methods that have a disadvantage in terms of collecting the data, so that further evaluation is required to compare both scoring in a prospective study in order to be able to see firsthand scoring was more effective in predicting the outcome of the ER to the trauma population.

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