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Rapid Response Systems

Exploring the performance of the National Early Warning Score (NEWS) in a European emergency department☆

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ABSTRACT

Background: Several triage systems have been developed for use in the emergency department (ED), however they are not designed to detect deterioration in patients. Deteriorating patients may be at risk of going undetected during their ED stay and are therefore vulnerable to develop serious adverse events (SAEs).

The National Early Warning Score (NEWS) has a good ability to discriminate ward patients at risk of SAEs. The utility of NEWS had not yet been studied in an ED.

Objective: To explore the performance of the NEWS in an ED with regard to predicting adverse outcomes.

Design: A prospective observational study.

Patients Eligible patients were those presenting to the ED during the 6 week study period with an Emergency Severity Index (ESI) of 2 and 3 not triaged to the resuscitation room.

Intervention: NEWS was documented at three time points: on arrival (T0), hour after arrival (T1) and at transfer to the general ward/ICU (T2). The outcomes of interest were: hospital admission, ICU admission, length of stay and 30 day mortality.

Results: A total of 300 patients were assessed for eligibility. Complete data was able to be collected for 274 patients on arrival at the ED. NEWS was significantly correlated with patient outcomes, including 30 day mortality, hospital admission, and length of stay at all-time points.

Conclusion: The NEWS measured at different time points was a good predictor of patient outcomes and can be of additional value in the ED to longitudinally monitor patients throughout their stay in the ED and in the hospital.

1. Introduction

1.1. Background

The triage of patients at the time of presentation to emergency departments (EDs) is crucial to the provision of safe patient care. Accurately triaging patients is difficult, requires experience and may be subject to inter-observer variability[1–3]. Several triage systems have been developed for use in the ED, including the Emergency Severity Index (ESI) and the Manchester Triage Scale (MTS)[4–6]. These systems provide a method of categorizing all incoming ED patients by level of acuity ranging from life threatening to non-urgent and dictate how quickly patient should be seen.

However, while virtually all EDs employ triage systems to determine treatment priority, the evidence suggests that less attention is paid to the longitudinal monitoring of patients once they are in the department.[7] There are no widely used scores specifically designed to detect deteriorating patients or to predict the chance of early intensive care unit (ICU) admission or death in ED patients. Further, small, single-site studies have demonstrated that longitudinal measurement of routine hemodynamic parameters in EDs is poor.[7] These factors suggest that deteriorating patients may be at risk of going undetected during their ED stay and are therefore vulnerable to develop serious adverse events,[8,9] such as unexpected cardiac

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Table 1
The National Early Warning Score (NEWS).

Physiological parameters	3	2	1	0	1	2	3
Respiration rate	≤8		9–11	12–20		21–24	≥25
Oxygen saturation	≤91	92–93	94–95	≥96			
Any supplemental oxygen		Yes		No			
Temperature	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	
Systolic blood pressure	≤90	91–100	101–110	111–219			≥220
Heart rate	≤40		41–50	51–90	91–110	111–130	≥131
Level of consciousness[a]				A			V, P, U

[a] Level of consciousness according to The AVPU scale wherein the response of a patient's responsiveness is assessed; A = alert, V = verbal, P = pain, U = unresponsive.

arrest and unnecessary ICU admission, with a higher consumption of resources through longer lengths of hospital stay (LoS).

First introduced in 1997, early warning scores (EWS) were developed in response to concerns about the failure to detect deteriorating physiological parameters in ward patients.[10] They are based on patient's vital signs and linked to 'triggers', which mandate the escalation of monitoring or call for assistance. However, while EWS are now widely used internationally, there are many different EWS scoring systems, with many being adapted for use in individual hospital.[11] The National Early Warning Score (NEWS), developed in conjunction with the Royal College of Physicians of London, has been more rigorously tested and performs better than any of the 33 published systems commonly in use.[12] It has a good 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 standardized system across the UK.

The utility of NEWS has not yet been studied in an ED. The aim of this study was to explore the performance of NEWS with regard to predicting adverse outcomes, such as ICU admission and death, in adult patients as well as the ability of NEWS to predict the need for hospital admission in an ED population. The study also aimed to assess the feasibility of the use of NEWS as a structural monitoring tool in a Dutch ED.

2. Methods

2.1. Design and setting

A prospective, observational feasibility study was performed at the ED of the VU Medical Center (VUmc), an academic urban tertiary care centre in Amsterdam, with approximately 31000 ED visits per year. The ED of the VUmc uses the Emergency Severity Index (ESI) for triage.[5]

2.2. Study population

Eligible patients were those of 18 years and older presenting to the ED of the VUmc during the 6 week study period (7th January till 15th February 2013, between 1200 and 2000 h) with an ESI of 2 and 3 not triaged to the resuscitation room.

Excluded were patients with an ESI 4 or 5 and patients undergoing cardiopulmonary resuscitation (ESI 1). Patients lost to follow-up were removed from the study analysis. The standard distribution of patients according to ESI at our ED is as follows: ESI-1 4.9%, ESI-2 5.0%, ESI-3 44%, ESI-4 39.3%, ESI-5 6.7%.[13]

The eligibility criteria was chosen on basis of results of an earlier study performed in our ED.[13] The researchers monitored patients during the time frame of 1200–2000 h as it mostly is the busiest time of the day at the ED. Patients triaged with category ESI 4 or 5 present with minor complaints, the larger percentage (95–99%) of these patients were discharged home within 4 h. The Medical Ethical Committee of the hospital approved the study, informed consent was waived as routine care was not influenced and no therapeutic intervention was introduced.

2.3. Methodology

The data used for calculation of the NEWS were collected at three time points, namely at arrival ED (time point 0: NEWS – T0), 1 h after arrival at the ED (time point 1: NEWS – T1), and if applicable at transfer to a hospital ward (time point 2: NEWS – T2). Two trained researchers (EH and BvB) collected data, which contained demographic details, medication use, medical history, and vital parameters needed to calculate the NEWS (see Table 1). This data collection was in addition to any observations taken at the time of triage.

EWS scores were calculated using the NEWS-score as proposed in the report by the Royal College of Physicians.[14] The outcomes of interest for this study were: hospital admission, ICU admission, length of stay and 30 day mortality.

2.4. Statistical analysis

For data analysis IBM SPSS 20.0 (Chicago, USA) was used. Student's *t* test was used for independent samples to compare means for normally distributed variables and Mann–Whitney *U* test for variables that were not normally distributed. A $p < 0.05$ regarded as statistically significant. Descriptive statistics were used to determine patient characteristics (presented as mean ± SD). Skewed variables were summarized using median and inter-quartile range (IQR). Receiver Operating Characteristic (ROC) analysis was used to identify the NEWS score for the highest sensitivity. The NEW scores were divided into three aggregates, aggregate 0–4 (low clinical risk), aggregate 5–6 (medium clinical risk) and aggregate 7 or more (high clinical risk) for the purposes of this study and according to the NEWS thresholds and triggers.[14]

3. Results

3.1. Patient population

A total of 300 patients were assessed for eligibility. Complete data was able to be collected for 274 patients at moment of entry to the ED (Table 3). For 247 of these 274 patients, the NEWS was calculated an hour later (Table 4). Only 133 of the 247 patients could be followed up to calculate the NEWS at discharge from the ED (admitted to the ward or discharged home). It was not possible to collect data for all patients at all-time points due to organizational reasons. The demographic characteristics are shown in Table 2.

3.2. NEWS scores

At T0 NEW scores ranged from 0 to 11 with a median score of 2.0 (IQR 1–4). The distribution of NEWS measured at T0 is shown in Table 3 (the distribution of NEWS measured at different time points is included in the appendix).