

# Recognition of the critically ill patient and escalation of therapy

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## Abstract

Critical illness often involves multiple organ failures and is associated with significant morbidity and mortality. In the vast majority of patients, there is a recognizable period of physiological deterioration which heralds the development of organ failure and critical illness. Despite efforts to improve the detection and management of critical illness, signs of deterioration are often missed and decisions to move patients to critical care units are delayed. Standardized approaches which implement an effective 'chain of response' are now utilized worldwide. They focus on attempting to reduce the incidence of serious adverse events (SAEs) such as in-hospital cardiac arrest and unplanned intensive care unit (ICU) admission using preventative measures. These systems should include: accurate recording and documentation of vital signs, recognition and interpretation of abnormal values, rapid bedside patient assessment by trained teams and appropriate interventions. Early warning systems (EWS) are an important part of this and can help identify patients at risk of deterioration and SAEs. Assessment of the critically ill patient should be undertaken by an appropriately trained clinician and follow a structured ABCDE (airway, breathing, circulation, disability and exposure) format. This facilitates correction of life-threatening problems by priority and provides a standardized approach between professionals. Lastly, timely support and input from members of the critical care team are vital to ensure optimal outcomes for critically ill patients.

**Keywords** Assessment; critical care outreach services (CCOS); critical illness; early warning systems; medical emergency teams (METs); outcomes; prediction; rapid response system (RRS); signs; track and trigger systems (TTS)

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## Learning objectives

After reading this article, you should be able to:

- describe a logical and systematic approach to the assessment of critically ill patients
- discuss the clinical importance of early warning scoring systems in the recognition of the critically ill patient and the role of rapid response systems
- discuss the importance of timely involvement of the critical care team in making decisions regarding the most appropriate environment to care for acutely unwell patients

## Introduction

Critical illness carries a significant burden of morbidity and risk of mortality. It can rapidly evolve into multiple organ failure (MOF). Early recognition of at-risk patients and preventative measures are the most effective approaches to managing this patient group, considering that up to 40% of ICU admissions are avoidable.<sup>1</sup> Ineffective management or failure to intervene in a timely fashion can lead to adverse outcomes as the number of organ systems involved increases.<sup>2</sup>

Occasionally, the onset of life-threatening illness is acute and catastrophic, but more commonly it is insidious. Early indicators of critical illness are often missed by healthcare professionals.<sup>3</sup> Signs and symptoms can be unreliable, and patients may compensate for abnormal changes in their measured physiological parameters for a long time (Figure 1). Hence, the gradually deteriorating patient on a hospital ward may go unnoticed until severe organ failure is established. The 'chain of response' requires accurate recording and documentation of vital signs, recognition and interpretation of abnormal values and appropriate patient assessment and intervention. Systems to standardize the 'chain of response' within a hospital are referred to as rapid response systems (RRS). As part of an RRS, the use of early warning scoring systems can highlight subtle physiological derangements. An abnormal score should prompt assessment by an appropriately qualified professional or team.

A systematic ABCDE approach should be utilized in the assessment of acutely unwell patients. This standardized rapid bedside approach prioritizes clinical assessment and correction of life-threatening problems of immediate risk to the patient. It also aids communication between professionals by creating a 'common language' and reduces the risk of error. Ideally, multidisciplinary input at the bedside should facilitate rapid assessment with concurrent resuscitation and life-saving interventions.

The critical care team should be involved in the early recognition, review and escalation of management of critically unwell patients throughout the hospital environment. In addition, this team plays an active role in the decision to admit patients to critical care units and supporting patients thereafter. Prompt input from critical care services and efficient transfer to a critical care area, when appropriate, has a favourable effect on patient outcomes.

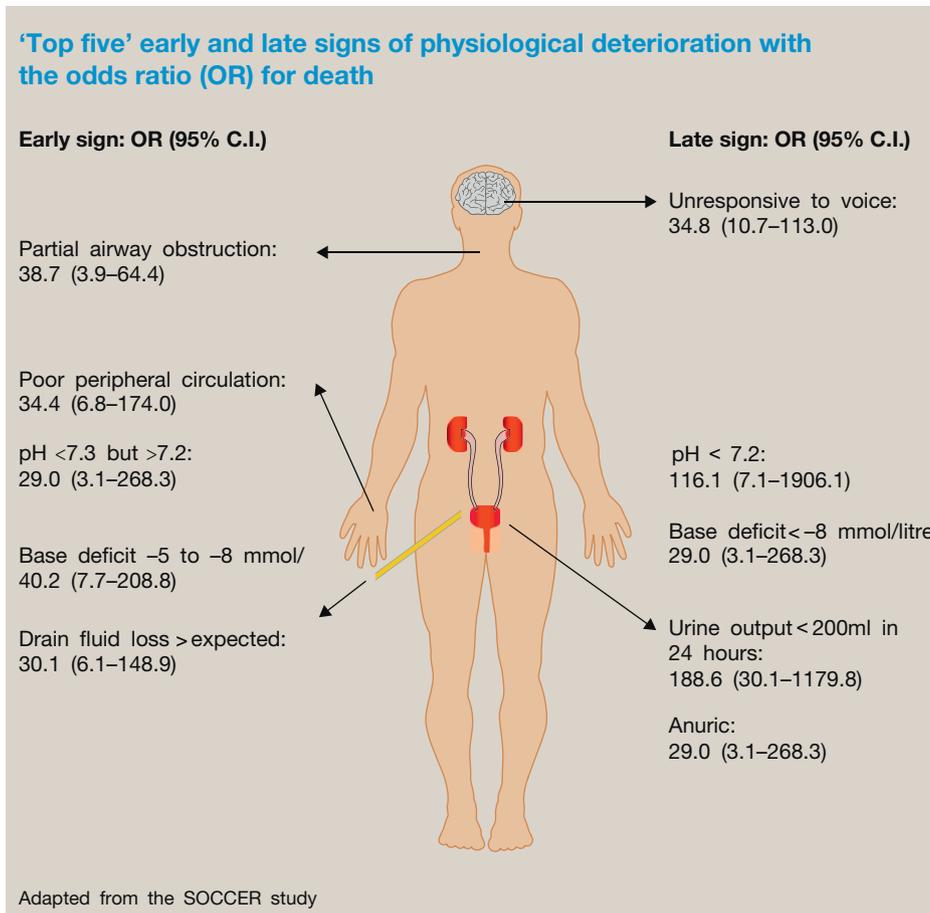


Figure 1

### A Assessment of Airway

The basic principles of airway assessment and management are covered elsewhere (see *Anaesthesia & Intensive Care Medicine* 2016; 27(10): 492–496.)

Assessment of airway patency is vital. Asking direct questions, for example, 'How are you?' or 'Can you hear me?' can elicit a quick response, determining patency of airway. A legible response gives an idea of both the patency of airway as well as adequacy of cerebral perfusion at that stage. The 'look, listen and feel' approach is effective, observing for chest wall movement, hearing breathing sounds and feeling active breathing from the patient.

*Partial airway obstruction* can occur in response to reduced level of consciousness, infection, foreign bodies or trauma, to name a few, and often results in noisy breathing. The hallmark signs of partial airway obstruction are stridor due to turbulent airflow through a narrowed airway and increased work of breathing. Hoarseness is another sign and suggests vocal cord involvement. These are all worrying signs and require the expert intervention of Anaesthetists or ENT specialists. Partial airway obstruction can progress to a *complete airway obstruction* with a progressively exaggerated breathing pattern and eventual cardiorespiratory collapse. Medical texts describe the 'optimal position' that conscious patients with airway compromise adopt to maintain their airway, often sitting upright and leaning forwards.

These patients should be supported in those positions and not be laid flat as it may exacerbate airway compromise.

Cervical spine (c-spine) injury must always be considered in airway management, particularly following trauma, where manual in line immobilization is essential. Subsequent application of a c-spine collar should be instituted until injury is ruled out. Supplemental high-flow oxygen administration is imperative, aiming for saturations of >94%.

Airway compromise requires immediate action and escalation to senior colleagues is key. Certain causes, for example, anaphylaxis, burns or epiglottitis can quickly become fatal and timely senior involvement can be life saving.

### B Assessment of Breathing

The look, listen and feel approach can be extrapolated to assess respiratory response. Note that tachypnoea is a useful and sensitive marker of illness severity. Other indicators of respiratory compromise include inability to complete sentences, use of accessory muscles of respiration, intercostal recession, altered mental status and the late sign of cyanosis. Pulse oximetry is a valuable bedside tool. Significant desaturation is often a late feature of ventilatory abnormalities, potentially resulting in false reassurance in the early stages. Arterial blood gas analysis is vital for further evaluation and management. Respiratory failure occurs when the respiratory system can no longer meet the

metabolic demands of the body and can be divided into type 1 and type 2 respiratory failures. Hypoxaemic or type 1 respiratory failure ( $\text{PaO}_2 < 8 \text{ kPa}$  or  $60 \text{ mmHg}$  with a low/normal  $\text{PaCO}_2$ ). Hypercapnic or type II respiratory failure is hypoxia ( $\text{PaO}_2 < 8 \text{ kPa}$  or  $60 \text{ mmHg}$ ) in addition to hypercarbia ( $\text{PaCO}_2 > 6 \text{ kPa}$  or  $45 \text{ mmHg}$ ). Type I respiratory failure can progress to type II respiratory failure as compensatory mechanisms fail with worsening hypoxia, acidosis and fatigue. Absence of an abnormality in oxygenation in a breathless patient should prompt a search for non-respiratory causes such as metabolic acidosis or sepsis.

Management of respiratory failure involves treating the underlying causes in addition to increasing inspired oxygen concentration. Non-invasive or invasive ventilation may be required in severe cases. The decision to ventilate patients if increases in  $\text{FiO}_2$  and continuous positive airway pressure are unsuccessful should involve senior clinicians. In some cases, the decision to ventilate patients can be straightforward, for example in a patient who remains hypoxic despite high inspired oxygen or a patient who is unconscious secondary to hypercapnia. In other cases the decision can be complex. Several factors should be taken into account such as the severity of respiratory failure, adequacy of compensation and the patient's cardiopulmonary reserve.

**Common causes of breathlessness based on speed of onset<sup>4</sup>**

Minutes	Hours	Days–weeks
Pneumothorax	Asthma	Pleural effusion
Pulmonary embolism	Pneumonia	Exacerbation of COPD
Pulmonary oedema	Pulmonary oedema	Pneumonia
	Metabolic acidosis	

**C Assessment of Circulation**

The basics of the assessment of the circulation will not be covered here. The management of circulatory failure, i.e. shock is covered in these articles (see *Anaesthesia & Intensive Care Medicine* 2017; **18**(3): 11–121; **18**(3): 122–125; and 2016; **17**(2): 86–91).

Shock is a state in which there is inadequate blood flow and oxygen supply to the organs and tissues to meet their metabolic demands. The different patterns of shock are covered in other articles (see above).

Adequate tissue perfusion, heart rate and blood pressure should all be assessed. Although shock and hypotension often coexist, hypotension need not be present. Altered consciousness level (reduced level of consciousness, agitation, confusion), skin mottling, cold peripheries, poor capillary refill ( $> 2 \text{ s}$ ), oliguria and metabolic acidosis all indicate inadequate tissue perfusion.

**D and E Assessment of Disability and Exposure**

The Glasgow Coma Score or Alert, Voice Pain, Unresponsive (AVPU) scale can be used to determine the patient's level of consciousness. Measuring blood glucose level is essential at this stage of the assessment in addition to measuring core temperature. Pupillary response should be checked frequently. The patient should be fully exposed, maintaining dignity, and examined for any other possible causes of critical illness while avoiding hypothermia.

**Early warning systems and the 'chain of response'**

In the majority of patients, there is a detectable period of physiological deterioration prior to in-hospital death, in-hospital cardiac arrest or unplanned ICU admission.<sup>5</sup> For the past two decades there has been much focus on standardizing the recognition of patients at risk of critical illness and optimizing in-hospital response to avoid such adverse events.<sup>6</sup>

Rapid response systems (RRS) have been implemented internationally as the standard structure for recognizing and managing deteriorating patients. The components of an RRS can be classified into one of two groups or 'limbs'. The afferent limb is concerned with recognizing the deteriorating and potentially critically ill patient and the efferent limb with responding to these patients and managing them appropriately.<sup>7</sup> Poor compliance with RRSs is associated with adverse patient outcomes.<sup>8</sup>

The first objective in the RRS process is to create an afferent limb system which is sensitive enough to detect potentially deteriorating patients. The system must also be efficient as it needs to be utilized at optimum intervals in order to observe trends in patient physiology over time but avoid creating extra workload for staff. Such systems, often referred to as track and trigger systems (TTS), can either take the form of (a) single or (b) multi-parameter systems or (c) aggregate-weighted track and trigger systems (AWTTS). Here, a score is calculated that reflects an aggregated number of physiological parameters out with predetermined targets. In AWTTS, the score generated is referred to as an early warning score or EWS. The National Early Warning Score (NEWS) is currently the gold standard AWTTS in the UK. It is recommended by NHS England, NHS Improvement and the Scottish Intercollegiate Guideline Network (SIGN).<sup>9,10</sup> The current system measures respiratory rate, peripheral oxygen saturation, supplemental oxygen flow rate, pulse rate, systolic blood pressure, temperature and conscious level using the AVPU score (see Table 1). The aggregate weighted scores then trigger an appropriate response as outlined in Table 2.

Much like a TTS, the efferent limb of the response system has varying structures with different terminology depending on the hospital site. Common examples include rapid response teams (RRT), medical emergency teams (MET) and critical care outreach services (CCOS). However, in every example the team must consist of a multi-disciplinary, organized group of trained clinicians including those with critical care competencies, airway skills and diagnostic skills. Their objective is to attend to deteriorating patients in order to provide an emergency review and initial management. They also contribute to decisions regarding escalation of patient care to critical care areas and establishing appropriate ceilings of care. A commitment to hospital staff education and ongoing quality improvement in managing critical illness also often fall within the team's remit. An effective CCOS specifically extends its role to include ongoing care for those patients recovering after a period of critical illness.<sup>11</sup>

The success of rapid response systems is far from irrefutable, however. There remain areas of contention and debate particularly around how human factor elements, such as poor communication and stress, as well as pressure on resources may effect such systems. Evidence to date has not always demonstrated a strong correlation between RRSs and positive patient outcomes. An RRS is a complex process with multiple steps

**Example of The National Early Warning Score (NEWS) system**

Physiological parameter	Score						
	3	2	1	0	1	2	3
Respiration rate (per minute)	≤8		9–11	12–20		21–24	≥25
SpO <sub>2</sub> Scale 1 (%)	≤91	92–93	94–95	≥96			
SpO <sub>2</sub> Scale 2 (%)	≤83	84–85	86–87	88–92 ≥93 on air	93–94 on oxygen	95–96 on oxygen	≥97 on oxygen
Air or oxygen?		Oxygen		Air			
Systolic blood pressure (mmHg)	≤90	91–100	101–110	111–219			≥220
Pulse (per minute)	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			CVPU
Temperature (°C)	≤35.0		35.1–36.0	36.1–38.0	38.1–39.0	≥39.1	

The NEWS system is employed in most UK hospitals to assist in the early detection of patients with physiological impairment. It is a seven component scoring system based on bedside physiological parameters including an assessment of neurological state using the AVPU score.

**Table 1**

involving many different multi-disciplinary staff members. Therefore, there is scope for breaches in this chain that may disrupt the process and lead to poorer outcomes than expected. Human or sociocultural factors such as fear of reprimand, poor communication and the general culture amongst ward staff are some of the most common individual factors leading to poor compliance with such systems.<sup>12</sup> Track and trigger systems should also be used to increase awareness of potentially

deteriorating patients and not viewed as purely a ‘tick box exercise’ to the detriment of employing good clinical skills and judgement.<sup>13</sup> Better outcomes are achieved when an RRS is implemented well with an EWS used alongside good clinical judgement, staff education and experienced staff.<sup>14</sup> In summary, there is reasonable evidence that RRSs are associated with a reduced rate of cardiorespiratory arrest and mortality.<sup>15</sup> However, it is recognized that such systems must be used in the

**Example of the NEWS thresholds and triggers as recommended by the Royal College of Physicians**

New score	Clinical risk	Response
Aggregate score 0–4	Low	Ward-based response
Red score Score of 3 in any individual parameter	Low–medium	Urgent ward-based response*
Aggregate score 5–6	Medium	Key threshold for urgent response*
Aggregate score 7 or more	High	Urgent or emergency response**

\*Response by a clinician or team with competence in the assessment and treatment of acutely ill patients and in recognising when the escalation of care to a critical care team is appropriate.

\*\*The response team must also include staff with critical care skills, including airway management.

**Table 2**

context of clinical judgement and be supported by sufficient resources.

### The role of the critical care team and early transfer

The concept of 'intensive care without walls' is now well established. It advocates that critical care teams should extend their resources and expertise to assisting with the detection, management and transfer of at-risk patients in the general ward and emergency department (ED). In line with our earlier comment, 41% of ICU admissions are considered avoidable. Moreover, 39% of patients admitted to ICU are transferred too late in the course of their clinical illness.<sup>1</sup>

The early stage in a patient's deterioration may present the optimum time for critical care interventions with actions during this time window offering the greatest chance of improving outcome. Delays in care escalation, defined as 'deterioration to door time', of greater than 4 hours are common and associated with an increased incidence of adverse outcomes.<sup>16</sup> Similarly, in one cohort study, prompt ICU admission in under 4 hours resulted in a 16.2% reduction in 90 day mortality amongst patients requiring ICU care.<sup>17</sup> No consensus statements or standards for maximum time to ICU admission are currently in use, however the above emphasizes the importance of timely escalation to ICU.

Factors which may reduce the 'deterioration to door time' begin with the detection and initial response to deteriorating patients as detailed previously. However, additional issues may include: communication with hospital management and bed flow, effective handovers, availability of ICU beds, clinician judgement regarding the appropriate thresholds for ICU admission and availability of staff to assist with the transfer.

Optimum care of the critically ill patient should include a prompt review by the critical care team and a decision regarding whether or not to transfer to ICU without delay. If queries or doubts arise regarding the appropriateness for ICU admission for a patient, advice should be sought promptly from a senior member of the critical care team to avoid delaying the transfer unnecessarily. If a decision is made not to transfer a patient to the ICU, the decision should be clearly documented, conveyed to the patient, next of kin and staff as appropriate. In addition, a clear plan should be made regarding further reviews by the critical care team, thresholds for re-referral or establishing an appropriate ceiling of care which may include a decision not to attempt cardio pulmonary resuscitation. ◆

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