mysafety insight

Automated Early Warning-Score (EWS) System

Clinical Information Leaflet

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Early Recognition Of Deterioration To Improve Clinical Outcomes And Patient Safety

Can patient deterioration be anticipated?

Studies have shown that in a large number of patients admitted to critical care departments, life-threatening changes were observed and documented up to 8 hours before the admission (Figure 1) [1,2,3]. These observations and decisions arising from such early manifestation could improve care and resuscitation outcomes, because most further deteriorations and even death can be prevented with early intervention (Figure 2).

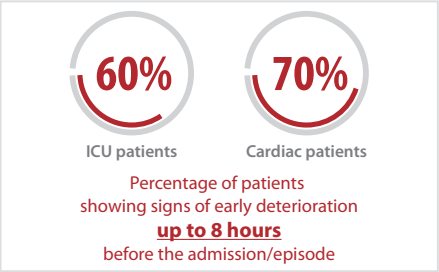

Figure 1. Deterioration could be anticipated earlier

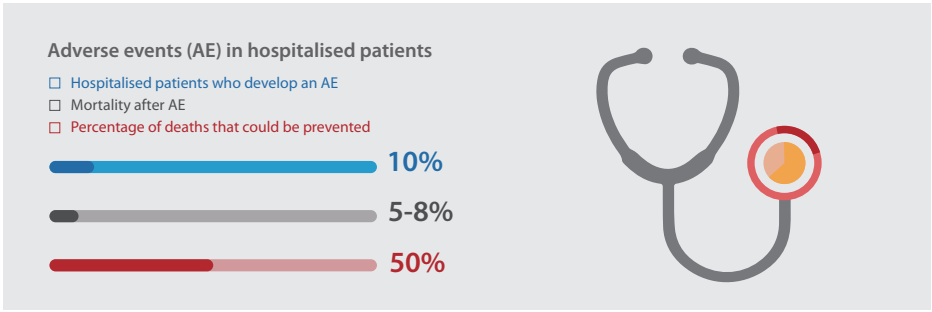

Figure 2. Incidence of in-hospital adverse events, mortality rate after AE, and the percentage of preventability [4,5,6,7,8]

Why does early deterioration sometimes go undetected?

However, there are numerous reports that indicate there is a high risk of missing patient deterioration episodes that develop in unexpected adverse events. One of these documents is the "Patient-Safety-Related Hospital Deaths in England: Thematic Analysis of Incidents Reported to a National Database, 2010–2012" [9]. It was reported that of all the reviewed hospital deaths on the document, the most common incident type was a failure to recognise or act on deteriorations (23%).

One of the reasons why patient deterioration may not be detected is the nurse-to-patient ratio and the subsequent frequency of vital sign monitoring; which decreases from higher to lower acuity care units. To confirm this hypothesis, a prospective defined

analysis of the UK National Cardiac Arrest Audit (NCAA), collected data from 144 acute hospitals relating to 23,554 patients over the age of 16, showing that most in-hospital cardiac arrests occurred in General Wards (56.6%) and not the conventional acute care units such as ICU (5.2%) or CCU (10.4%) (Figure 3) [10].

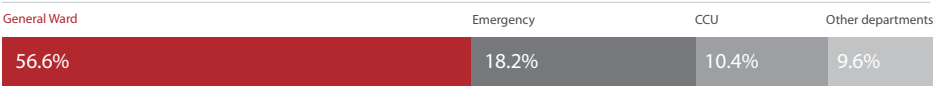

Figure 3. Location of cardiac arrests for 23,554 in-hospital patients

Looking For A Systemic Approach To Identify Early Deterioration

Early recognition of patient deterioration to reduce sudden adverse events (SAE)

Research figures suggest that failing to identify early deterioration can increase the risk of mortality. For example, Cardoso et al. reported that each hour of delay in the admission of a patient to the ICU was associated with a 1.5% increased risk of ICU death [11]. Therefore, timely recognition of patients with deteriorating acute illness and providing prompt management can be of great influence in improving clinical outcomes. It can reduce the need to transfer these patients to higher acuity units like ICU, decrease the length of a hospital stay, and reduce the costs [12,13].

In-hospital patient deterioration is often preceded by a period of abnormalities in vital signs, for example, changes in physiological parameters like pulse, blood pressure, respiratory rate and temperature [14]. Based on this premise, in the late 90' s several studies were able to develop scores to anticipate these situations, and as a result, Early Warning Scores (EWS) were created to determine the degree of patients' illness based on their physiological parameters [15].

Protocols used for EWS systems

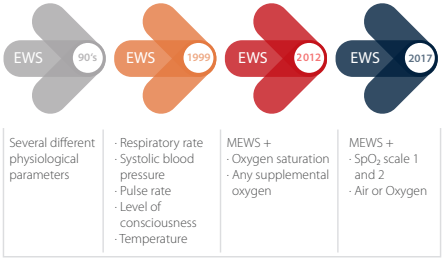

Figure 4. The development of typical EWS protocols

For example, in the UK, several reports from the National Institute for Health and Clinical Excellence (NICE) and the Royal College of Physicians, have advocated the use of the two most popular EWS systems worldwide, Modified Early Warning Score (MEWS) and National Early Warning Score (NEWS). NEWS2 is the latest version of NEWS, updated in 2017. All these protocols advocate a system to standardise the assessment and response to acute illness (Figure 5).

However, throughout the world, EWS departs from the principle that clinical deterioration can be seen through changes in multiple physiological measurements. These scales are calibrated to different populations and the scored parameters may vary. Until recently there has been a lack of consensus regarding the ideal EWS protocol, but there is evidence that certain parameters are better than others to identify early deterioration [16].

Listed below is a description of the physiological parameters included in most EWS systems:

• Respiratory rate: respiratory rate is an important indicator of potential respiratory dysfunction.

• Systolic blood pressure: high systolic blood pressure may indicate cardiovascular disease, while low systolic blood pressure may indicate circulatory compromise.

• Pulse rate: tachycardia may indicate circulatory compromise.

• Level of consciousness: Alert: a fully awake patient; Voice: the patient makes a response to voice; Pain: the patient delivers a response to a pain stimulus; Unresponsive: the patient does not give a response to voice or pain.

• Temperature: a temperature that is too high or too low is a sensitive indicator of acute illness, especially infection.

• Oxygen saturation: oxygen saturation is an important parameter for the integrated assessment of pulmonary and cardiac function. Routine monitoring by pulse oximetry is recommended (NEWS and NEWS2).

• Patient on room air or supplemental oxygen: whether the patient is on oxygen support (NEWS and NEWS2).

National Early Warning Score 2 (NEWS2)

Physiological parameters	3	2	1	0	1	2	3
Respiratory rate (permin)	≤8	-	9-11	12-20	-	21-24	≥25
SpO_2 scale 1(%)	≤91	92-93	94-95	≥96	-	-	-
SpO_2 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 BP (mmHg)	≤90	91-100	101-110	111-219	-	-	≥220
Pulse rate (per min)	≤40	-	41-50	51-90	91-110	111-130	≥131
Level of consciousness	-	-	-	A	-	-	C,V,P or U
Temperature (°C)	≤35.0	-	35.1-36.0	36.1-38.0	38.1-39.0	≥39.1	-

A=Alert	C=New confusion (delirium)	V=Response to verbal stimulation	P=Response to painful stimulation	U=Unresponsive

NEWS2 score	Clinicalrisk	Frequency of monitoring	Clinical response
Total score 0		Minimum 12 hourly	· Continue routine NEWS monitoring
Total score 1-4	Low	Minimum 4-6 hourly	· Inform registered nurse, who must assess the patient · Registered nurse decides whether increased frequency of monitoring and/or escalation of care is required
3 in a single parameter	Low-medium	Minimum 1 hourly	· Registered nurse to inform medical team caring for the patient, who will review and decide whether escalation of care is necessary
Total 5 or more: Urgent response threshold	Medium	Minimum 1 hourly	· Registered nurse to immediately inform the medical team caring for the patient · Registered nurse to request urgent assessment by a clinician or team with core competencies in the care of acutely ill patients · Provide clinical care in an environment with monitoring facilities
Total 7 or more: Emergency response threshold	High	Continuous monitoring of vital signs	· Registered nurse to immediately inform the medical team caring for the patient this should be at least at specialist registrar level · Emergency assessment by a team with critical care competencies, including practition(s) with advanced airway management skills · Consider transfer of care to a level 2 or 3 clinical care facility, ie higher-dependency unit or ICU · Clinical care in an environment with monitoring facilities

Figure 5. An example of how an EWS system works (NEWS2)

Automated EWS And Its Application Along The Clinical Pathway To Improve Outcomes

Recommending EWS

It is recommended to use EWS during initial prehospital and/or hospital assessment of a patient throughout the patient's hospital stay [17]. However, EWS should only be used as an aid to clinical decision making rather than a substitute for the prognosis of critically ill patients. The overall performance of the EWS system is not solely dependent on the scoring system but also the organization of the response [18]. Successful implementation of an EWS in the hospital must go hand in hand with proper education of staff and increasing awareness of the necessity of structural patient monitoring. This will eventually lead to a change in the mindset of healthcare providers to collaborate as a team, thereby leading to a better organization of patient care. Every score should be used as an adjunct to the clinical judgment of the doctor [15].

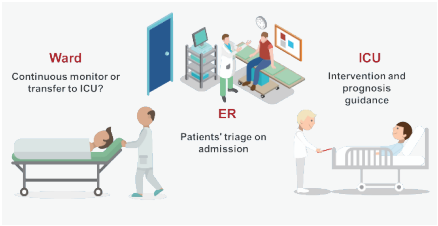

Figure 6. Typical scenarios where EWS can be helpful

Automated systems to improve workflow

Automatisation of EWS into the vital signs monitoring system has decreased the time required for vital sign measurement and recording, an improvement in the proportion of rapid-response-team-calls triggered by respiratory criteria, and an increase in the survival rate of patients receiving rapid-response-team-calls [19].

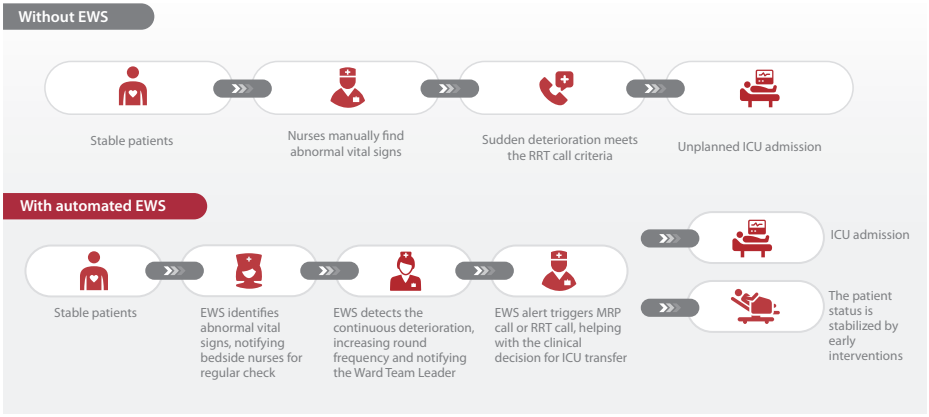

Figure 7. An example of how automated EWS systems could help with workflow

Fast Intervention With Mindray Automated EWS, Smart Alarming, And Intuitive Visuals

Flexible and configurable protocols

Mindray's EWS will provide the standard MEWS, NEWS, and NEWS2, but will also allow users to create and save customised scoring protocols. To better satisfy patient needs, the individual parameter scoring (IPS) places full control of all parameters and limits in the clinicians' hands.

Automated EWS and Smart Alarming

Early warning scores are used to identify the patients at risk. With Mindray' s automated EWS, a patient' s vital signs are automatically measured and the EWS is calculated regularly or linked to certain conditions. Auto calculation of a new score can be triggered by each or all the three following events: preset time interval or interval according to the last EWS score, every new NIBP, or a vital sign alarm (Figure 8). The interval can be set by the user in a time range (from 5 minutes to 24 hours) or according to the patient' s last EWS score result. Once a deterioration is detected, the patient monitor will start alarming based on predefined settings to inform the responsible staff about the change in patient condition at an early stage.

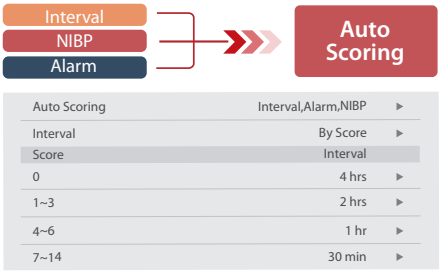

Figure 8. Auto calculation of a new socre can be linked to certain conditions

Intuitive visuals and a comprehensive graphic display

Mindray's Intuitive Visuals system shows all relevant information in one place, with data integrated into the patient monitor's main screen. With a single tap of the finger, the EWS panel will appear or disappear and can display short or long trends. Even when the EWS panel is not shown directly on the patient monitor main screen, a small graphic will show the current EWS status as well as information from the other patient parameters.

Figure 9. Clinical response according to different scores

• Clinical response according to different scores empowers staff to make more informed decisions and is available with a simple finger tap.

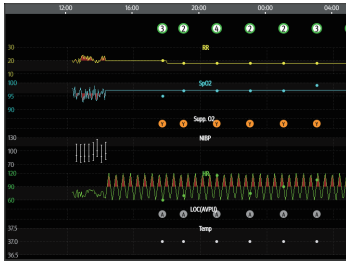

Figure 10. EWS trends with detailed information

• In this time scale example, users can see the patient's EWS development or examine both comprehensive and mini trend views for further patient insights.

Aiming to create safer patient environments, Mindray incorporates automated early warning scoring notification systems in a wide range of patient monitors, from low to high acuity. By including this EWS system, Mindray products contribute to safer and more efficient patient management by anticipating potential complications and improving workflows.

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