An evaluation of the Triage Early Warning Score in an urban accident and emergency department in KwaZulu-Natal

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Abstract

Objective: Triage is an essential first step in the efficient and effective running of any emergency department. A good triage tool saves lives and reduces mortality. The Triage Early Warning Score (TEWS) is a useful tool used to identify patients in emergency departments who are at risk of deterioration and who may require admission. As this triage tool has only been evaluated to a limited extent, this study assessed its effectiveness in identifying patients at risk of early deterioration to enable timely medical intervention.

Design and setting: This was a retrospective study of medical records within the accident and emergency department of an urban public hospital.

Outcome measures: The calculated TEWS was compared to one of four possible outcomes viz. discharge within 24 hours, admission to the ward, admission to the intensive care unit (ICU), or death in hospital. Pearson's chi-squared tests and cross-tabulation was used to determine the statistical significance of the association.

Results: Of the 265 patient records analysed, 233 (87.9%) had a TEWS of < 7. Of patients with a TEWS of < 7, 53.7% were discharged, compared to 18.7% with a score ≥ 7, who were discharged. The average score of the four patients who died was 9.5, and 8.2 for the three admitted to ICU. Higher TEWS were significantly associated with increased admission to hospital and in-hospital deaths (p-value 0.032).

Conclusion: An effective triage scoring system ensures that those requiring emergency care are appropriately categorised. Prompt intervention will either reverse further physiological decline or facilitate timely referral to the appropriate service level, including ICU.

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Introduction

Traditionally, clinicians are well trained in history taking and physical examinations which are used to make a diagnosis. Protocols in pocket handbooks have been designed to ensure that emergencies are appropriately processed. However, there is perceived poor understanding when dealing with the altered physiology that accompanies acute illness.[1] This is often owing to poor training and can only result in suboptimal care. This is particularly relevant in accident and emergency departments where patients with critical injuries often require timeous attention to prevent avoidable deterioration of their condition. Delayed or poor action in response to observed abnormal physiological parameters can lead to avoidable and unexpected deaths.[2,3] Identifying patients at risk of deterioration at an early stage by means of simple guidelines based on physiological parameters can reduce the number of resuscitation procedures required in emergency rooms. This can potentially improve the gap between suboptimal care and good care, resulting in better outcomes.

The sudden deterioration of a patient' condition in hospital is often preceded by documented evidence of changes in physiological parameters.[4] Delays in recognising the deterioration of respiratory or cerebral functions using simple physiological observations increase the risk of cardiopulmonary arrest.[5,6] In the absence of timely and appropriate intervention, local inflammatory processes deteriorate and eventually become generalised.[7] Prognosis is then poor. The clue is nearly always in the physiological observations that are part of the routine examination.[6] A

Table I: Modified Early Warning Score[12]

Physiological characteristics	3	2	1	0	1	2	3
Systolic blood pressure (mmHg)	< 70	71-80	81-100	101-1		> 200	
Heart rate (beats per minute)		< 40	41-50	51-100	101-110	111-129	> 130
Respiratory rate (beats per minute)		< 9		9-14	15-20	21-29	> 30
Temperature (°C)		< 35		35-38.4		> 38.5	
AVPU score				Alert	React to voice	React to pain	No response

AVPU: A = alert, V = responding to voice, P = responding to pain, U = unconscious

Table II: The adult Triage Early Warning Score[10]

Physiological characteristics	Adult triage score (> 12 years, > 150 cm)						
	3	2	1	0	1	2	3
Mobility				Walking	With help	Stretcher or immobile	
Resting rate		Less than 9		9-14	15-20	21-29	More than 29
Heart rate		Less than 41	41-50	51-100	101-110	111-129	More than 129
Systolic blood pressure	Less than 71	71-80	81-100	101-199		More than 199	
Temperature (degrees C)		Feels cold or under 35		35-38.4		Feels hot or over 38.4	
AVPU		Confused		Alert	Reacts to voice	Reacts to pain	Unresponsive
Trauma				No	Yes		

AVPU: A = alert, V = responding to voice, P = responding to pain, U = unconscious

common error that is made is the assumption that a patient who is sitting up in bed and talking is not critically ill.[1]

Scoring systems developed in response to studies have demonstrated that abnormal physiological parameters were often documented in patients who had suffered an in-hospital cardiac arrest in the preceding hours of arrest.[2,5,6] Several scoring systems are currently in use in different parts of the world, such as the Canadian Triage Acuity Scale,[8] the Manchester Triage Scale,[9] the Australasian Triage Scale[10] and the Emergency Severity Index.[11] These are complex scoring methods and are of limited use in resource-constrained environments or situations in which junior staff have limited experience and clinical practice.

The Modified Early Warning Score (MEWS) is a simple validated physiological scoring system that can be calculated at the patient's bedside using parameters that are routinely measured.[12] It does not require complex, expensive equipment to measure any of the parameters and is reproducible. It can be used to rapidly identify patients who are clinically deteriorating and who need urgent intervention.[13] The score is a linear summary of five parameters, each with seven bands. It classifies systolic blood pressure, pulse rate, respiratory rate, temperature and level of consciousness according to their deviation from normality.[12] (Table I).

The purpose of an early warning scoring system is to provide staff with an aggregate physiological score generated from baseline recordings of the vital signs. The greater the physiological deviations from the normal parameters, the higher are the point scores. Clinical deterioration is subsequently detected and medical intervention can be implemented at an early stage in the patient's illness.[14]

However, the use of the MEWS system is limited to medical patients in the emergency room setting.[15] There is a clear need to efficiently identify all patients in emergency departments, particularly in departments that operate as a single system and which attend to trauma and medical emergencies together. Trauma cases may often be prioritised because of the physical appearance of the injuries, while medical patients may have to wait for long periods before being evaluated.

The South African Cape Triage Group adapted the MEWS to include mobility and trauma parameters in response to local emergency department needs. This resulted in the development of the Triage Early Warning Score (TEWS)[15,16] (Table II). It is anticipated that this system will facilitate early medical intervention and result in better outcomes for patients. However, it has not been widely evaluated to identify patients needing hospital admission and those at increased risk of in-hospital death.

Therefore, the purpose of this study was to evaluate the use of the TEWS by healthcare workers in an emergency department in a large urban hospital in KwaZulu-Natal, and its ability to identify patients who require admission and at increased risk for in-hospital mortality.

Method

This was a retrospective observational study, conducted in 2011 in the Accident and Emergency Unit of Addington Hospital, an urban hospital that serves a population of one-million residents in the central Ethekwini District. The 571-bed facility provides a service for all major surgical, medical, obstetric and paediatric emergencies. The average daily number of patients seen in the emergency department is 150. The majority presented with cardiac, neurological, respiratory and traumatic emergencies. The average in-patient bed occupancy rate on most days is 92%.

The medical records of patients presenting to the accident and emergency department over one-month were included in the study. A sample size of 200 medical records, calculated to ensure a 95% confidence interval, was determined by a biostatistician using Epi Info™ version 3.4.3. A sampling process was used whereby the medical records of every fifth patient entered in the emergency room register in that one month, and who met the inclusion criteria, were selected for review. The extracted data from the records consisted of demographic details, systolic blood pressure, pulse rate, temperature, respiratory rate and the AVPU score (A: alert, V: responding to voice, P: reacting to pain, U: unconscious). The collected data were entered into Microsoft® Excel® spreadsheets, and were then used to calculate a TEWS (Table II). This score was then compared to patient outcomes obtained from the records which were defined as "discharge within 24 hours of admission, admission to a ward, admission to an intensive care unit (ICU), and death in hospital".

The quantitative data were analysed using the Statistical Software Package for Social Sciences® version 15. Early warning scores were compared to patient outcomes, and means and standard deviations calculated for physiological variables. The TEWS was split into two categories for analytical purposes, viz. < 7 and ≥ 7. These categories were then compared to the previously defined outcome.

The cut-off score of 7 was used as the differentiation between the low and high scores. A comparison of the proportion of patents with high (TEWS ≥ 7) and low (TEWS < 7) scores between the outcome groups was achieved using Pearson's chi square tests. A p-value < 0.05 was considered to be statistically significant. Specificity and sensitivity were also calculated to validate the association between the TEWS and the outcomes.

Ethical approval was obtained from University of KwaZulu-Natal (BE 216/09). Permission to conduct the study was obtained from Addington Hospital and the KwaZulu-Natal Department of Health.

Results

Five hundred and ninety records were identified, of which 265 were eligible for inclusion as these records had complete datasets for analysis. This number of records exceeded the minimum of 200 that was required for the study. The mean age (standard deviation 17.05) was 41.4 years. 46.4% of the patients in the records were male. Of these, 51 patients (19.2%) presented on stretchers, 80 (30.2%) required assistance and 134 (50.6%) walked into the emergency unit unaided. Almost half of the patients, (49.8%) were discharged after being attended, 47.6% were admitted to wards and 3 (1.1%) admitted to ICU. Four patients (1.5%) died within 24 hours of admission (Table III).

The frequency distribution of the TEWS shown in Figure 1 indicates that the majority of patients who presented to the ICU had scores < 7. The highest percentage of patients had a score of three.

Of the 265 patients who were analysed, 233 (87.9%) had a TEWS < 7, while 32 (12.1%) had a TEWS ≥ 7 (Table IV). The average score of the four patients who died was 9.5, and 8.2 for the three admitted to the ICU.

Table III: Analysis of Triage Early Warning Score and outcome (n = 265)

Outcome	n	%
Discharged	132	49.8
Admitted to ward	126	47.6
Admitted to the ICU	3	1.1
Death in hospital	4	1.5

ICU: intensive care unit

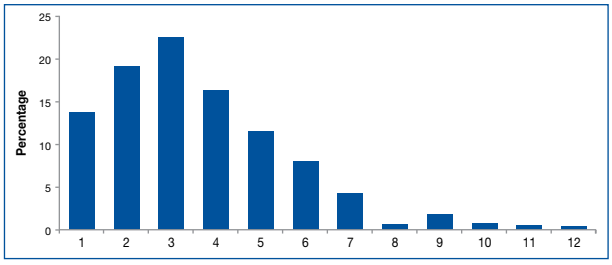

Figure 1: Frequency distribution of the Triage Early Warning Score on evaluation

Table IV: Analysis of the Triage Early Warning Score categories

TEWS	n = 265	%
Low score: < 7	233	87.9
High score: ≥ 7	32	12.1

TEWS: Triage Early Warning Score

Table V: Association of Triage Early Warning Score and outcome

Category	Discharge, n (%)	Admission ward, n (%)	Admission to ICU, n (%)	Death, n (%)	Total, n (%)
TEWS category (low): < 7	125 (53.7)	108 (46.3)	0	0	233 (87.9)
TEWS category (high): ≥ 7	6 (18.7)	19 (59.4)	3 (9.4)	4 (12.5)	32 (12.1)
Total	131 (49.4)	127 (47.9)	3 (1.1)	4 (1.5)	265

ICU: intensive care unit

These variables were cross-tabulated and a significant association between the TEWS category and outcome was established. 53.7% of patients with a TEWS of < 7 were discharged, compared to 18.7 % with a score ≥ 7 who were discharged. No patients in the low-score category were admitted to ICU. No patients died. Three patients were admitted to ICU, and four died in the high-score category.

Discussion

This study demonstrated that an increased TEWS was significantly associated with increased admission to hospital and in-hospital death. Hence, calculation of the TEWS early on in the patient's presentation in the emergency room can serve as a baseline and help to identify patients at risk of clinical deterioration. The findings in this study are in keeping with those of other studies which have demonstrated an association between the TEWS and outcome.[17-19] These studies indicated that a higher TEWS identified early on in a patient's care could predict the need for admission and a risk of increased mortality.

It was also observed that 53.7% of patients with a TEWS of < 7 were discharged and the remaining 46.3% admitted. This category of patients with a low TEWS who were admitted may be attributed to inaccurate triaging. 18.7% of patients with a score that was ≥ 7 were discharged, which may relate to the high number of patients with a chronic condition who presented at the emergency unit with altered physiological parameters which may not have required urgent intervention. These observations are in keeping with those in other studies.[12,13,19]

These scores were not only meant to predict or indicate end-points, but also to encourage the routine and detailed measurement of simple physiological observations. The score converts these abnormal recordings into a summary score which has a critical threshold above which medical review and intervention are required.[1] The scores are designed to alert staff to a sudden deterioration in a clinical condition. The effectiveness of the medical response can be assessed by decreases in the summary score.[1]

The requirement of senior staff at the level of consultant in the triage process is not often available in public service emergency departments. The success of implementing the South African Triage Score (SATS) in emergency units in South Africa is dependent on the willingness of the relevant authorities to recognise the need for senior and experienced consultants and emergency trained nurses in the staffing complement. Rosedale, Smith, Davies and Wood noted that one of the problems in implementing the SATS is the requirement of a senior clinician's input in the emergency room.[19] Most emergency departments in the KwaZulu-Natal public service are staffed by junior doctors with little or no experience. When a senior clinician is available, his or her responsibilities often focus on resuscitation and clinical procedures, rather than monitoring of triaging.

Although the TEWS took into consideration parameters for trauma and mobility, increasing the parameters used to determine the score may be problematic with regard to implementation by the initial providers. This is in keeping with the findings of Rosedale, Smith, Davies and Wood, who noted the reluctance of nursing staff to implement this scoring system.[19]

The TEWS, which is part of the SATS which incorporates a discrimination list, was thought to be an easier and more user-friendly system than the MEWS. Although the system may be regarded as being superior to the MEWS, its practical implementation and interpretation remains a challenge. This is borne out by our finding that only 44.9 % (265) of all selected medical records contained sufficiently complete datasets for analysis.

In spite of there being a significant association between increased admission to hospital and in-hospital death and the recorded TEWS, the additional parameters included in the TEWS system add to its complexity, and make implementation and adherence difficult. Furthermore, the additional parameters may result in inappropriate triaging. However, the data have indicated that if staff members with sufficient experience are available to triage patients, and if it is possible to identify and exclude patients with chronic conditions, the TEWS can be used to assist staff in identifying high-risk patients early on in the process of patient care.

Conclusion

The TEWS is a useful and appropriate risk management tool which optimises the quality and safety of patients in the emergency department. It allows for earlier intervention

that can lead to improved quality of care, and decreased morbidity and mortality. The challenge to ensure its successful implementation remains in acceptance of the system by healthcare workers, as well as the relevant authorities. Appropriate training in measuring essential physiological parameters and use of these measurements in determining correct scores would add value to patient care in emergency units.

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