

NEWS2 and improving outcomes from sepsis

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ABSTRACT

The cause of deterioration is often unclear, so it is vitally important that we spot the sick and deteriorating patient from all causes. As a result, warning scores must cater for all conditions, and – where possible – be standardised across all healthcare settings. This article summarises the importance of an ‘unblinkered’ approach to acute illness assessment, comparing and examining the evidence for different historical scoring systems and looking at the early impact of national alignment to NEWS2 in patients admitted to hospital with suspected bacterial infections.

KEYWORDS: deterioration, pragmatism, all-causes, sepsis, outcomes, NEWS2

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Introduction

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection that is most often seen in the context of bacterial infections.¹ While infections are the most common reason for emergency admission in England, they are not the only cause, and only one of a number of reasons for an individual patient’s deterioration (Fig 1).² Studies of patients who have died from ‘sepsis’ have shown that deaths are only rarely truly preventable, and often more linked to advanced age or underlying comorbidities (eg cancer, end-stage heart failure or chronic obstructive pulmonary disease).^{3–5}

Nevertheless, to improve outcomes, it is imperative that at-risk patients are picked up as early as possible and the initial assessment of an acutely ill patient requires the clinician to determine the severity of illness, prioritisation, placement and then causation. While disease-specific scoring systems where a diagnosis is known may be useful, the acute setting of real-world medicine is far ‘grayer’ and more complex; and, as such, a more general deterioration score that detects physiological deterioration and, therefore, caters for a wide range of pathologies is often preferable.⁶

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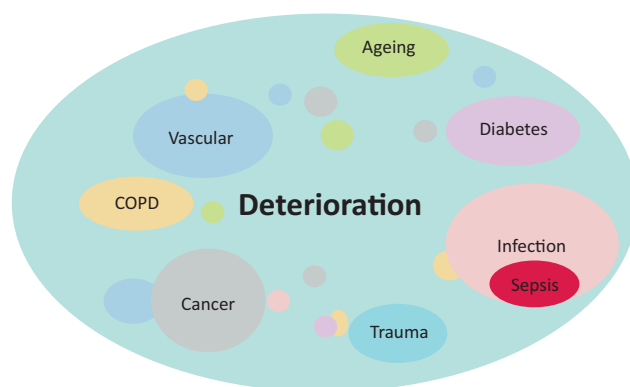


Fig 1. Reasons for an individual patient’s deterioration. COPD = chronic obstructive pulmonary disease.

Scoring systems

There have been many attempts to develop standalone severity scoring systems specifically for sepsis (Table 1), distinct from those for all-cause deterioration, by including laboratory investigations (eg systemic inflammatory response syndrome (SIRS) and Sequential Organ Failure Assessment (SOFA)) or demographic data; however, in clinical practice, this approach may have unintended consequences.

First, diagnostic uncertainty at the time of acute presentation of an illness is common, and those admitted and suspected as having an infection as a cause for their acute illness may end up with a completely different end diagnosis.

An ideal scoring system, designed to detect acute illness severity and/or clinical deterioration, must cater for all sick patients regardless of cause to prioritise those at highest risk and ideally must have been developed from an undifferentiated population with all possible conditions.⁶

Second, the scoring system must be readily calculable in settings (such as in the community or in an ambulance) without access to pathology or radiology results.

Third, the score must be easily communicable and understood, as patients traverse multiple healthcare settings during the course of a single episode of illness, enabling the recording of physiological baselines and tracking to detect early deterioration or recovery.

Over the years, a variety of sepsis scoring tools have been created.

Table 1. Comparison between the criteria of sepsis screening tools

	SIRS	Single parameter	qSOFA	NEWS aggregate score			
	TWO or more of:	ONE or more of:	TWO or more of:	0	1	2	3
Respiratory rate, breaths per minute	>20	≥25	>22	12–20		9–11 or 21–24	≥25
SpO ₂ , scale 1	n/a	n/a	n/a	≥96	94–95	92–93	≤91
SpO ₂ , scale 2	n/a	n/a	n/a	88–92	86–87	84–85	≤83
Oxygen treatment	n/a	Yes	n/a	No	No	Yes	Yes
Blood pressure, mmHg	n/a	≤90	<100	111–219	101–110	91–100	≤90 or ≥220
Heart rate, beats per minute	>90	≥130	n/a	51–90	91–110 or 41–50	111–130	≥131
ACVPU	n/a	CVPU	CVPU	Alert	Alert	Alert	CVPU
Temperature	>38°C or <36°C	n/a	n/a	36.1°C–38.0°C	38.1°C–39.0°C or 35.1°C–36.0°C	≥39.1°C	≤35.0°C
White blood count	Yes	n/a	n/a	n/a	n/a	n/a	n/a

ACVPU = alert, confusion, voice, pain or unresponsive; NEWS = National Early Warning Score; qSOFA = quick Sequential Organ Failure Assessment; SIRS = systemic inflammatory response syndrome; SpO₂ = oxygen saturation.

Single parameter systems

Sepsis scoring systems that rely on single extreme physiological parameters (eg heart rate >130 beats per minute (bpm), systolic blood pressure ≤90 mmHg) as ‘sepsis triggers’ (eg National Institute for Health and Care Excellence sepsis guidance NG51) have the appeal of simplicity.⁷ However, it is unusual for a single extreme physiological abnormality (also known as ‘red flag’ criteria) to occur in isolation as a precursor of significant deterioration; rather, a combination of several, often minor abnormalities are more common and more predictive.⁸ Single extreme parameter observations are significantly lower risk (odds ratio (OR) 0.26) than an aggregate National Early Warning Score (NEWS) of 5 (OR 1.0) and increases workload by 40%.⁹ Furthermore, a study looking at 459 suspected infection patients found that single extreme physiological parameters (red flags) should not be used in isolation as a triggering tool as it can potentially miss up to 45% of patients who are at high risk of death following an infectious episode, and it is not independently associated with adverse outcomes.¹⁰ For these reasons, they have not been broadly implemented.¹¹

Systemic inflammatory response syndrome

SIRS was developed in 1991 and utilises both physiology (temperature, heart rate and respiratory rate) and white blood cell response with the aim of capturing an exaggerated host response to infection.¹² In a study of over 100,000 patients with confirmed sepsis, 12% were SIRS ‘negative’ and, subsequent to this, an international Sepsis-3 task force was established to review the performance of sepsis scoring systems and proposed a new definition for sepsis and the use of a quick Sequential Organ Failure Assessment (qSOFA).^{1,13}

Quick Sequential Organ Failure Assessment

qSOFA outperforms SIRS by measuring just three bedside parameters: respiratory rate, systolic blood pressure and level of consciousness.^{14,15} These are also three of the seven physiological components of NEWS2.

NEWS2 adds to qSOFA’s three key parameters with oxygen saturation, pulse rate and temperature, as well as adding a score if the patient is dependent on oxygen therapy. These extra variables enhance the ability of NEWS2 to identify patients at risk compared with qSOFA. A single site study looked at 241,996 hospital admissions in patients with or without suspected infection.¹⁶ In those with primary infection, NEWS had an area under the receiver operator curve (AUROC) of 0.805 (95% confidence interval (CI) 0.799–0.812) vs qSOFA 0.677 (95% CI 0.670–0.685).^{16,17}

For these reasons and the universal uptake of NEWS2 nationally, qSOFA has not been utilised across the NHS in England.

NEWS/NEWS2 of 5 or more

There are major advantages in using a single scoring system to evaluate illness severity and detect clinical deterioration, especially when evaluating undifferentiated acute illness (Fig 2).^{20–22} When NEWS was updated to NEWS2, consideration was given to whether a separate scoring system was required to prompt healthcare professionals to consider acute sepsis, or whether NEWS2 could serve that purpose. Studies have shown that NEWS2 performs well at detecting and monitoring sick patients from all causes, including those with infection.^{3,9,16} An aggregate score of 5 or more appears to be the ‘sweet spot’ of sensitivity and specificity in alerting clinicians to potentially sick patients without causing excessive workloads.^{10,11} In a systematic review of studies of patients with infection receiving care outside an intensive care

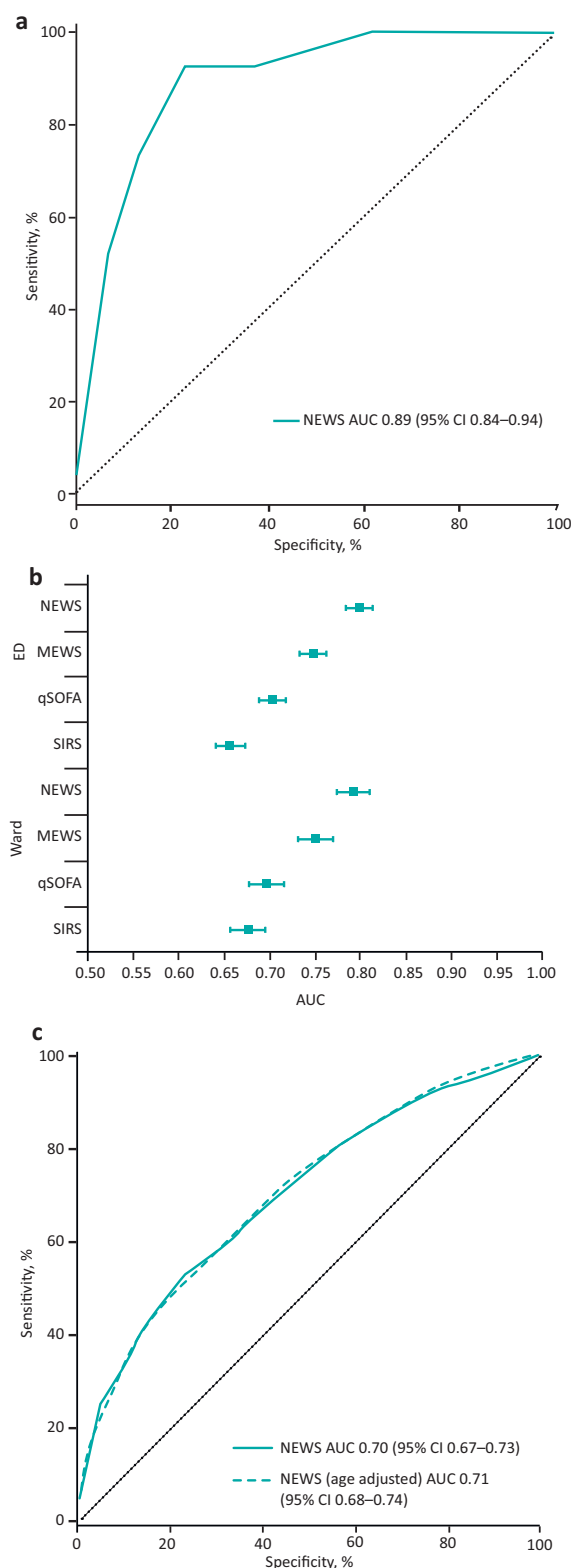


Fig 2. Aggregate National Early Warning Score receiver operating curves in different healthcare settings. a) Emergency department triage.²⁰ b) Hospital inpatients.²¹ c) Ambulance.²² AUC = area under the curve; CI = confidence interval; ED = emergency department; NEWS = National Early Warning Score; MEWS = Modified Early Warning Score; qSOFA = quick Sequential Organ Failure Assessment; SIRS = systemic inflammatory response syndrome.

unit, a NEWS score ≥ 5 predicted death with a pooled sensitivity, specificity, and area under the curve (AUC) of 0.80 (95% CI 0.71–0.86).¹⁸ Even a single NEWS aggregate score, at either pre-hospital or admission point, predicted those with sepsis or all-cause deterioration who are likely to die or require critical care.²² A study of 91,871 undifferentiated attendances to two English emergency departments reported a high predictive accuracy (AUC >0.90) for mortality with a NEWS ≥ 5 representing the right balance of sensitivity vs specificity.¹⁹ Pragmatically, a NEWS ≥ 5 identifies adult hospital patients who are severely ill with likely organ dysfunction, and it is these patients who require urgent assessment by a senior clinical decision-maker who can then determine if the underlying cause is likely to be sepsis and decide on appropriate treatment.

Spot deterioration, consider sepsis

To enhance communication between general practitioners, ambulance and secondary care services by using the same 'common language' of concern throughout the patient pathway, NHS England mandated NEWS2 national implementation across all hospital and ambulance trusts in 2018.²³ Currently, 99.5% of acute trusts and 100% of ambulance trusts now use NEWS2. It is also being increasingly adopted in the community and care homes to monitor residents and when to seek help in the event of deterioration.

NHS England published its sepsis implementation guidance in 2017, recommending a combined 'all-cause deterioration' pathway based on NEWS.^{6,24} This provides guidance for how quickly senior clinical review is required in response to patients deteriorating with a NEWS of 5 or more based on widespread evidence of its sensitivity and specificity in conjunction with clinical judgement above scores such as qSOFA, single parameter scoring systems and SIRS in patients with or without infection.^{25–28}

The Academy of Medical Royal Colleges published a statement on the initial antimicrobial treatment of sepsis that corroborates this perspective, on the usage of NEWS (using the low-, medium- and high-risk aggregate scores as specified by the Royal College of Physicians) in concert with clinical conviction of infection.²⁹

Another advantage of a single scoring system for acute illness is that it guards against blinkered, condition specific approaches because when patients are admitted as emergencies, the cause of deterioration is often unclear. This alignment of sepsis scoring with all-cause deterioration is strongly supported by clinicians as it is the safest strategy when dealing with diagnostic uncertainties.

Indeed, separating the pathways for sepsis from other causes of deterioration is potentially harmful, and sick patients (with elevated NEWS) from all causes must be equally prioritised and managed as aggressively as those with suspected sepsis.⁶ ■

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