Using Early Warning Score in GE B105/B125 Patient Monitor for Covid-19 patients

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Role of EWS for Covid-19 cases

As the COVID-19 pandemic spreads, it is straining the overall healthcare infrastructure at all locations across the globe. The number of doctors and nurses are not sufficient compared to the inflow of patients. In such a resource constraint and highly contagious environment, it is even more important to monitor the condition of the patient and take the right clinical decisions before it's too late.

Based on Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19) by CDC

Among patients who developed severe disease

- Medium time to dyspnea: 5 to 8 days
- Median time to ARDS (acute respiratory distress syndrome): 8 to 12 days
- Median time to ICU admission ranged from 10 to 12 days.

26% to 32% of hospitalized patients need ICU Care

ARDS among COVID-19 Patients

- 20% to 42% for hospitalized patients
- 67% to 85% of ICU Patients

Clinicians should be aware of the potential for some patients to rapidly deteriorate one week after illness onset.

Use of NEWS

Patient management based on case severity

EWS score can be used to help clinician to determine the monitoring frequency. EWS score group can also be used for overall Patient Management. Following guidelines show how EWS score can be used to decide monitoring frequency and course of treatment.

Guideline references for Covid-19

WHO

World Health Organization's guidance issued in Mar-2020 for Clinical management of Severe Acute Respiratory Infection (SARI) for COVID-19, recommends utilization Early Warning Score that facilitates early recognition and escalation of treatment of the deteriorating patients[19]

INDIA

MoHFW India guidelines for management of COVID-19 recommends monitoring all elements of Early Warning Score such as Temp, RR, SpO_2, HR etc. Automated way of calculating of EWS can serve as quick bedside tool especially in resource constraint environment[23]

ITALY

Recommendation report written by Emanuele Nicastri et all at National Institttute for the Infectious Diseases "L. Spallanzani", IRCCS, Rome, Italy, recommends course of treatment based on MEWS score for COVID-19 patients[20]

Source: Emanuele Nicastri et al. Recommendations for COVID-19 Clinical Management. National Institute for Infectious Diseases L. Spallanzani", IRCCS, Rome, Italy. Infectious Disease Reports 2020; 12:8543

CLINICAL OBSERVATION	EWS	MONITORING FREQUENCY
Asymptomatic or mild infection	NA	1-3 times a day
Stable patient presenting with respiratory/ systemic symptoms	<3	Every 8 hours
Patient affected with respiratory symptoms, clinically unstable but not critical	3-4	Every 2 -4 hours
Critical Patients	>4	Continuous

Swiss Society of Intensive Care Medicine

Inpatient management according to the Early Warning Score (EWS)

- 0-4 points: hospitalisation without special additional supervision
- 5-6 points (or ≥3 points in one parameter): intermediate care unit (IMCU) or monitoring unit/room
- >6 points: intensive care unit (ICU)

Table 1: Decision support for patient assessment using the modified Early warning score.

Parameter	3	2	1	0	1	2	3
Age				<65			>65
Respiratory frequency (/min)	<9		9-11	12-20		21-24	>25
Oxygen saturation under room air (%)	<92	92-93	94-95	>95			
Oxygen supply necessary		Yes		No			
Systolic blood pressure (mm Hg)	<91	91-100	101-110	111-219			>219
Pulse (/min)	<41		41-50	51-90	91-110	111-130	>132
Conscious-ness				Normal			Confused, lethargic, coma
Tempera-ture (°C)	<35.1		35.1-36.0	36.1-38.0	38.1-39.0	>39.0	

CHINA

A paper published from China during the early phase of COVID-19 pandemic offered an early warning score based on an adapted version of the NEWS2 score with age >65 (score 3 points) added to reflect emerging evidence that age is an independent risk factor for survival[21]

EARLY WARNING SCORE FOR 2019 nCoV INFECTED PATIENTS

PARAMETERS	3	2	1	0	1	2	3
Age				<65			≥65
Respiration rate	≤8		9-11	12-20		21-24	≥25
Oxygen saturations	≤91	92-93	94-95	≥96			
Any supplemental oxygen		Yes		No			
Systolic BP	≤90	91-100	101-110	111-219			≥220
Heart rate	≤40		41-50	51-90	91-110	111-130	≥131
Consciousness				Alert			Drowsiness Lethargy Coma Confusion
Temperature	≤35.0		35.1-36.0	36.1-38.0	38.1-39.0	≥39.1	

EARLY WARNING RULES FOR 2019 nCoV INFECTED PATIENTS

Score	Risk Grading	Warning Level	Monitoring Frequency	Clinical Response	Solution
0	/		Q12h	Routine Monitoring	/
1-4	Low	Yellow	Q6h	Bedside evaluation by nurse	Maintain existing monitoring/ Increase monitoring frequency/ Inform doctor
5-6 or 3 in one parameter	Medium	Orange	Q1 - 2h	Bedside nurse notifies doctor for evaluation	Maintain existing treatment I Adjust treatment plan/ CCRRT* remote consultation
≥7	High	Red	Continuous	Bedside nurse notifies doctor for emergency bedside evaluation CCRRT remote consultation	CCRRT on - site consultation
≥7	High	Black	Continuous	Patients are extremely severe with irreversible end -stage diseases facing death, such as serious irreversible brain injury, irreversible multiple organ failure, end -stage chronic liver or lung disease, metastatic tumors, etc. Should be discussed urgently by the expert group about the admission decision.	

Early warning score and ru!es for 2019 - nCoV infected patients. *CCRRT: Critical Care Rapid Response Team

Source: Liao, X., Wang, B. & Kang, Y. Novel coronavirus infection during the 2019-2020 epidemic: preparing intensive care units-the experience in Sichuan Province, China. Intensive Care Med 46, 357-360 (2020). https://doi.org/10.1007/s00134-020-05954-2

National Early Warning Score (NEWS)

What is NEWS ?

The **National Early Warning Score (NEWS)** was launched by the Royal College of Physicians (RCP) in 2012 to improve the identification, monitoring and management of unwell patients in hospital.

Need for standardization of **Early Warning Score (EWS)** across the NHS led to the development of the **National Early Warning System (NEWS)**

Background

EWS was initially introduced in 1997 in the UK and has been further developed over years into various types.

KEY TAKEAWAY

- It is an internationally recognized risk scoring system
- Developed to facilitate early detection of deterioration in hospitals
- It helps to increase the chances of improving patient's outcome[1]
- The real-time score is able to assist clinical decision making and enable more actionable and effective individualized care
- EWS Helps to map the Care pathways or protocol guidelines to score or score group[11]

1997	2003	2007	2010	2019
EWS	**MEWS, SEWS**	**Multi-Parameter EWS**	**ERC on EWS**	**NEWS / NEWS2**
Morgan et al developed Early Warning System Composed of five physiological parameters to predict outcome and to identify early signs of deterioration[2]	Base EWS modified to create MEWS (UK) and SEWS (Scotland)	The National Institute for Health and Clinical Excellence (NICE) recommended use of multiple parameter or aggregate weighted scoring systems, in acute hospital settings	ERC outlined the importance of EWS by including them in the guidelines for resuscitation[3]	The use of NEWS/NEWS2 has been mandated in the UK for acute trusts and ambulance services since 2019

Contributing parameters of NEWS score calculations

National Institute for Health and Clinical Excellence (NICE) recommends that EWS system should measure following six parameters.


RESPIRATORY RATE


PULSE


SYSTOLIC BLOOD PRESSURE


SpO_2


CONSCIOUSNESS


TEMPERATURE

EWS Scoring System

EWS is categorized into three classes to understand the severity of risk.
The higher score indicates a greater severity of illness and risk of adverse outcome.

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*

Source: Chart 2: NEWS thresholds and triggers
https://www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news-2

Benefits of NEWS functionality

- It is a simple and cost-effective bedside tool for the assessment of severity and prognosis of sepsis caused by Gram-negative bacteremia[6]
- A review of 33 EWS found that NEWS was the most effective in predicting patients at risk of cardiac arrest, unanticipated intensive care unit admission or death within 24 hours[7]
- The real-time score is able to assist clinical decision making and enable more actionable and effective individualized care for patients' better health outcomes in target medical facilities[8]
- It enables medical staff to recognize an acute illness of deterioration of a patient even before the critical deterioration of vital signs[1]
- It measures and classifies cardinal vital signs, which offers an easy way to track and respond to changes in patient's condition
- EWS system is designed through scientific studies of parameters that contribute to medical emergency
- It helps to take prompt and appropriate clinical decisions to improve patient outcome[9]
- Based on EWS score, healthcare provider can establish monitoring frequency e.g. Every 8 hours[10]
- EWS Helps to map the Care pathways or protocol guidelines to score or score group[11]

NEWS score with B105/B125 Patient Monitor

GE Patient Monitor has capability of providing NEWS which is based on Aggregated Weighted Track and Trigger System (AWTTS).

NEWS parameters can be manually recorded and tracked on paper. However, it is cumbersome to record and calculate weighted score in often stressful situation. B105 / B125 Patient Monitors provide a simple Bedside automated way to calculate and record NEWS score.

To ensure that an early warning score is of a **high quality**, four data quality dimensions need to be considered[5]

- Timeliness
- Accuracy
- Consistency
- Completeness

Benefits with GE Monitors

- It shows the score and care instruction on screen which provides support at the point of care
- It reduces human error in recording and calculation of weighted score
- Parameters displayed- Heart rate, Systolic BP (NIBP or IBP), Temperature, SpO_2, Respiratory rate, Level of consciousness, Air or oxygen
- Total score will be displayed on the main screen with color coding and time stamp
- History with detailed parameter values and sub scores are displayed on screen
- Clinical response and individual parameter scores with colors are on a dedicated window
- Up to 100 values could be saved

Cost of High-Quality data

Manual calculation of EWS

- Time required to record parameters and calculate EWS : **3.58 minute/ Observation**
- Cost per observation : **£1.67**
- Cost per bed per year : **£1002**

Considering 3 observation per bed per day for 200 days a year

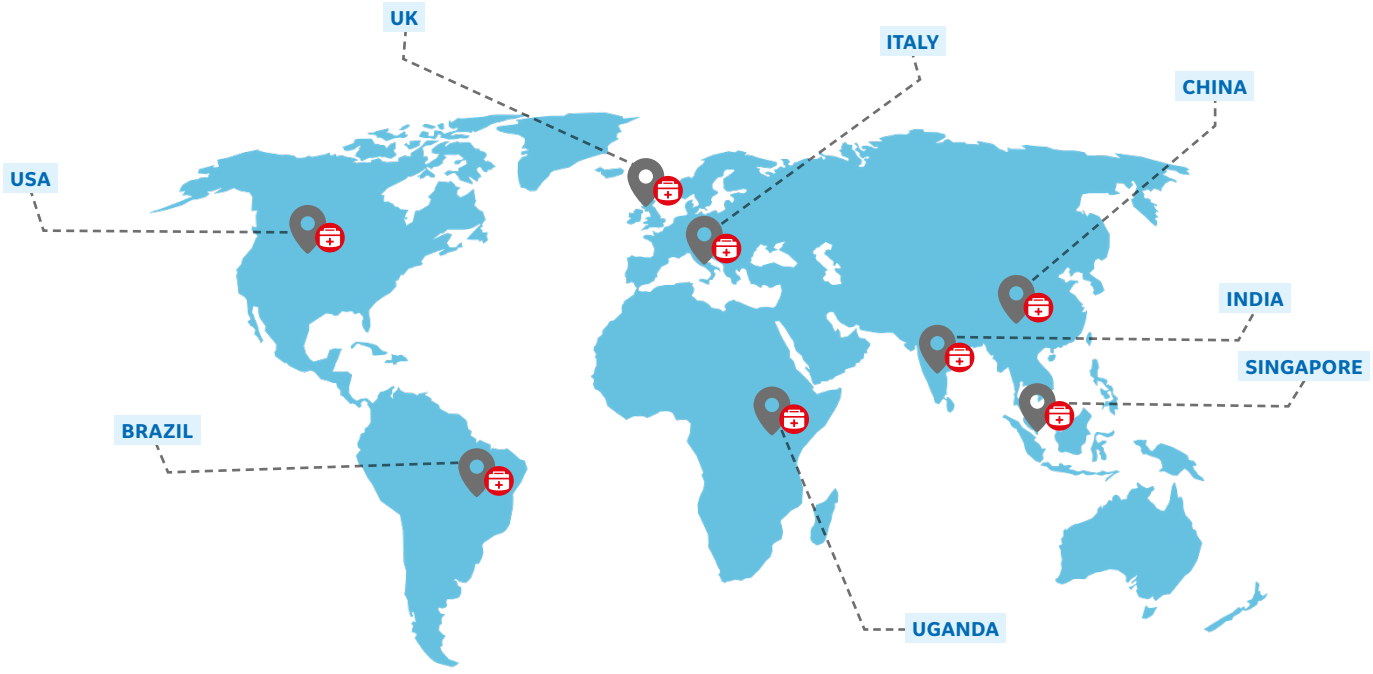
Source : https://academic.oup.com/jamia/article/24/4/717/2987471

Benefits of B1x5 Monitors

- **Accuracy** and **Completeness** of recording and calculation
- **Reduced time** to record and calculate EWS
- **Reduced cost** of calculation
- **Consistency** in calculation
- Improve Patient Care

EWS CASE STUDIES

Research and analysis across the globe have provided evidence of benefits of EWS. Different organizations of repute have adopted EWS, in different countries.



Subsequent sections detail the case studies across the world in various care areas.

Region	Sample size	Care area	Summary
USA	3.5 yr long study: large Cohort of Rapid Response per 100 patient days	Non-ICU Wards	Use of EWS led to higher rapid response system utilization, lower cardiopulmonary arrest events; this is associated with a lower mortality rate, improved patient safety, and better clinical outcomes[13]
EUROPE	35,585 patients, 198,755 observation sets	Intensive Care Unit (ICU)	NEWS has a greater ability to discriminate patients at risk of the combined outcome of cardiac arrest, unanticipated ICU admission or death within 24 h of a NEWS value than 33 other EWSs[4]
	225 Patients	Emergency Care	Higher EWS on admission correlates with increased risk of CCU/ ICU admission, death and longer hospital stays indepen-dent of patient age. An improvement in serial EWS within 4 h of presentation to hospital predicts improved clinical outcomes[15]
ASEAN	11,300 patients, 298,743 vital signs observation sets	Acute Medical Ward	NEWS accurately triages patients according to the likelihood of adverse outcomes in infection-related acute medical settings. Outcome Measured was the deterioration that required transfer to ICU or death within 24 hours of a vital signs observation set.[12]
LATAM	115 Patients	Trauma Care Unit	This cross-sectional and retrospective study concludes that the EWS system is a good predictor of severity and it can improve the care in the shortest possible time[16]
INDIA	150 consecutive medical emergency patients	Emergency Care	National Early Warning Score (NEWS) is a useful simple physiological scoring system for assessment and risk management of medical emergency admissions[17]
AFRICA	452 patients	Medical and Surgical ward patients	Study concludes that it is useful triage tool to identify patients at greatest risk of death[14]

Instruction on using EWS in GE Patient Monitor

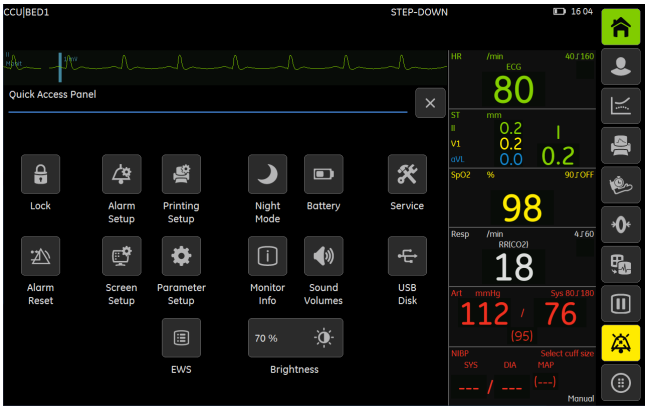
NEWS parameters can be manually recorded and tracked on paper. However, it is cumbersome to record and calculate weighted score in often stressful situation. For critical patients, continuous monitoring is required, this can be better achieved by automated NEWS calculation supported in B105/B125 VSP2.0 Patient Monitors.

GE Healthcare Patient Monitor provides the National Early Warning Score reference from the Royal College of Physicians. Please follow below set of instruction to use EWS on Patient Monitors.

VIEWING EWS

The EWS can be set to digit field to display last score.

- Select > ***Screen Setup.***
- Setup EWS to digit field.
- For waveform layout: Select ***Waveform*** horizontal tab > ***Lower Area*** vertical tab.
- For large number layout: Select ***Large Number*** horizontal tab.



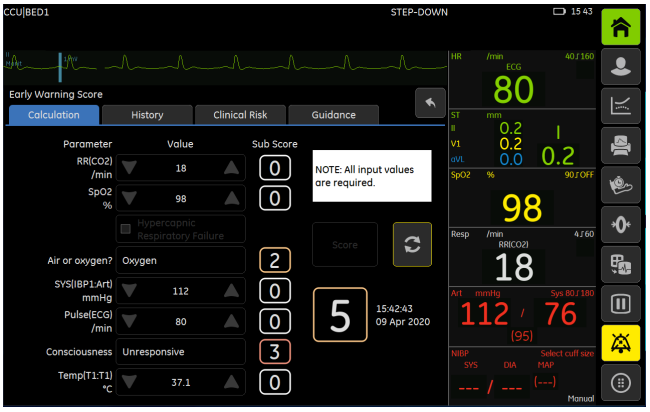
MONITOR SCREEN SETUP

CALCULATING EWS

- Select > ***EWS***.
- Confirm if the patient meets the intended use.
- Select check box of ***Hypercapnic Respiratory Failure***, select the ***Air or oxygen?*** and ***Consciousness*** value.

  Note: If IBP is connected, system auto populates SBP where while using NIBP, manually input SBP data
- Check other parameter values, if the parameter is not available on monitor, adjust values if necessary.
- Select Score to do single calculation.

  Use to refresh calculations



EWS CALCULATION SCREEN

VIEWING EWS HISTORY

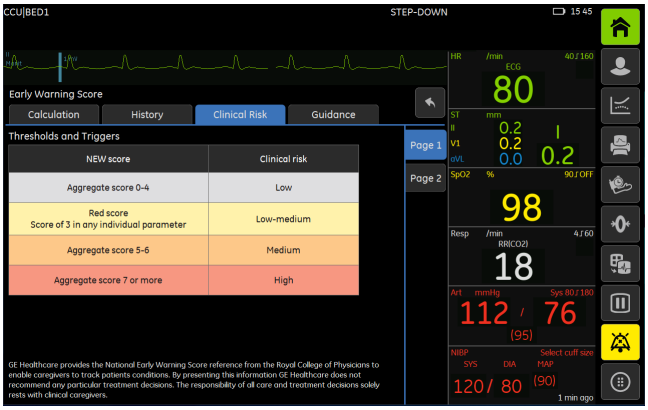
The EWS can be set to digit field to display last score.

- Select > ***EWS***.
- Select ***History*** tab.
- Select one historical score, you can review the detail parameters value for this EWS.

EWS HISTORY SCREEN

VIEWING EWS CLINICAL RISK

- Select > ***EWS***.
- Confirm if the patient meets the intended use.
- Select the ***Clinical Risk*** tab.
- Select ***Page 1*** vertical tab to review EWS clinical risk.



CLINICAL RISK SCREEN PAGE 1

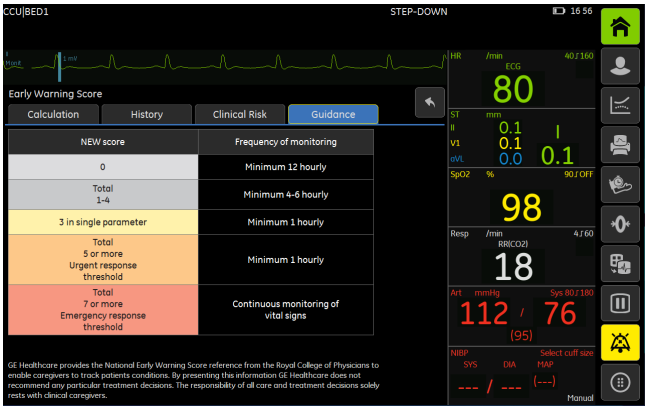
VIEWING EWS CLINICAL RISK

- Select > ***EWS***.
- Confirm if the patient meets the intended use.
- Select the ***Clinical Risk*** tab.
- Select ***Page 2*** vertical tab to review EWS calculation rule.

CLINICAL RISK SCREEN PAGE 2

VIEWING EWS GUIDANCE

- Select > ***EWS***.
- Select the ***Guidance*** tab to review EWS guidance.



EWS GUIDANCE SCREEN

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B125 and B105 patient monitor software version VSP 2.0 is not available in US and is not 510k cleared.