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REVISIONES

Early warning scales to track clinically deteriorating in emergency medical services: an integrative review

Escalas de alerta precoce para rastrear deterioração clínica em serviços médicos de emergência: revisão integrativa

Escalas de alerta temprana para rastrear el deterioro clínico en los servicios médicos de emergencia: una revisión integradora

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ABSTRACT:

Objective: To identify the scientific evidence in the literature on the use of early warning scales in the identification of adult and elderly patients in clinical deterioration in emergency medical services.

Methods: Integrative review, supported by the recommendation Preferred Reporting Items for Systematic Reviews and Meta-Analyses, with a search mnemonic based on the Populacion - Interest Phenomenon - Context (PICo) strategy, performed in the sources: US National Library of Medicine National Institutes Database Search of Health, Web of Science, SciVerse Scopus, Latin American and Caribbean Literature in Health Sciences and Cumulative Index to Nursing and Allied Health Literature. Rayyan was used in selection and content analysis to analyze the findings.

Results: 691 articles were identified, of which 22 composed the sample and 27 scales were listed, with emphasis on the National Early Warning Score, National Early Warning Score 2, Quick Sepsis Related Organ Failure Assessment and Modified Early Warning Score. The scales had similar assessment parameters, characterized by heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation and level of consciousness.

Conclusion: 27 scales were listed with similar evaluation parameters, in which four were the most prevalent and of these the National Early Warning Score proved to be the most accurate, however evidence shows that the Modified Early Warning Score is the most used in emergency medical services.

Keywords: Clinical Deterioration; Emergency Medical Services; Patient Safety; Vital Signs.

RESUMO:

Objetivo: Identificar as evidências científicas existentes na literatura sobre o uso de escalas de alerta precoce na identificação de pacientes adultos e idosos em deterioração clínica nos serviços médicos de emergência.

Métodos: Revisão integrativa sustentada pela recomendação *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*, com estratégia de busca fundamentada no mnemônico *Populacion - Interest Phenomenon - Context* (PICo), realizada nas fontes: *US National Library of Medicine National Institutes Database Search of Health*, *Web of Science*, *SciVerse Scopus*, Literatura Latino-americana e do Caribe em Ciências da Saúde e *Cumulative Index to Nursing and Allied Health Literature*. Utilizou-se o *Rayyan* na seleção e a análise de conteúdo para análise dos achados.

Resultados: Identificaram-se 691 artigos, destes, 22 compuseram a amostra e elencaram-se 27 escalas, com destaque para a *National Early Warning Score, National Early Warning Score* 2, *Quick Sepsis Related Organ Failure Assessment* e *Modified Early Warning Score.* As escalas possuíam parâmetros de avaliação semelhantes, caracterizados pela frequência cardíaca, frequência respiratória, pressão arterial sistólica, temperatura, saturação de oxigênio e nível de consciência.

Conclusão: Elencaram-se 27 escalas com parâmetros de avaliação semelhantes, das quais quatro foram as mais prevalentes e, destas, a *National Early Warning Score* demonstrou ser a mais precisa. No entanto, as evidências demonstram que a *Modified Early Warning Score* é a mais utilizada nos serviços médicos de emergência.

Palavras-chave: Deterioração Clínica; Serviços Médicos de Emergência; Segurança do Paciente; Sinais Vitais.

RESUMEN:

Objetivo: Identificar la evidencia científica en la literatura sobre el uso de escalas de alerta temprana en la identificación de pacientes adultos y ancianos en deterioro clínico en servicios médicos de emergencia.

Métodos: Revisión integradora, apoyada por la recomendación Preferred Reporting Items for Systematic Reviews and Meta-Analyses, con una estrategia de búsqueda basada en la mnemotécnica Población - Fenómeno de interés - Contexto (PICo), realizada en las fuentes: *US National Library of Medicine National Institutes Database Search of Health*, *Web of Science*, *SciVerse Scopus*, Literatura Latino-americana e do Caribe em Ciências da Saúde e *Cumulative Index to Nursing and Allied Health Literature*. Rayyan se utilizó en la selección y el análisis de contenido para analizar los hallazgos.

Resultados: Se identificaron 691 artículos, de los cuales 22 compusieron la muestra y se enumeraron 27 escalas, *National Early Warning Score, National Early Warning Score* 2, *Quick Sepsis Related Organ Failure Assessment* e *Modified Early Warning Score*. Las escalas tenían parámetros de evaluación similares, caracterizados por frecuencia cardíaca, frecuencia respiratoria, presión arterial sistólica, temperatura, saturación de oxígeno y nivel de conciencia.

Conclusión: Se enumeraron 27 escalas con parámetros de evaluación similares, en las cuales cuatro fueron las más prevalentes y de estas la *National Early Warning Score* resultó ser la más precisa, sin embargo, la evidencia muestra que la *Modified Early Warning Score* es la más utilizada en servicios médicos de emergencia.

Palabras clave: Deterioro Clínico; Servicios Médicos de Urgencia; Seguridad del Paciente; Signos Vitales.

INTRODUCTION

Most patients admitted to critical care units who evolve to cardiorespiratory arrest (CRA) or clinical worsening present early signs and symptoms of clinical deterioration, characterized by altered vital signs associated with other neurological, respiratory, and cardiovascular clinical signs[1].

Clinical deterioration, in most cases, occurs due to the lack of adequate monitoring and recording of vital signs, which makes it difficult for the healthcare team to recognize the worsening process of the patient's clinical condition, leading to an increase in CRA and death in the hospital environment[2].

To detect clinical deterioration of critically ill patients during their stay in the hospital, in the last decades scales have been developed with resources to establish parameters that identify worsening of the clinical picture and point out signs that demonstrate instability[3]. In view of the above, several early warning scales known as "Early Warning Scores" (EWS) have been developed and used with the purpose of identifying the patient at risk of clinical deterioration[4]. These scales are tools applied at the bedside to systematize monitoring and allow early intervention in the patient, enabling the determination of risk scores for clinical deterioration[4].

EWS include vital sign data such as respiratory rate (RR), heart rate (HR), systolic blood pressure (SBP), peripheral oxygen saturation (SaO2), temperature (T), and level of consciousness, and some include criteria such as age, urine output, and laboratory values, among others[1-4].

Each parameter receives a specific score that, added to the others, determines the severity of the condition, and higher scores portray greater clinical instability[5]. Some scales, in face of the score obtained, indicate a conduct to be taken by the professional, such as: immediate assessment by the nurse or physician, more frequent observation and monitoring, or referral to the Intensive Care Unit (ICU)[5].

It is observed in the literature that the monitoring of patients is still deficient in Emergency Medical Services (EMS), hindering early detection of clinical deterioration[6]. Public health services show a daily context of overcrowding, shortage of material and human resources, patients with unknown history and heterogeneous profile, besides an intense and unpredictable demand for care[6].

In this scenario, it is important to apply the EWS as a strategy to organize the process of patient care in critical care environments, thus enhancing the quality and safety of care, as well as contributing to paving the way for a better prognosis with shorter hospitalization and lower resource consumption[1-4].

In the literature search, it was found that there is a scarcity of national publications on the application and performance of assessment scales for recognition of cases of clinical deterioration[6]. Given this scientific gap, the need arises to investigate what scientific evidence exists in the literature on the use of EWS in the identification of adult and elderly patients in clinical deterioration in EMSs?

Thus, this study aimed to identify the existing scientific evidence in the literature on the use of early warning scales in identifying adult and elderly patients in clinical deterioration in emergency medical services.

METHOD

This is an integrative literature review, supported by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendation[7], which gathers and synthesizes the results of research on a theme or delimited question in a systematic and orderly manner, contributing to the deepening of knowledge on the investigated theme and to support decision making and improvement of clinical practice[8].

The following steps were followed: (1) identification of the research question; (2) establishment of the inclusion and exclusion criteria; (3) database search; (3) categorization of the information to be extracted from the studies; (4) evaluation of the studies included in the review; (5) interpretation of the results; and (6) synthesis of knowledge[8].

In the first step, the topic that addressed the EWSs used in EMSs to screen patients in clinical deterioration was identified and the research question was formulated based on the Population - Interest Phenomenon - Context (PICo) strategy(9). The acronym "P" (Population) was represented by adult and elderly patients; the acronym "I" (Phenomenon of Interest) was configured by the identification of EWSs to identify patients in clinical deterioration; and the acronym "Co" (Context of the study) was represented by SMEs. Thus, the research question emerged: what scientific evidence exists in the literature on the use of EWSs in identifying adult and elderly patients in clinical deterioration in EMSs?

In the second step, the inclusion criteria were defined: primary studies that answered the research question. Reviews, theses, dissertations, opinion articles, commentaries, essays, preliminary notes, manuals, books, and book chapters were excluded.

Utilizaram-se as seguintes fontes de informação: US National Library of Medicine National Institutes Database Search of Health (PubMed®/Medline), Web of Science, SciVerse Scopus, Latin American and Caribbean Literature on Health Sciences (LILACS) and Cumulative Index to Nursing and Allied Health Literature (CINAHL).

The search for scientific evidence occurred in May 2021 using the health descriptors available in the Health Sciences Descriptors Portal (DeCS) in the Virtual Health Library (VHL) and by the controlled descriptors from the Medical Subject Headings, detected through the respective search strategy, specific for each database selected and validated by a librarian.

For the PubMed® database search, we adopted the controlled descriptors, in the English language, identified in the Medical Subjects Headings (MeSH): *Adult; Aged;* "*Clinical Deterioration*"; "*Emergency Medical Services*"; "*Early Warning Score*". The strategies were used: (*Adult* AND *Aged* AND "*Clinical Deteriorations*" OR "*Deterioration, Clinical*" AND "*Early Warning Score*" OR "*Early Warning Scores*" OR "*Score, Early Warning*" OR "*Scores, Early Warning*" AND "*Emergency Medical Services*" OR "*Emergency Services, Medical*" OR "*Medical Emergency Service*" OR "*Service, Medical Emergency*" OR "*Service, Emergency Medical*").

In Web of Science the following English language descriptors were adopted: *Adult; Aged; "Clinical Deterioration"; "Emergency Medical Services"; "Early Warning Score".* The strategies were carried out: TS=*(Adult* AND *Aged* AND "*Clinical Deteriorations*" OR "*Deterioration, Clinical*" AND "*Early Warning Score*" OR *"Early Warning Scores*" OR "*Score, Early Warning*" OR *"Scores, Early Warning*" AND *"Emergency Medical Services*" OR "*Emergency Services, Medical*" OR *"Medical Emergency Service*" OR "*Service, Medical Emergency*" OR *"Service, Emergency Medical*").

In SCOPUS, we used the controlled descriptors in the English language and identified in the *Medical Subjects Headings* (MeSH) *Adult; Aged;* "*Clinical Deterioration*"; "*Emergency Medical Services*"; "*Early Warning Score".* Strategies were elaborated:

TITLE-ABS-KEY=(*Adult* AND *Aged* AND "*Clinical Deteriorations*" OR "*Deterioration, Clinical*" AND "Early Warning Score" OR "Early Warning Scores" OR "Score, Early Warning" OR "Scores, Early Warning" AND "*Emergency Medical Services*" OR "*Emergency Services, Medical*" OR "*Medical Emergency Service*" OR "*Service, Medical Emergency*" OR "*Service, Emergency Medical*").

In LILACS, the controlled descriptors were present in the Health Sciences Descriptors (Decs) in Portuguese Adult; Elderly; "Clinical Deterioration"; "Emergency Medical Services"; "Early Warning Scale" and their versions in English and Spanish. The strategies: (Adult OR Elderly AND "Clinical Deterioration" AND "Emergency Medical Services" AND "Early Warning Scale") and their versions in English and Spanish were adopted.

In CINAHL, the following controlled descriptors were identified in Titles/Subjects in English: *Adult; Aged; "Clinical Deterioration*"; "*Emergency Medical Services*"; "*Early Warning Score*". The strategy was adopted: SU=((Adult OR Aged AND ("Clinical Deteriorations") AND ("*Early Warning Score*") AND ("*Emergency Medical Services*")).

To select the studies following the inclusion and exclusion criteria, the titles, and abstracts of 691 studies were read a priori by two researchers independently, using the free, single-version web review software called *Rayyan Qatar Computing Research Institute* (Rayyan QCRI), which eliminates duplicate articles, speeds up the initial screening using a reliable semi-automation process, and incorporates a high level of usability and efficiency in the process[10]. After the selection by titles and abstracts, 38 studies that caused disagreement among researchers were given to a third party, responsible for making the decision of inclusion or exclusion, and then 57 articles were read in full by the same researchers, independently, to define the final sample of 22 manuscripts.

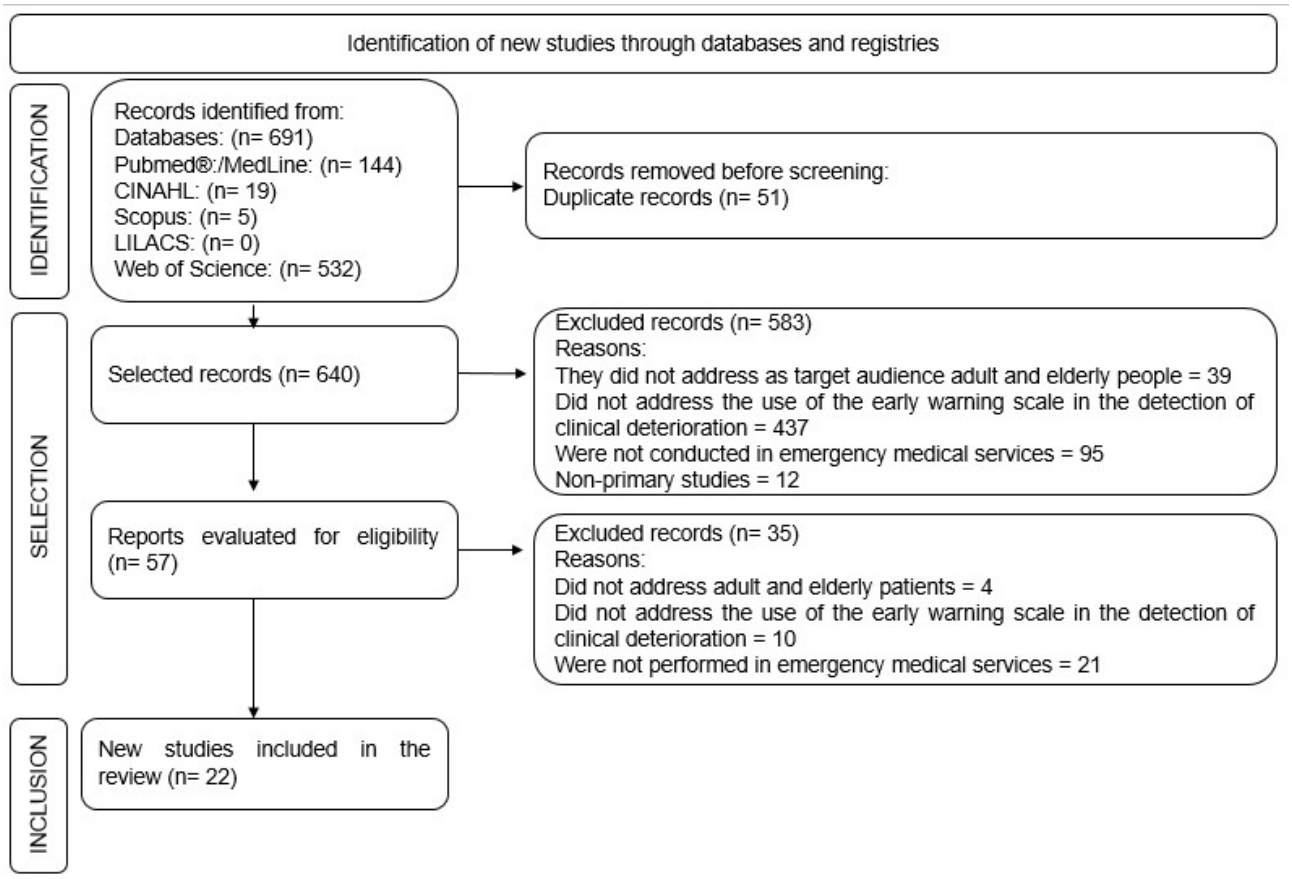
Next, the information to be extracted from the selected studies was defined. To this end, we used the criteria of a validated instrument[11] and adapted to the context of this study, extracting the following information: author, early warning scale, year of publication, objective, type of study, results and conclusion, and level of evidence[12].

In the next step, the included studies were read in their entirety and a critical evaluation of the methodological quality was performed using the Critical Appraisals Skills Programme (CASP) instrument, which includes 10 items related to: objective; adequacy of the method; presentation of the theoretical and methodological procedures; sample selection criteria; sample detailing; relationship between researchers and respondents (randomization/blinding); respect for ethical aspects; rigor in data analysis; property to discuss results; and contributions and limitations of the research. Subsequently, the studies were classified as level A (score between 6 and 10 points), being considered of good methodological quality and reduced bias or level B (up to 5 points), meaning satisfactory methodological quality, but with considerable risk of bias[13]. After this step, the interpretation of results and synthesis of knowledge occurred.

RESULTS

A priori, 691 studies were identified and, of these, 22 made up the final sample of this research. The selection process is shown in figure 1, below.

Figure 1: Flowchart of identification, selection, and inclusion of studies, based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) recommendation. Uberaba, MG, Brazil, 2021.



Source: authors, 2021.
CINAHL: Cumulative Index to Nursing and Allied Health Literature; LILACS: Latin American and Caribbean Literature on Health Sciences

Chart 1 below presents the characterization of the studies included in the sample.

Chart 1: Characterization of the studies that comprised the sample of the integrative literature review. Uberaba, MG, Brazil, 2021.

Authors/ year of publication/ periodical	Objective	Type of study/ Level of evidence/ Methodological quality	Results/conclusion
Aygun; Eraybar, 2021[14] Ir J Med Sci	To evaluate the effectiveness of TREWS§ and MEWS* in predicting mortality in patients with COVID-19α.	Retrospective cohort study/4/A	MEWS* and TREWS§ calculated in emergency departments are effective in predicting 28-day mortality in patients who required hospitalization for COVID-19α.
Prasad et al., 2021[15] J Hosp Med	Compare the evaluation ability of qSOFAμ with that of NEWS2∞ to predict poor outcomes.	Retrospective cohort study/4/A	**The qSOFAμ was highly specific and the NEWS2∞ was the most sensitive for ruling out high-risk patients.**
Martín-Rodrígues et al., 2021[16] J Pers Med	The qSOFAμ was highly specific and the NEWS2∞ was the most sensitive for ruling out high-risk patients.	Retrospective observational study/6/A	Among the EWS∑, NEWS2∞ showed the best predictive power, even when applied separately to patients testing positive and negative for COVID-19 α.
Carr et al., 2021[17] BMC Medicine	Evaluate NEWS2∞ for the prediction of COVID-19 α severe outcome.	Cohort study/4/A	The NEWS2∞ score showed poor to moderate discrimination for the mid-term COVID-19 α outcome, raising questions about its use as a screening tool at hospital admission.
Ruangsomboon et al., 2021[2] BMC Emergency Medicine	To evaluate and compare the prognostic utility of REMSΩ with that of SIRS©, qSOFAμ and NEWS€ in predicting mortality in patients with suspected sepsis in the emergency room.	Retrospective observational study/6/A	The REMSΩ obtained higher accuracy than the other scales in predicting in-hospital mortality in patients presenting to the emergency room with suspected sepsis.
Lópes-Izquierdo et al., 2021[18] Int J Clin Pract	To determine the prognostic utility of the NEWS2∞ and qSOFAμ scales, alone and combined	Prospective observational study/6/A	The NEWS2∞ and qSOFAμ scores are a very useful tool for assessing the status of patients arriving at the emergency room in general for all types of

	with capillary lactate, using the new NEWS2-Lư and qSOFA-L+ to predict 30-day mortality risk.		patients and for detecting the risk of 30-day mortality.
Covino et al., 2020[19] Resuscitation	Identify more accurate EWS∑ to predict an adverse outcome in COVID-19 α patients admitted to the emergency department.	More accurately identify EWS∑ to predict an adverse outcome in COVID-19 α patients admitted to the emergency department.	REMSΩ and NEWS€ were the most accurate indices for predicting hospital death and intensive care unit admission within seven days, respectively.
Endo et al., 2020[1] BMJ Open	To examine whether NEWS€ could be applied to patients transported by ambulance in Japan.	Retrospective observational study/6/A	The findings from this Japanese tertiary care hospital showed that pre-hospital NEWS€ can be used to identify patients at risk of adverse outcomes.
Su et al., 2020[20] Front Med	To investigate the predictive value of EWS∑ to detect clinical deterioration in patients with COVID-19α.	Observational study 6/A	NEWS-C¬ was the most accurate scoring system among the common EWS∑ to identify patients with COVID-19α.
Skov et al., 2020[3] Scand. J. Trauma Resusc. Emerg. Med	Investigate whether including oxygen supplementation in the TOKS™ algorithm improves the ability to predict 7-day mortality.	Cohort study/4/A	The discriminative ability of TOKS™ improved statistically when including oxygen supplementation.
Viglino et al., 2020[21] Resuscitation	Perform early detection of unfavorable outcomes in patients with dyspnea.	Observational study/6/A	The EWS.O2ɔ is equivalent or superior to common early warning scales and can be used to predict poor outcomes.
Martín-Rodríguez et al., 2020[22] J Clin Med	To evaluate whether the use of prehospital lactate can increase the prognostic accuracy of NEWS2∞ to detect the risk of	Prospective observational study/6/A	The risk stratification provided by NEWS2∞ can be improved by incorporating measurement of prehospital lactate use to predict mortality risk more accurately in patients at low risk.

	death within 48 h.		
Spencer et al., 2019[4] Emergency Medicine Journal	Determining which of the 13 EWS∑ based largely on vital signs data from the emergency department can best predict important clinical outcomes.	Prospective cohort study/4/A	Several EWS∑ have excellent predictive ability for 2-day mortality and have the potential to stratify patient risk in departments of evidence. No EWS∑ adequately predicted clinical deterioration.
Dynesen et al., 2019[23] Eur J Emerg Med	Examine whether 7-day mortality associated with an initial warning score differs between age groups.	Cohort study/4/A	Older patients have a higher 7-day mortality compared to young patients with a similar initial warning score.
Prabhakar et al., 2019[24] PLoS One	Improving 30-day in-hospital mortality prediction scales for septic patients in the emergency room.	Retrospective observational study/6/A	qSOFAµ can improve the accuracy of predicting in-hospital mortality in septic patients arriving in the emergency room.
Skitch et al., 2018[5] CJEM	To examine HEWS₥ in emergency department triage among critically ill patients during their hospitalization.	Retrospective pilot study/6/A	HEWS₥ in emergency triage has limited utility for identifying patients at risk of experiencing a critical event.
Redondo-González et al., 2018[25] Rev Esp Quimioter	To determine the utility of the SOFA¥, qSOFAµ, LODS㎰, and EWS∑ scores to predict mortality among septic patients seen in the emergency room.	Retrospective observational study/6/A	The SOFA¥ score and newly developed scores may be useful in assessing the risk of in-hospital mortality in patients included in the sepsis code.
Keep et al., 2016[26] Emerg Med J	Examine the relationship between NEWS€ in the emergency department.	Retrospective Observational Study/6/A	NEWS€ can be the trigger for systematic patient screening, which can lead to early recognition and treatment.
So et al., 2015[27] Australas Emerg Nurs	Compare the performance of patient deterioration detection with and	Observational study/6/A	The use of MEWS* for patient monitoring did not significantly improve performance in detecting patient deterioration.

J	without the use of MEWS* for a group of patients waiting for beds in a public emergency room.		
Jarvis et al., 2013[28] Resuscitation	Build an EWS∑ based solely on laboratory tests that can provide early discrimination of in-hospital death.	Methodological study/7/A	This study provides evidence that the results of laboratory tests commonly collected shortly after hospital admission can be represented in a simple EWS∑ to discriminate in-hospital mortality.
Griffiths; Kidney, 2012[29] Emergency Medicine Journal	To evaluate the use of MEWS* in UK emergency departments.	Retrospective observational study/6/A	Despite the lack of strong evidence, most UK emergency departments are using MEWS*.
Fullerton et al., 2012[30] Resuscitation	Compare the predictive accuracy of MEWS* with current clinical practice.	Retrospective cohort study/4/A	The addition of MEWS* improves detection at the expense of reduced specificity.

Source: authors, 2021.

**Modified Early Warning Score*; §*Triage Early Warning Score;* ᵅ*Coronavirus Disease;* Σ*Early Warning Score,* €*National Early Warning Score,* ¥*Sequential Organ Failure Assessment,* ᵘ*Quick Sepsis Related Organ Failure Assessment,* ᵀ*Logistic Organ Dysfunction System;* ∞*National Early Warning Score 2;* Ω*Rapid Emergency Medicine Score;* ©*Systemic Inflammatory Response Syndrome Criteria;* ™*Tidling Opsporing af Kritisk Sygdom;* ᵒ*Early Warning Score* O_2; ¬*National Early Warning Score C;* ᵐ*Hamilton Early Warning Score;* ⁺*Quick Sepsis Related Organ Failure Assessment Lactato;* ᵘʰ*National Early Warning Score 2 – Lactato*

The studies were published between 2012 and 2021 internationally and were mostly characterized by level 6 evidence and rated level A for good methodological quality and reduced bias.

Chart 2, following, presents the main scales and the parameters used in identifying adult and elderly patients in clinical deterioration addressed in the scales.

Chart 2: Identification parameters of adult and elderly patients in clinical deterioration presented by the scales identified in the sample. Uberaba, MG, Brazil, 2021.

Instrument	Evaluation Parameters
National Early Warning Score (NEWS)[1,2,3,4,19,20,21,24,25]	HR*, RR€, SBP§, TΣ, SaO_2£, use of oxygen device and level of consciousness.
National Early Warning Score 2 (NEWS2)[15,16,17,18,19,20,21,22]	HR*, RR€, SBP§, TΣ, SaO_2£, level of consciousness and the use of auxiliary oxygen, and a specific assessment for patients with hypercapnic respiratory failure
Quick Sepsis Related Organ Failure Assessment (qSOFA)[2,15,16,18,19,20,22,24,25]	RR€, SBP§, and level of consciousness.
Modified Early Warning Score (MEWS) [4,14,20,24,27,29,30]	HR*, RR€, SBP§, TΣ and level of consciousness.
Rapid Emergency Medicine Score (REMS) [2,4,19]	HR*, RR€, SBP§, SaO_2£, age and level of consciousness.
Rapid Acute Physiology Score (RAPS) [4,16,20]	HR*, FR€, SBP§, and level of consciousness.
National Early Warning Score C (NEWS-C) [19,20]	HR*, RR€, SBP§, TΣ, SaO_2£, age, oxygen supplement, level of consciousness.
Tidling Opsporing af Kritisk Sygdom (TOKS)[3,23]	HR*, RR€, SBP§,TΣ, SaO_2£ and level of consciousness.
Modified Rapid Emergency Medicine Score (MREMS) [16,20]	HR*, RR€, SBP§, SaO_2£, age and level of consciousness.
Hamilton Early Warning Score (HEWS)[5,20]	HR*, RR€, SBP§,TΣ, SaO_2£, use of oxygen device and level of consciousness, including presence of delirium.
Goodacre Score[4]	Age, SaO2 and level of consciousness.
Worthing Physiological Score (WPS) [4]	HR*, RR€, SBP§,TΣ, SaO_2£ and level of consciousness.
Groarke Score[4]	HR*, RR€, SBP§,TΣ, SaO_2£ and level of consciousness.
VitalPac EWS (ViEWS) [4]	HR*, RR€, SBP§, TΣ, SaO_2£ and level of consciousness.
Abbreviated VitalPac EWS (AbViEWS) [4]	HR*, RR€, SBP§, T∑, SaO2£, oxygen supplementation and level of consciousness.
Glasgow Coma Scale-Age-Systolic Blood Pressure Score (GAP)[4]	Nível de consciência, idade e SBP§.
Vital Sign Score (VSS)[4]	HR*, RR€, SBP§, SaO2£, need for intubation and/or aspiration, and level of consciousness.
Vital Sign Group (VSG) Scores[4]	HR*, RR€, SBP§, T∑, SaO2£ and level of consciousness
National Early Warning Score 2 – Lactato (NEWS2–L)[18]	HR*, RR€, SBP§, T∑, SaO2£, level of consciousness and serum lactate value.
Quick Sepsis Related Organ Failure Assessment Lactato (qSOFA-L)[18]	RR€, SBP§, lactate and level of consciousness.
Triage Early Warning Score	HR*, RR€, SBP§, TΣ, level of consciousness,

(TREWS)[14]	mobility (walks without assistance, walks with assistance and bedridden or immobile) and trauma (no and yes).
Laboratory Decision Tree Early Warning Score (LDT-EWS)[28]	Hemoglobin, leucocytes, serum urea, serum albumin, serum creatinine, serum sodium and serum potassium
Modified TOKS (mTOKS)[3]	HR*, RR€, SBP§, SaO2£, oxygen supplementation and level of consciousness
***Early Warning Score* O_2 (EWS.O_2)[21]**	HR*, RR€, SBP§, and SaO_2£,
***Systemic Inflammatory Response Syndrome Criteria* (SIRS)[2]**	HR*, RR€, TΣ, leukocytosis or leukopenia.
***Logistic Organ Dysfunction System* (LODS)[25]**	HR*, SBP§ , FiO2α, platelets, total leukocytes count, bilirubin, and creatinine.
***Sequential Organ Failure Assessment* (SOFA)[25]**	RR€, SBP§, SaO2£, FiO2α, mechanical ventilation, platelets, level of consciousness, bilirubin, vasoactive drugs, and creatinine.

Source: authors, 2021.
*Heart Rate, €Respiratory Rate, §Systolic Blood Pressure, £Oxygen Saturation, ΣTemperature, αFraction of Inspired Oxygen

Among the 27 scales identified, NEWS[1-4,19-21,24,26], NEWS 2[15-22], qSOFA[2,15,16,18-20,22,24,25] and MEWS[4,14,20,24,27,29,30] were the most frequently mentioned by the studies that comprised the sample of the present review. Regarding the EWS assessment parameters, there was a predominance of physiological parameters characterized by heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation and level of consciousness[1-5,14-30].

DISCUSSION

The use of early warning scales based on physiological parameters allows the detection of clinical deterioration and the assessment of the risk of severe events such as unexpected death, cardiac arrest, and transfers to ICU beds[4].

The sample of identified findings is mostly supported by observational level 6 manuscripts, with good methodological quality and reduced bias. However, the low level of evidence implies the incentive for the development of methodologically well-designed studies, characterized by experimental studies, to explore and compare the effectiveness of EWSs, enabling an evidence-based clinical decision in favor of prevention, resolution, management and reduction of risks and complications[13].

This study is unprecedented in nursing science because it brings together in a single article scientific evidence citing the use of scales to identify adult and elderly patients in clinical deterioration in EMSs and their assessment parameters to contribute to the development of new scientific research, methodologically well designed.

Twenty-seven scales comprised the sample of the present study. Of these, NEWS[1-4,19,21,24,26] was noteworthy, in which an observational study of patients with COVID-19

and admitted to an emergency department of a university hospital in Rome showed that NEWS is among the most accurate tools to predict deterioration of the patient outside the ICU[19].

In line with the present research, an observational, retrospective study carried out in the emergency department of a university hospital, located in the United Kingdom, complements the point that NEWS, can also be used to detect and triage patients in clinical deterioration due to septic shock[26].

It is noteworthy that NEWS has been updated, which contributed to the development and validation of NEWS2, which was also highlighted in this review[15-22]. This scale was evidenced by an observational study carried out with adult patients with suspected COVID-19 infection, admitted to an emergency department in Spain, where it was shown that when compared to the other EWSs, NEWS2 stands out for having a better predictive capacity and a higher sensitivity for COVID-19 cases regarding the detection of clinical deterioration[16].

NEWS2, also stood out in an observational, prospective, multicenter study conducted in four nursing departments when it evidenced that this scale is a tool with significant utility to assess the status of patients who are admitted to the emergency room, regardless of their clinical condition, in addition, they are useful to detect the risk of mortality within 30 days[22].

Like NEWS2, a prevalence of qSOFA was identified in this review[2,15,16,18,19,20,22,24,25]. A cohort study in an emergency department demonstrated that the qSOFA is highly specific for detecting high-risk patients[15]. In contrast, a Wuhan study of patients infected with COVID-19 has shown that the qSOFA, although relevant, is less sensitive than other EWS to predict early deterioration of respiratory function in patients diagnosed with COVID-19[22].

In addition to the scales presented, the literature has highlighted the MEWS as a useful tool to predict early deterioration[4,14,20,24,27,29,30]. Research aimed to evaluate the use of MEWS in UK emergency departments indicates that this scale is the most used in hospital settings[29]. Furthermore, an observational study conducted in an emergency department in Hong Kong adds that the use of the MEWS may be beneficial for health professionals who have less clinical experience in identifying clinical deterioration in patients because it is a tool that is easy to apply and understand[27].

Regarding the evaluation parameters of the early warning scales, most of them are composed of physiological parameters characterized by heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation and level of consciousness. Scientific evidence shows that assessment by physiological parameters is effective and reliable in detecting clinical deterioration of adult and elderly patients admitted to EMSs[14-17,19,24,25].

In summary, it was identified that the ideal scale for identifying clinical deterioration is one that broadly covers physiological parameters and can accurately identify what it is intended to measure, that is easy to handle, has a high level of interobserver agreement, reproducibility, and predictive value, and rapidly predicts patient deterioration, morbidity, and mortality[1-4,19-21,24,26].

In this context, the multi-professional team, specifically the nursing professional, must choose the tool that best fits the health service, besides the fact that they must be aware of the signs and symptoms that characterize the clinical deterioration of adult and elderly patients because they are often in the front line, which leads them to be considered one of the professionals who can early identify the patient's evolution to CRA and, especially, outline possible behaviors that prevent a poor prognosis[1-4,19-21,24,26].

A priori, the low level of evidence of the studies and the lack of clarity in the description of the assessment parameters are considered a limitation of the present study, which made it difficult to understand and identify the form of assessment of the listed scales. In addition, it is noteworthy that most scales do not establish a protocol of conduct to be adopted when assessing the patient in clinical deterioration. Therefore, it is suggested that research be conducted with a high level of evidence, characterized by experimental and quasi-experimental studies that seek to investigate the effectiveness of the scales and that can establish a plan of care for patients who present worsening of clinical condition.

CONCLUSION

We identified 27 early warning scales used to identify clinical deterioration in adult and elderly patients, of these, the most prevalent were NEWS, NEWS 2, qSOFA and MEWS. Among those that stood out, NEWS proved to be the most accurate, however, evidence shows that MEWS is the most used in EMSs. The scales, in general, have similar assessment parameters, characterized by heart rate, respiratory rate, systolic blood pressure, temperature, oxygen saturation, and level of consciousness.

This study contributes to teaching, research, and assistance in health and nursing, a priori, by structuring a theoretical framework about the main scales for identifying adult and elderly patients in clinical deterioration in EMSs and presenting their assessment parameters, which can help the work of nursing, favoring better decision making for clinical practice, for deployments, use, and training, and also to subsidize the development of new scientific research, methodologically well designed, which propose to validate them and compare their effectiveness.

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