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Research Article

A Prospective Observational Study to Analyse the Utility of National Early Warning Score (NEWS) in Predicting the Outcome of Patients Presenting to the Emergency Department

Krishna Dayal B, Udaykumar J. Khasage, Praveen Kumar and Veeresh Balkal*

Department of Emergency Medicine, Shri BM Patil Medical College, India

Abstract

Introduction: Triaging patients in the Emergency Departments (EDs) is crucial in providing sufficient care. Several triage systems have been developed in the ED, like the Emergency Severity Index (ESI) and the Manchester Triage Scale (MTS). These systems render a way of categorising all incoming ED patients by level of understanding ranging from life-threatening to non-urgent and dictate how quickly patients should be seen.

The National Early Warning Score (NEWS), formulated with the Royal College of Physicians of London, has been more rigorously tested and performs better than any of the 33 published systems commonly used.

Prediction of factors like the need for ICU admission, the length of hospital stay, and the patient's long-term outcome using NEWS can, to a certain extent, help in intensifying the management and early anticipatory counselling of patient attendees. NEWS has an excellent ability to discriminate ward patients at risk of cardiac arrest, death or unexpected Intensive Care Unit (ICU) admission, and it is currently being promoted as a standardised system across the UK. The utility of NEWS still needs to be adequately studied in an emergency department in India.

Methods: A prospective observational study. Patients older than 18 with an Emergency Severity Index (ESI) of 2, 3 and 4 were eligible.

Intervention: NEWS was noted at 4 points- on arrival (T0), an hour after arrival (T1), 2 hours after arrival (T2) and at transfer to the ward/ICU (T3). The outcomes of interest were: the need for hospital admission, the need for ICU admission, the length of hospital stay and the patient's outcome (after 45 days).

Results: A total of 560 patients were assessed. The NEWS at various points correlated well with the outcomes of interest, like the need for hospital admission, the need for ICU admission and the patient's outcome (after 45 days). Data regarding the length of hospital stay could not be adequately obtained.

Conclusion: All the associations were found to be significant. So, patients with higher NEWS at various stages of the triage system had a higher risk of bad prognosis and outcomes than those with lower NEWS. Thus, NEWS is an efficient predictor of the outcomes in the patients presenting to the ED.

Categories: Emergency Medicine, Quality Improvement, Trauma

Keywords: Prognostication; Vital parameters; Monitoring; Emergency department; National early warning score (news)

Introduction

The triaging of patients while they present to the Emergency Departments (EDs) is vital for proper management. The triage is essential in identifying the priorities and categorising patients accordingly. This is crucial in managing the emergency department's patient load and ensuring appropriate and timely patient care based on the assigned preferences. This will help in saving lives with necessary active interventions on time. The triage system also paves the way for the effective utilisation of resources and significantly reduces resource wastage. An accurate triage system will greatly affect emergency service quality to a great extent [1].

Precise triaging of patients is not easy and requires expertise. Inter-observer variability can be there in triaging [2-4]. Various triage protocols are for utilisation in the Emergency Department (ED), including the Emergency Severity Index (ESI), the Australasian triage system, and the Canadian and Manchester Triage Scales. These systems ensure a systematic way of sorting out all emergency patients into different categories ranging from severe to stable cases and deciding how seriously patients must be treated. While every ED implements triage protocols to decide treatment anteriority, it is evident that minimal care is given to the horizontal assessment of patients. No proper scoring systems are specifically implemented to anticipate 2 of 8 deteriorations or the probability of intensive care admission or grave risk in ED cases. Further, various single- centre studies have shown that horizontal assessment of vital parameters in EDs is poor [5].

These factors point to the fact that worsening patients could

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***Corresponding author:** Krishna Dayal B, Department of Emergency Medicine, Shri BM Patil Medical College, BLDE (DU) Bijapur, Karnataka, India, E-mail: krisnadayal@gmail.com

be at the peril of being undiscovered in the ED and are prone to developing severe untoward events such as sudden unexplainable cardiopulmonary arrest and ICU admission, with more significant depletion of resources through prolonged hospitalisation [6,7].

The National Early Warning Score (NEWS), formulated in colligation with the Royal College of Physicians, London, in 2012, has been trialled and executes better than any of the other commonly used ones [8].

Prediction of factors like the need for ICU admission, length of hospital stay, and patient's long-term outcome using NEWS can, to a certain extent, help in intensifying the management and early anticipatory counselling of patient attendees. NEWS has the potential to distinguish patients at risk of cardiopulmonary arrest, death or unplanned ICU admission, and it is utilised as an accepted system across the UK [9].

In India, the serviceability of NEWS in predicting the outcomes of Covid patients has been explored to some extent, given the pandemic scenario. Several prospective and retrospective studies have been undertaken on this aspect [10,11]. But there is a crack in the literature exploring the utility of NEWS in other settings, especially among patients attending an emergency department in India.

There is a need for efforts to fill this gap in research so that the capability of NEWS can be utilised to the maximum if it could be proven as an effective tool in predicting the outcomes of patients in the emergency department. Hence this study has been undertaken to evaluate the efficiency of NEWS in predicting the outcome of patients presenting to the ED in a tertiary care medical college.

Materials and Methods

Study design

A prospective observational feasibility study was performed at the ED of Shri BM Patil Medical College (SBMPMC), Bijapur, and Karnataka, India. The ED of the SBMPMC uses the Emergency Severity Index (ESI) for triage and has approximately 40000 patient loads per year.

Study population

Eligible patients were those of 18 years and older presenting to the ED of Shri BM Patil Medical College, Bijapur, during the 2-year study period (1.12.2020 to 30.11.2022) with an ESI of 2, 3 and 4. Pregnant women with a gestation of more than 20 months were excluded. The Medical Ethical Committee of the college approved the study, informed consent was waived as routine care was not influenced and no therapeutic intervention was used.

Methodology

NEWS were assessed at four time intervals- at arrival to ED (T0), one hour after arrival (T1), two hours after arrival (T2) and when the patient is getting shifted from ED (T3). Three trained researchers collected data, which contained demographic details, medication use, medical history, and vital parameters needed to calculate the NEWS (Table 1). This data collection was in addition to any observations taken at the time of triage.

The outcomes of interest were:

1. Hospital admission
2. ICU admission
3. Length of hospital stay
4. 45-day outcome (improved/deteriorated/died).

Sample size

Sample size was calculated with nMaster version 2.0. As per the reference study by Alam et al. [12], the area under the ROC (Receiver Operating Characteristic) curve was more than 0.5, so assuming the same sensitivity of at least 50%, with a 95% confidence interval and 5% absolute precision, the final estimated sample size was 384. With assumptions of 20% non-response, we calculated a sample size of 456.

Statistical analysis

The data obtained was collected in a Microsoft Excel sheet, and statistical analysis was done using a Statistical Package for the Social Sciences (SPSS) Version 20. Results were presented as Mean (Median) ± SD, counts and percentages and diagrams. For normally distributed continuous variables, data were compared using the independent t-test. For not normally distributed variables, the Mann-Whitney U test was used.

Categorical variables were compared using the Chi-square test. Receiver Operating Characteristic (ROC) analysis was utilised to identify the NEWS for the sensitivity. $p<0.05$ was considered statistically significant. Descriptive statistics were used to evaluate patient characteristics (presented as mean ± SD).

The NEWS was divided into two aggregates,

1. Aggregate 0-7: Low-medium clinical risk
2. Aggregate ≥ 7: High clinical risk for this study and according to the NEWS thresholds and triggers.

Results

In the present study, a total of 560 patients were considered. The majority was in the age group of 30 to 50 years. The mean age of the population was 46.4 years. The gender distribution is shown in (Table 2). The majority of our study population was male (51.3%). 44.6% of the study population belonged to ESI criteria 2, followed by ESI 3 and ESI 4 (Table 3). Among the 560 study participants, 90.2% needed hospital admission, and 57.3% were admitted to ICU. On outcome, around 90% of patients improved, and 5% died in 45 days.

Since the patients were taken over to concerned departments after initial stabilisation, data regarding the length of hospital stay could not be adequately assessed.

Table 1: NEWS.

Parameters	3	2	1	0	1	2	3
Respiratory Rate (permin)	8		11-Sep	20-Dec		21-24	≥ 25
Spo2 (% inroomair)	91	92-93	94-95	≥ 96			
Need for O2 Supplementation		Yes		No			
Temperature (C°)	35		35.1-36	36.1-38	38.1-39	≥ 39.1	
Systolic Blood Pressure (mmHg)	90	91-100	101-110	111-219			≥ 220
Heart Rate (permin)	40		41-50	51-90	91-110	111-130	≥ 131
Level of Consciousness				A			V,P,U

Table 2: Gender distribution.

Category	Frequency	Percentage
Female	287	51.3
Male	273	48.8
Total	560	100

Table 3: ESI Criteria.

ESI	Frequency	Percentage
2	250	44.6
3	177	31.6
4	133	23.8
Total	560	100

The need for hospitalisation was compared with the NEWS scores at different time intervals (T0, T1, T2, and T3) (Table 4). It was observed that 100% of the study population with NEWS of more than seven required hospital admission. Whereas those with scores below seven had hospital admission less than 100%. This difference in admission rates had a statistically significant association in all time intervals except for T2, where the p-value was >0.05 (p=0.231). For all other instances of time, the p-value was found to be <0.05.

Table 4: Comparison of NEWS with the need for hospitalization.

		Need for hospital admission			
		No	Yes	Total	P-value
NEWS at T0	0-7	55 (12.9%)	372 (87.1%)	427 (100.0%)	<0.001
	>7	0 (0.0%)	133 (100.0%)	133 (100.0%)	
NEWS at T1	0-7	55 (10.7%)	458 (89.3%)	513 (100.0%)	0.006
	>7	0 (0.0%)	47 (100.0%)	47 (100.0%)	
NEWS at T2	0-7	55 (10.1%)	491 (89.9%)	546 (100.0%)	0.231
	>7	0 (0.0%)	14 (100.0%)	14 (100.0%)	
NEWS at T3	0-7	55 (10.4%)	472 (89.6%)	527 (100.0%)	0.03
	>7	0 (0.0%)	33 (100.0%)	33 (100.0%)	
Total		55 (9.8%)	505 (90.2%)	560 (100.0%)	

The need for ICU admission was comparatively higher among those with a NEWS score greater than 7 (Table 5). This difference in admission rates in both groups (NEWS >7 and NEWS <7) at all instances of time interval had a statistically significant association as the chi-square test revealed the p-value to be <0.05.

Table 5: Comparison of NEWS with the need for ICU admission.

		Need for hospital admission			
		No	Yes	Total	P-value
NEWS at T0	0-7	234 (54.8%)	193 (45.2%)	427 (100.0%)	<0.001
	>7	5 (3.8%)	128 (96.2%)	133 (100.0%)	
NEWS at T1	0-7	239 (46.6%)	274 (53.4%)	513 (100.0%)	<0.001
	>7	0 (0.0%)	47 (100.0%)	47 (100.0%)	
NEWS at T2	0-7	239 (43.8%)	307 (56.2%)	546 (100.0%)	<0.001
	>7	0 (0.0%)	14 (100.0%)	14 (100.0%)	
NEWS at T3	0-7	239 (45.4%)	288 (54.6%)	527 (100.0%)	<0.001
	>7	0 (0.0%)	33 (100.0%)	33 (100.0%)	
Total		239 (42.7%)	321 (57.3%)	560 (100.0%)	

The comparison of the need for invasive ventilation revealed a statistically significant association with NEWS (p<0.05) (Table 6). The proportion of those requiring invasive ventilation was higher among the group with NEWS scores >7 at each time interval.

The study found that NEWS scores at T0 had a significant association with 45-day outcomes (Table 7). Among the participants with a NEWS score >7, 21.1% succumbed to death, whereas it was 0.0% among those with NEWS <7. This result had a statistically significant association (p<0.05).

Discussion

The provision of safe patient care depends on the triage of patients when they first appear in Emergency Departments (EDs). Intensifying the treatment and early anticipatory counselling of the patient's caregivers can aid to some extent when factors like the necessity for ICU admission, length of hospital stay, and patient's long-term outcome are predicted utilising NEWS in the triage phase. To prioritise patients' needs and classify them appropriately, triage is crucial. This is essential in managing patients in the emergency room and ensuring that they receive prompt, appropriate care based on the priorities set.

Table 6: Comparison of NEWS with the need for invasive ventilation.

		Invasive ventilation			
		No	Yes	Total	P-value
NEWS at T0	0-7	427 (100.0%)	0 (0.0%)	427 (100.0%)	<0.001
	>7	72 (54.1%)	61 (45.9%)	133 (100.0%)	
NEWS at T1	0-7	499 (97.3%)	14 (2.7%)	513 (100.0%)	<0.001
	>7	0 (0.0%)	47 (100.0%)	47 (100.0%)	
NEWS at T2	0-7	499 (91.4%)	47 (8.6%)	546 (100.0%)	<0.001
	>7	0 (100.0%)	14 (100.0%)	14 (100.0%)	
NEWS at T3	0-7	499 (94.7%)	28 (5.3%)	527 (100.0%)	<0.001
	>7	0 (0.0%)	33 (100.0%)	33 (100.0%)	
Total		499	61	560	

Table 7: Comparison of NEWS at T0 with the 45-day outcome.

		45-Dayoutcome				
		Deteriorated	Died	Improved	Total	P-value
NEWS at T0	0-7	27 (6.3%)	0 (0.0%)	400 (93.7%)	427 (100.0%)	<0.001
	>7	0 (0.0%)	28 (21.1%)	105 (78.9%)	133 (100.0%)	
Total		27 (4.8%)	28 (5.0%)	505 (90.2%)	560 (100.0%)	

The present study was aimed at providing insight into "Predicting the outcome of patients presenting to the ED using NEWS". A prospective observational study which included 560 patients was conducted to assess the same. To the best of our knowledge, this is the first prospective study performed in an ED in India to evaluate the performance of the NEWS. Our study determined the relationship between NEWS (at T0, T1, T2, and T3) and the patient's need for hospital admission, the need for ICU admission, and the 45-day outcome. A score of 1-4 is regarded as low risk, a score of 5-6 as medium risk, and a score of more than seven as high risk by the NEWS rating system. Here, for convenience, we defined low risk as 0-7 and high risk as more than 7.

Several studies have been performed to evaluate the ability of NEWS in identifying patients at risk of hospital admission [13,14], ICU admission [14-16], and deteriorating outcome [13,17,18]. In a related prospective observational feasibility research, 300 patients were evaluated at the ED of an academic urban tertiary care facility in Amsterdam by Alam et al. [12]. Their outcomes agreed with what we discovered. They also came to the conclusion that NEWS, as measured at various time points, was a reliable indicator of patient outcomes such as hospital admission, ICU admission, length of stay in the hospital, and length of stay in the ICU. In line with our findings, they also recommend that NEWS can be used in the ED to longitudinally follow patients over the course of their hospital and ED stays. A similar prospective cohort single-centre study conducted by Spagnolli et al. [19] on 2,677 patients came to the ED of a hospital in Trento, Italy, found that the NEWS, which is assessed upon ward admission, may help in risk stratification of clinical worsening and can be a good indicator of in-hospital adverse outcomes, although there may be some limitations due to sudden cardiac events and chronic hypoxia.

A prospective observational research with a comparable goal was conducted in Finland by Kemp et al. [20]. However, they discovered that, in contrast to our findings, the NEWS-level scale was ineffective at forecasting 30-day death, length of hospital stay, hospital admission, and ICU admission.

The present investigation discovered a relationship between the need for hospital admission and the NEWS score at T0, T1, T2, and T3. A higher proportion of patients (100% vs. 87%, 100% vs. 89%, 100% vs. 90%, and 100% vs. 89%) who require hospital admission belonged to have a NEWS score of more than seven compared to those with a score less than seven at T0, T1, T2, and T3. It also discovered a relationship between the need for ICU admission and the NEWS score at T0, T1, T2, and T3. At T0, T1, T2, and T3, a more significant proportion of patients (97% vs. 45%, 100% vs. 53%, 100% vs. 56%, and 100% vs. 54%) who needed hospital admission belonged to a NEWS score of more than seven compared to those with a score less than 7.

Our study found a statistically significant relation between the NEWS score and the 45-day outcome of the patients. The majority of patients with NEWS severe category (more than 7) at T0, T1, T2, and T3 were admitted to ICU (96.7%, 100%, 100%, 100% respectively), followed by dead (21%, 60%, 100%, 43% respectively). Meanwhile, most patients with NEWS low-risk category (less than 7) at T0, T1, T2, and T3 conditions improved (93.7%, 95%, 93%, and 92%, respectively). All the associations were found to be significant. So, patients with a high score in NEWS at various stages of the triage system had a higher risk of mortality, while patients with a low score in NEWS at different locations of the triage system had a lower risk. Thus, the NEWS score is an efficient predictor of the outcomes in the patients presenting to the emergency department.

The results of our research referred to the possibility of using NEWS in conjunction with emergency triage to more accurately identify individuals in need of immediate care and perhaps hasten admittance to the 7 of 8 medical wards and intensive care. Thus, the patient flow through the ED will be improved. As opposed to earlier studies, ours assessed the NEWS at various intervals (T0, T1, T2, T3) throughout a patient's stay in the ED. One of the causes of bias is interobserver variance. Furthermore, to reduce the bias, the measurements were carried out by enthusiastic and qualified experts. Training and staff motivation was crucial for the appropriate adoption and application of the NEWS score in the future. However, the uniformity of the score presents many chances for simpler application, particularly in the medical degree program.

Even though there were many commonalities, some studies revealed slight variations in the outcome. The difference observed in the parameters assessed by our analysis could be attributed to the comparatively smaller sample size, different study designs, geography, socio-economic variations, the difference in assessment scales used for NEWS scoring, intra-observer variation, and lack of psychomotor skills.

Research had its limitations all the time. The limitations and shortcomings are an inevitable result of not having unlimited resources, funding, access to information, or a flawless system to follow. We had some limitations in our research. We could only include a small number of cases because this was a one-centre study; therefore, the sample size was smaller. We couldn't see the reason for admission consideration as a variable because the patient selection criteria were inclusive (all patients aged more than 18 years presenting to ED). This results in a pretty varied research population. The vital parameters considered in the NEWS have not been statistically examined; it would be fascinating to know which characteristics had a more robust predictive value than the others. The patients who required diagnostic tests and did not present to the ED for further assessment at time point T1 or who were otherwise evacuated straight from the ED to the ward prevented us from obtaining complete data sets at all subsequent time points (T2). Unknown confounding variables that might have affected long-term mortality after hospital admission were not considered.

Finally, it is crucial to consider other variables that may affect the course of the disease, such as lifestyle choices and the use of self-reporting or underreporting of comorbidities. However, to increase the precision and applicability of NEWS, additional disease-specific research will be needed due to the variable performance of NEWS in other research.

Conclusion

The NEWS assessed at various time intervals was a good indicator of patient outcomes. It correlated significantly well with the results of interest- the need for hospital admission, the need for ICU admission and the 45-day outcome. So, the NEWS can be used as a helpful tool to longitudinally monitor patients in the ED as well as in the hospital. It can serve as a prognostic indicator, enhancing the quality of patient care.

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