Artigo de Revisão
Review Article
Artículo de Revisión

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

Early warning scores in patients with suspected or diagnosed sepsis: an integrative review

Escores de alerta precoce em pacientes com suspeita ou diagnóstico de sepse: uma revisão integrativa

Puntuaciones de alerta temprana en pacientes con sospecha o diagnóstico de sepsis: una revisión integradora

Alldren Silva de Sousa[I]; Giovanna da Rosa Soares[I]; Lisiane Teobaldi Severo[I]; Ana Paula Amestoy de Oliveira[II]; Michelle Dornelles Santarém[III]; Rita Catalina Aquino Caregnato[I]

[I]Universidade Federal de Ciências da Saúde de Porto Alegre, Porto Alegre, Brazil; [II]Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil; [III]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

ABSTRACT

Objective: to examine scientific publications on the use of early warning scores in tertiary services as tools for detecting clinical deterioration in patients with suspected or diagnosed sepsis. **Method:** this integrative review was conducted in PubMed, Scopus, Web of Science and the Virtual Health Library between February and March 2021. Articles in English, Spanish, and Portuguese were included with no time limits on the search. **Results:** different scores were found for early detection of clinical deterioration in patients with suspected or diagnosed sepsis. The most frequent tools in tertiary services were the National Early Warning Score, Sequential Organ Failure Assessment Score and Systemic Inflammatory Response Syndrome (n = 6) (50%), most of them in Emergency Departments (n = 5) (41.6 %). **Final remarks:** the National Early Warning Score was the most used for patients with suspected or diagnosed sepsis and was the most accurate in predicting hospital mortality and admission to the Intensive Care Unit.

Descriptors: Critical Care Nursing; Emergencies; Sepsis; Clinical Deterioration; Early Warning Score.

RESUMO

Objetivo: analisar publicações científicas sobre a utilização de escores de alerta precoce, nos serviços terciários, como ferramentas de detecção da deterioração clínica em paciente com suspeita ou diagnóstico de sepse. **Método:** revisão integrativa realizada na *PubMed*, Scopus, *Web of Science* e Biblioteca Virtual em Saúde entre fevereiro e março de 2021. Incluídos artigos em inglês, espanhol e português, sem delimitação de tempo na busca. **Resultados:** identificou-se diferentes escores para detecção precoce da deterioração clínica em pacientes com suspeita ou diagnóstico de sepse. As ferramentas mais frequentes nos serviços terciários foram: *National Early Warning Score, Sequential Organ Failure Assessment Score* e *Systemic Inflammatory Response Syndrome* (n=6) (50%), sendo a maioria nos Departamentos de Emergências (n=5) (41,6%). **Considerações finais:** *National Early Warning Score* foi o escore mais utilizado para pacientes com suspeita ou diagnóstico de sepse com maior acurácia para a predição de mortalidade hospitalar e admissão em Unidade de Terapia Intensiva.

Descritores: Enfermagem de Cuidados Críticos; Emergências; Sepse; Deterioração Clínica; Escore de Alerta Precoce.

RESUMEN

Objetivo: analizar publicaciones científicas sobre la utilización de puntuaciones de alerta temprana, en servicios terciarios, como herramientas para detección de deterioro clínico en pacientes con sospecha o diagnóstico de sepsis. **Método:** revisión integradora en *PubMed*, *Scopus*, Web of Science y Biblioteca Virtual en Salud entre febrero y marzo de 2021. Fueron incluidos artículos en inglés, español y portugués, sin límite de tiempo en la búsqueda. **Resultados:** se identificaron diferentes puntuaciones para detección temprana de deterioro clínico en pacientes con sospecha o diagnóstico de sepsis. Las herramientas frecuentes en los servicios terciarios fueron: *National Early Warning Score, Sequential Organ Failure Assessment Score* y *Systemic Inflammatory Response Syndrome* (n=6) (50%), la mayoría en Servicios de Emergencia (n=5) (41,6 %). **Consideraciones finales:** *National Early Warning* Score fue la puntuación más utilizada para pacientes con sospecha o diagnóstico de sepsis con mejor precisión para predecir la mortalidad hospitalaria e ingreso a la Unidad de Cuidados Intensivos.

Descriptores: Enfermería de Cuidados Críticos; Urgencias Médicas; Sepsis; Deterioro Clinico; Puntuación de alerta temprana.

INTRODUCTION

Sepsis, a condition resulting from wide pathophysiological and clinical variability induced by infection, is one of the main causes of morbidity and mortality in the world, resulting in the death of approximately 30 million people per year[1,2]. It occurs both in developed and in developing countries and is considered a public health problem[3].

In 2017 the global incidence of sepsis corresponded to 48.9 million people, and its mortality was 11 million[4]. Global lethality was approximately 32.2%, with disparity between public (39.3%) and private (25.9%) hospitals[5]. In Brazil, high mortality is observed, mainly related to care from the Unified Health System (*Sistema Único de Saúde*, SUS), which is estimated at 55% in Brazilian intensive care units (ICUs) and can be attributed to insufficient number of professionals, lack of resources and lack of knowledge[3].

Corresponding author: Alldren Silva de Sousa. E-mail: alldren.sousa@ufcspa.edu.br
Editor in chief: Cristiane Helena Gallasch; Associate Editor: Cintia Silva Fassarella

Received: May 30th 2022 – Accepted: Sep 27th 2022

Artigo de Revisão
Review Article
Artículo de Revisión

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

On the other hand, during the Severe Acute Respiratory Syndrome by the Coronavirus 2 (SARS-CoV-2), patients with inflammatory responses similar to that of septic patients were observed[6]. Patients with coronavirus disease 2019 (COVID-19) admitted to ICUs frequently have respiratory failure, septic shock and multiple organ dysfunction, thus increasing the mortality rates[7]. The *Third International Consensus Definitions for Sepsis and Septic Shock* acknowledges that the coronavirus infection predisposes to sepsis, which was confirmed by the *Global Sepsis Alliance* as the most incident complication in patients with severe COVID-19 associated with high mortality[7].

Currently, sepsis is considered as a "life-threatening organ dysfunction caused by a non-regulated host response to the infection" clinically sustained by the ≥ 2-point variation in the *Sequential Organ Failure Assessment* (SOFA) as indicative of increased risk of death[8]. According to the 2021 *International Surviving Sepsis Campaign* guidelines, it is not recommended to use the *quick Sequential Organ Failure Assessment* (qSOFA), compared to the *Systemic Inflammatory Response Syndrome* (SIRS), the *Modified Early Warning Score* (MEWS) or the *National Early Warning Score* (NEWS), as the only tool for screening for sepsis or septic shock[9].

For being the most common cause of hospitalization and the leading cause of death in ICUs among adult patients, using tools for early detection of sepsis and clinical deterioration allows for the development of proactive and reactive strategies, providing quality and safety[1,10].

In the meantime, early warning scores such as MEWS and *Simplified Acute Physiology Score II* (SAPS II) and III (SAPS III) are used in ICUs reflecting severity of the admitted cases, overall institutional performance and resource allocation[11]. In 2012, *NEWS* emerged in the United Kingdom, with an update to the *National Early Warning Score 2* (NEWS2) in 2017, adding a specific assessment for patients with respiratory failure and hypercapnia, cross-culturally adapted and translated in Brazil[12,13]. These scores are easy to apply, enabling early recognition of clinical deterioration signs by means of easy-to-collect variables[11]. Thus, decision-making and the reduction of unfavorable outcomes were favored, such as increased in-hospital mortality due to sepsis and the need for hospitalization in critical units[11].

However, there are still many gaps about professional nurses using early warning scores in the clinical practice. Thus, it is considered fundamental to develop studies on the use of these tools, making it possible to distinguish between the scores and describing their importance, the impact of their use in the detection of clinical deterioration and their bedside applicability to septic patients with suspected sepsis. Through this, nurses are allowed to have greater knowledge about the tools and qualification of the Nursing care provided, facilitating their understanding and enabling the best choice of score adapted to their work reality and to the profile of the patient assisted. Consequently, this exerts an impact on patient safety, on ICU admissions, and on the reduction of in-hospital mortality.

The research guiding question sought to know the existing experiences on the use of early warning scores to assess clinical deterioration in patients with suspected or diagnosed sepsis in tertiary-level health services.

Thus, this study aimed at analyzing publications on the use of early warning scores in tertiary-level services as a tool for early detection of clinical deterioration in patients with suspected or diagnosed sepsis.

METHOD

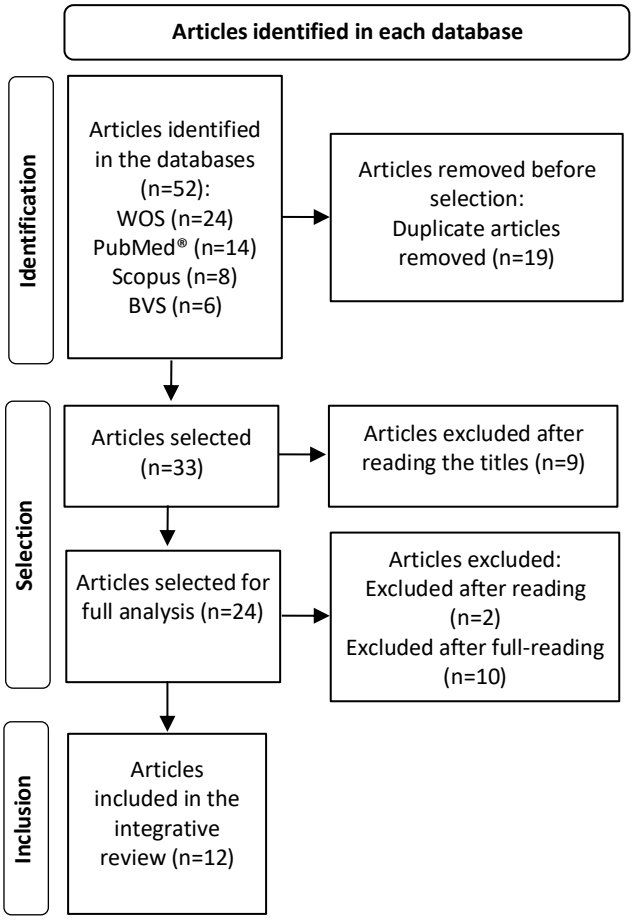
An integrative review structured in six stages was conducted, namely: (1) identification of the research topic and question; (2) definition of eligibility criteria; (3) definition of the information extracted, categorization; (4) evaluation of the studies included; (5) interpretation of the results; and (6) knowledge synthesis[14-17]. This method aims at gathering and synthesizing the results of the studies found on the topic, enabling knowledge construction based on the best evidence for the implementation of interventions in the clinical practice[15].

Elaboration of the research question of the current study was based on the PICo strategy, where P (Population) corresponds to patients with suspected or diagnosed sepsis; I (Phenomenon of Interest) is to the use of early warning scores to assess clinical deterioration and Co (context) represents tertiary-level health services[17].

The search for articles was performed by two reviewers, and the following controlled descriptors were selected according to the Descriptors in Health Sciences Descriptors (*Descritores em Ciências da Saúde*, DeCS) and the Medical Subject Headings (MeSH), "*Early Warning Score*", "*Sepsis*" and "*Clinical Deterioration*"; in addition, the following uncontrolled descriptors were also selected: "*NEWS2*" and "*National Early Warning Score 2*". The search strategy used was the following: ("*early warning score*" *OR* "*NEWS2*" *OR* "*national early warning score 2*") *AND sepsis AND* "*clinical deterioration*". The search was performed between February 10th and March 31st, 2021, in the following databases: *Biblioteca Virtual em Saúde* (BVS), National Library of Medicine (PubMed®), Scopus and Web of Science (WoS).

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

The studies included were those available in full, written in Portuguese, English and Spanish, with no time clipping. Review articles were excluded, as well as those focused on the Gynecology and/or Obstetrics, oncology, Pediatrics and Neonatal areas. The methodological process is presented in Figure 1.



WoS: Web of Science; BVS: *Biblioteca Virtual em Saúde*.
FIGURE 1: Flowchart to obtain the sample. Porto Alegre (RS), Brazil, 2021.

A spreadsheet prepared in the *Google Sheets* platform was used for data extraction, in order to record the following variables: author, journal, year of publication, locus, Level of Evidence and main results.

To classify the Level of Evidence, the *Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions* was used, as follows: I for systematic reviews or meta-analysis of randomized clinical trials; II for randomized clinical trials; III for non-randomized clinical trials; IV for case-control and cohort studies; V for systematic reviews of descriptive and qualitative studies; VI for descriptive or qualitative studies; and VII for opinion of authorities and/or experts' reports[18].

Finally, a critical analysis and comparative synthesis of the results found were performed, grouped by topics according to similarity of the articles, with addition of complementary studies to the discussion. Two categories were thus obtained: Early warning scores used in the detection of sepsis; and Use of early warning scores in different patient care areas.

RESULTS

All 12 articles selected were designed in the following countries: United States (n=5), South Korea (n=2), Canada (n=2), Scotland (n=1), Netherlands (n=1) and England (n=1). In relation to the year of publication, 41.6% (n=5) were published in 2020. There was predominance of cohort studies (10), followed by case-control and case-control and cohort. Figure 2 displays the articles presented.

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

Authors	Journal, year of publication and locus	Level of Evidence	Main results
Corfield AR et al.[19]	*Emerg Med J,* 2014, Scotland	IV	High NEWS on admission of patients in ER is associated with a higher probability of adverse outcomes in septic patients
Yu S et al.[20]	*Crit Care,* 2014, USA	IV	Prediction scores based on ICU and ER can be used to predict risk of clinical deterioration in non-ICU patients
Churpek MM et al.[21]	*Crit Care Med,* 2017, USA	IV	Choice of criteria to define the potentially infected population exerts impacts on the prevalence of mortality, but has little impact on accuracy; more accurate eCART, followed by NEWS, MEWS and qSOFA. SIRS was the least accurate score
Churpek MM et al.[22]	*Am J Respir Crit Care Med,* 2017, USA	IV	qSOFA should not replace early warning scores when stratifying the risk of patients with suspected infection NEWS has proved to be more sensitive than MEWS, qSOFA and Sirs, respectively
Skitch S et al.[23]	*CJEM,* 2018, Canada	IV	HEWS in ER screening has a limitation for predicting the risk of critical events, although it is suggested that it may allow early identification of septic patients
Brink A et al.[24]	PLoS One, 2019, Netherlands	IV	NEWS is more accurate to predict mortality at 10 and 30 days when compared to qSOFA and SIRS in patients with suspected sepsis
Fernando SM et al.[25]	*Crit Care,* 2019, Canada	VI	HEWS has clinical accuracy comparable to NEWS2 for prediction of in-hospital mortality among patients treated by RRT For precision of the prognosis, NEWS2 was more sensitive, but HEWS was more specific
Levin N et al.[26]	*Am J Emerg Med,* 2020, USA	IV	Dynamic vital signs in the ER, categorized by MEWS delta, and failure in normalization were associated with increased mortality, ICU admission, length of stay and sepsis
Hargreaves DS et al.[27]	*Eur J Emerg Med,* 2020, England	IV	Persistently high NEWS from pre-hospital to ward, combined with elevated lactate, identifies patients suspected of having sepsis with high mortality risk
Liu VX et al.[28]	*JAMA Network, Open,* 2020, USA	IV	Among the commonly used scores, NEWS can identify patients with and without infection with a high mortality risk NEWS has greater sensitivity to in-hospital mortality when compared to SIRS and qSOFA
Jang JG et al.[29]	*J Korean Med Sci,* 2020, South Korea	IV	NEWS calculation at hospital admission can predict critical outcomes in COVID-19 patients
Hwang TS et al.[30]	*Diagnostics,* 2020. South Korea	VI	NEWS with lactate was the best predictor of 7-day mortality when compared to sofa, qSOFA and SIRS

NEWS: National Early Warning Score; ER: Emergency Department; ICU: Intensive Care Unit; eCART: electronic Cardiac Arrest Risk Triage; MEWS: Modified Early Warning Score; qSOFA: quick Sequential Organ Failure Assessment Score; SIRS: Systemic Inflammatory Response Syndrome; HEWS: Hamilton Early Warning Score; NEWS2: National Early Warning Score 2; RRT: Rapid Response Teams; SOFA: Sequential Organ Failure Assessment Score.
FIGURE 2: Variables that were evaluated from the articles selected, in chronological order. Porto Alegre (RS), Brazil, 2021.

Figure 3 displays the scores used in the studies and the sectors in which they were applied to the population.

Scores used	Sectors in which they were applied
NEWS[19]	ER
APACHE III, MEDS, MEWS, PIRO, REMS, SAPS II, SCS, SOFA, ViEWS[20]	Ward
eCART, MEWS, NEWS, qSOFA, SIRS, SOFA[21]	ER and Ward
MEWS, NEWS, qSOFA, SIRS[22]	ER and Ward
HEWS, NEWS[23]	ER
NEWS, qSOFA, SIRS[24]	ER
HEWS, NEWS2[25]	Ward
MEWS[26]	ER
NEWS, qSOFA[27]	Pre-hospital, ER and Ward
BTF, MEWS, NEWS, qSOFA, SIRS[28]	ER and Ward
NEWS, qSOFA, SIRS[29]	ER and Outpatient
NEWS, qSOFA, SIRS[30]	ER

NEWS: National Early Warning Score; ER: Emergency Department; APACHE III: Acute Physiology and Chronic Health Evaluation Score III; MEDS: Mortality in Emergency Department Sepsis; MEWS: Modified Early Warning Score; PIRO: Predisposition Infection Response Organ Dysfunction Score; REMS: Rapid Emergency Medicine Score; SAPS II: Simplified Acute Physiology Score II; SCS: Simple Clinical Score; SOFA: Sequential Organ Failure Assessment Score; ViEWS: VitalPac Early Warning Score; eCART: electronic Cardiac Arrest Risk Triage; qSOFA: quick Sequential Organ Failure Assessment Score; SIRS: Systemic Inflammatory Response Syndrome; HEWS: Hamilton Early Warning Score; BTF: Between the Flags.
FIGURE 3: Scores used and sectors in which they were applied. Porto Alegre (RS), Brazil, 2021.

Artigo de Revisão
Review Article
Artículo de Revisión

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

The following set of tools was used in 50% of the studies: NEWS, qSOFA and SIRS. However, NEWS2 was only identified in one study. The research studies were conducted in the following sectors: Emergency Department (ER) (n=5); wards (n=2); ER and wards (n=3); ER and outpatient services (n=1); and Pre-hospital, ER and wards (n=1).

DISCUSSION

Use and comparison of different scores for early detection of clinical deterioration in patients with suspected or diagnosed sepsis have been identified. The sectors where these tools were applied were in-hospital (emergencies, wards and outpatient clinics) and pre-hospital. These environments have a greater need to apply these instruments and, consequently, nurses, professionals who deal with these tools directly in their work routine, must be trained in relation to their application, in order to enable and instrumentalize the clinical practice.

The ER screening systems presented varied tools for effective assistance[20]. Scores are of great importance for estimating mortality, morbidity and decision-making in the clinical context, with increasing global prevalence, thus strengthening evidence-based Nursing[19-20,23,26]. These instruments provide early and individualized therapeutic implementation of sepsis, resulting in better outcomes and facilitating the activation of Rapid Response Teams[19-20,24-25].

Early warning scores used in the detection of sepsis

NEWS was the most used score in hospitals to evaluate patients with suspected or diagnosed sepsis[19-22,24,25,27-30]. Its use facilitated monitoring of the patients from admission to the outcome, ensuring high-accuracy screening and early intervention, a process that exerts a direct impact on satisfactory health care results[20,23]. It was characterized by specificity and sensitivity at an intermediate level, considered effective to distinguish between low- and high-risk patients[24]. Its use is recommended in the ER, with a cohort score ≥ 7, as well as in the pre-hospital environment for patients at risk of deterioration, given the need for rapid and effective intervention[24]. It is also noted that its increase can be associated with high chances of adverse outcomes among patients with sepsis, even if it has not been developed specifically for this population, due to the clinical profile of the patients studied[20,23,24]. On the other hand, few studies were found that describe use of this instrument in the Brazilian reality.

One of the studies evaluated clinical deterioration using NEWS2 together with HEWS, capable of predicting in-hospital mortality, with similar accuracy for this prediction[25]. It was observed that both HEWS and NEWS2 ≥ 5 are worrying values, indicating risk of deterioration requiring urgent response and, for this reason, care intervention [25]. In the ER screening, HEWS proved to be useful as a predictor for sepsis and occurrence of critical events[23].

The *Mortality in Emergency Department Sepsis* (MEDS), another score found, was considered a useful predictor in the ER for stratifying patients according to their mortality risk[20]. However, it had high sensitivity and a need for laboratory results, delaying the final score and, consequently, the early intervention that is the marker of favorable results in sepsis[20].

Among the qSOFA, SOFA, MEWS, NEWS and eCART scores, the algorithms, when compared in descending precision order (more to less precise), were as follows: *electronic Cardiac Arrest Risk Triage* (eCART), NEWS, MEWS, qSOFA and SOFA[21]. This last one was the least accurate of all. Unlike NEWS and similar to MEDS, this score needs laboratory parameters for its calculation that may not be available at the patient's admission, which could hinder its implementation in the services, as well as agility of the process[20,21].

The study corroborated this information, pointing out NEWS as a score with better accuracy when compared to qSOFA[22]. However, Brazilian institutions still use qSOFA as a screening tool for patients with suspected sepsis, although an incomplete score is shown in the practice, making it difficult to detect changes in vital signs not measured by this score. NEWS proved to be superior to qSOFA and SIRS in predicting mortality from 10 to 30 days before the event, acting as the only one among the three with good agreement of the expected outcomes and observed among the population[24]. However, institutions that use NEWS or MEWS did not benefit from the exchange for qSOFA, as there are costs and risks involved in retraining the professionals to use a new less effective system[22,25].

NEWS, MEWS and eCART, originally designed for use in wards, proved to be more accurate than SIRS, characterized by high sensitivity and low specificity, and qSOFA, highly specific, but not very sensitive, describing potential use in other care spheres[21,24,25]. In the analysis of the use of SIRS and qSOFA to predict mortality and transfer to the ICU, the latter showed better precision in the in-hospital environment[22]. The high accuracy of eCART illustrates the potential for elaboration of scores with more advanced statistical methods, as opposed to NEWS, seen as a standard model[21].

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

On the other hand, SOFA showed an increase in predictive power compared to the results obtained, when measured in a unique way, presenting better performance when closer to the time of clinical deterioration (from zero to 24 hours before the event)[19]. A number of studies describe that physiological changes prior to deterioration can be identified between 12 and 24 hours before the event, with the best performance in this interval by SOFA in relation to the others evaluated (*Predisposition Infection Response Organ Dysfunction Score* – PIRO, *VitalPac Early Warning Score* – ViEWS, *Simple Clinical Score* – SCS, MEDS, MEWS, SAPS II, APACHE II and *Rapid Emergency Medicine Score* – REMS)[20], a score widely used in Brazilian ICUs, while MEWS is widely used for in-hospital patient transfers. Due to its structural composition, MEDS achieved acceptable performance between 48 and 72 hours prior to clinical deterioration[19]. As for NEWS with subsequent measurement, it is expected that its precision will be enhanced, benefiting its sensitivity to identify patients at risk of deterioration[24].

Serum lactate, recognized as an independent predictor of mortality in cases of septic patients, was viable in the ER[20,27]. This test can be used to identify patients at a potential risk of unfavorable outcomes resulting from sepsis, with the possibility of combining its use with the scores to predict mortality[20,24,25].

Use of early warning scores in different patient care areas

Early warning scores originally implemented in ERs and ICUs can be used with patients in wards, with similar performances between the scores, even though they address different physiological parameters[19].

A number of studies were developed in different areas of tertiary-level health services, most in the ER[19,21-24,25-30]. Others occurred in different areas, with admission of patients from the ER and a tertiary-level service with outpatient care evaluating patients with coronavirus, with septic shock as a secondary outcome, obtaining more accurate qSOFA, SIRS and NEWS values in relation to the other scores[29]. Two studies were developed in wards, places where patient evaluations usually occur at longer intervals of time and, oftentimes, the interventions are only performed with deterioration already installed[20,25].

However, the recommendation to use tools of this type in pre-hospital services as a warning of possible admission to ER was verified, which can be a determining factor for the entire patient's path after hospital admission[27]. A study applied NEWS in the pre-hospital environment, after admission to the emergency room and during hospitalization in the ward, allowing monitoring and detecting clinical deterioration throughout the patient's hospitalization[27].

A retrospective cohort study evaluated the use of scores in patients with SARS-CoV-2. NEWS has shown efficacy in predicting complications such as septic shock, mortality, acute respiratory distress syndrome (ARDS) and intensive care, with a higher predictive value compared to SIRS and qSOFA[29]. Among the items, the score assesses oxygen saturation, which could further corroborate the evaluation of this patient profile.

NEWS was the most accurate score to stratify the risk of hospitalized patients with suspected infection outside the ICU, showing greater precision in predicting in-hospital mortality when compared to other scores[27,28]. Due to its easy application, it would be possible to incorporate it as an instrument of choice in the routine evaluation, obtaining positive results and interventions in a timely manner to minimize unfavorable outcomes.

SOFA and qSOFA, combined with lactate, proved to be good predictors of in-hospital mortality[27,30]. However, combined with serum lactate, NEWS proved to be superior in predicting in-hospital mortality at seven days for septic patients in the ER[27,30].

Early warning scores, tools with great internationally recognized value, are available for use in the Brazilian Nursing practice and can assist not only in patients' systematic evaluations, but also enable early identification of clinical deterioration signs. Through this, actions by these professionals are triggered based on the best evidence, allowing for a reflection on the care practices and corroborating multiprofessional discussions on the patients' clinical health condition and on the improvement of the quality of the care provided. In addition, it is necessary that nurses working in tertiary-level services appropriate use of these instruments, as it will be from knowledge about these tools that the impact of their use will be perceived.

However, using early warning scores in nurses' clinical practice has a significant impact on decision-making at critical moments, favoring care in various in-hospital environments and, thus, being able to positively influence the care provided to the patients and bedside clinical reasoning and of optimizing Nursing care.

Study limitations

As a limitation of this study it was observed that, even with the search in different databases, it was not possible to find a significant number of studies on the topic, possibly because it is characterized as recent in the health context. In addition, there is lack of publications on the theme that address NEWS2, due to the scarcity of research studies in this context.

Artigo de Revisão
Review Article
Artículo de Revisión

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

FINAL CONSIDERATIONS

The scientific production of the topic researched is recent and comes from developed countries. It was evidenced that most of the studies were conducted with patients admitted to the Emergency Department. The *National Early Warning Score* was the most widely used score for patients with sepsis or suspected sepsis, with greater accuracy in predicting in-hospital mortality and requiring admission to the Intensive Care Unit, followed by the *Modified Early Warning Score*, the *Hamilton Early Warning Score* and the *quick Sequential Organ Failure Assessment Score*. Therefore, it was considered that serum lactate together with scores may have the potential to predict mortality in septic patients and ensure greater precision.

However, there are evident gaps in the context of the theme, and it is necessary to carry out more studies in the national scenario that validate these early warning tools in different environments of tertiary-level services, as well as advantages for the use and impact on patient safety.

REFERENCES

1. Liu AC, Patel K, Vunikili RD, Johnson KW, Abdu F, Belman SK, et al. Sepsis in the era of data-driven medicine: personalizing risks, diagnoses, treatments and prognoses. Brief Bioinform. 2020 [cited 2022 Sep 30]; 21(4):1182-95. DOI: https://doi.org/10.1093/bib/bbz059.
2. Dugani S, Veillard J, Kissoon N. Reducing the global burden of sepsis. CMAJ. 2017 [cited 2022 Sep 30]; 189(1):E2-3. DOI: https://doi.org/10.1503/cmaj.160798.
3. Viana RA, Machado FR, Souza JL. Sepse: um problema de saúde pública. São Paulo: Instituto Latino Americano para Estudos da Sepse (ILAS); 2020 [cited 2022 Sep 30]. Available from: https://ilas.org.br/wp-content/uploads/2022/02/livro-sepse-um-problema-de-saude-publica-cfm-ilas.pdf.
4. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, et al. Global, regional, and national sepsis incidence and mortality, 1990-2017: analysis for the Global Burden of Disease Study. Lancet. 2020 [cited 2022 Sep 30]; 395(10219):200-11. DOI: https://doi.org/10.1016/s0140-6736(19)32989-7.
5. Instituto Latino Americano de Sepse. Programa de melhoria de qualidade. Protocolos gerenciados de sepse. Relatório nacional. São Paulo: ILAS; 2020.
6. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ, et al. Covid-19: consider cytokine storm syndromes and immunosuppression. Lancet. 2020 [cited 2022 Sep 30]; 395(10229):1033-4. DOI: https://doi.org/10.1016/s0140-6736(20)30628-0.
7. Olwal CO, Nganyewo NN, Tapela K, Djomkam Zune AL, Owoicho O, Bediako Y, et al. Parallels in sepsis and Covid-19 conditions: implications for managing severe Covid-19. Front Immunol. 2021 [cited 2022 Sep 30]; 12:602848. DOI: https://doi.org/10.3389/fimmu.2021.602848.
8. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016 [cited 2022 Sep 30]; 315(8):801-10. DOI: https://doi.org/10.1001/jama.2016.0287.
9. Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021. Intensive Care Med. 2021 [cited 2022 Sep 30]; 47:1181-247. DOI: https://doi.org/10.1007/s00134-021-06506-y.
10. Jones D, Mitchell I, Hillman K, Story D. Defining clinical deterioration. Resuscitation. 2013 [cited 2022 Sep 30]; 84(8):1029-34. DOI: https://doi.org/10.1016/j.resuscitation.2013.01.013.
11. Plate JD, Hietbrink F, Leenen LP, Peelen LM. Predicting early deterioration of admitted patients at the Intermediate Care Unit. J Crit Care. 2018 [cited 2022 Sep 30]; 48:97-103. DOI: https://doi.org/10.1016/j.jcrc.2018.08.012.
12. Royal College of Physicians. National Early Warning Score (NEWS) 2: standardising the assessment of acute-illness severity in the NHS. Updated report of a working party. London: RCP; 2017 [cited 2022 Sep 30]. Available from: https://www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news-2.
13. Oliveira AP, Urbanetto JS, Caregnato RC. National Early Warning Score 2: transcultural adaptation to Brazilian Portuguese. Rev Gaúcha Enferm. 2020 [cited 2022 Sep 30]; 41:e20190424. DOI: https://doi.org/10.1590/1983-1447.2020.20190424.
14. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021 [cited 2022 Sep 30]; 372:n71. DOI: https://doi.org/10.1136/bmj.n71.
15. Mendes KD, Silveira RC, Galvão CM. Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. Texto Contexto - Enferm. 2008 [cited 2022 Sep 30]; 17(4):758-64. DOI: https://doi.org/10.1590/S0104-07072008000400018.
16. Whittemore R, Knafl K. The integrative review: updated methodology. J Adv Nurs. 2005 [cited 2022 Sep 30]; 52(5):546-53. DOI: https://doi.org/10.1111/j.1365-2648.2005.03621.x.
17. Aromataris E, Munn Z (eds.). JBI manual for evidence synthesis. JBI; 2020.
18. Melnyk B, Fineout-Overholt E. Evidence-based practice in nursing and healthcare: a guide to best practice. 2nd. ed. Philadelphia: Lippincott, Williams & Williams; 2011.
19. Corfield AR, Lees F, Zealley I, Houston G, Dickie S, Ward K, et al. Utility of a single early warning score in patients with sepsis in the emergency department. Emerg Med J. 2014 [cited 2022 Sep 30]; 31(6):482-7. DOI: https://doi.org/10.1136/emermed-2012-202186.

DOI: http://dx.doi.org/10.12957/reuerj.2022.67662

20. Yu S, Leung S, Heo M, Soto GJ, Shah RT, Gunda S, et al. Comparison of risk prediction scoring systems for ward patients: a retrospective nested case-control study. Crit Care. 2014 [cited 2022 Sep 30]; 18(3):r132. DOI: https://doi.org/10.1186/cc13947.
21. Churpek MM, Snyder A, Sokol S, Pettit NN, Edelson DP. Investigating the impact of different suspicion of infection criteria on the accuracy of quick sepsis-related organ failure assessment, systemic inflammatory response syndrome, and early warning scores. Crit Care Med. 2017 [cited 2022 Sep 30]; 45(11):1805-12. DOI: https://doi.org/10.1097/ccm.0000000000002648.
22. Churpek MM, Snyder A, Han X, Sokol S, Pettit N, Howell MD, et al. Quick sepsis-related organ failure assessment, systemic inflammatory response syndrome, and early warning scores for detecting clinical deterioration in infected patients outside the intensive care unit. Am J Respir Crit Care Med. 2017 [cited 2022 Sep 30]; 195(7):906-11. DOI: https://doi.org/10.1164/rccm.201604-0854oc.
23. Skitch S, Tam B, Xu M, McInnis L, Vu A, Fox-Robichaud A. Examining the utility of the Hamilton early warning scores (HEWS) at triage: Retrospective pilot study in a Canadian emergency department. CJEM. 2018 [cited 2022 Sep 30]; 20(2):266-74. DOI: https://doi.org/10.1017/cem.2017.21.
24. Brink A, Alsma J, Verdonschot RJ, Rood PP, Zietse R, Lingsma HF, et al. Predicting mortality in patients with suspected sepsis at the Emergency Department: a retrospective cohort study comparing qSOFA, SIRS and National Early Warning Score. PLoS One. 2019 [cited 2022 Sep 30]; 14(1):e0211133. DOI: https://doi.org/10.1371/journal.pone.0211133.
25. Fernando SM, Fox-Robichaud AE, Rochwerg B, Cardinal P, Seely AJ, Perry JJ, et al. Prognostic accuracy of the Hamilton Early Warning Score (HEWS) and the National Early Warning Score 2 (NEWS2) among hospitalized patients assessed by a rapid response team. Crit Care. 2019 [cited 2022 Sep 30]; 23(1):60. DOI: https://doi.org/10.1186/s13054-019-2355-3.
26. Levin N, Horton D, Sanford M, Horne B, Saseendran M, Graves K, et al. Failure of vital sign normalization is more strongly associated than single measures with mortality and outcomes. Am J Emerg Med. 2020 [cited 2022 Sep 30]; 38(12):2516-23. DOI: https://doi.org/10.1016/j.ajem.2019.12.024.
27. Hargreaves DS, Carvalho JL, Smith L, Picton G, Venn R, Hodgson LE. Persistently elevated early warning scores and lactate identifies patients at high risk of mortality in suspected sepsis. Eur J Emerg Med. 2020 [cited 2022 Sep 30]; 27(2):125-31. DOI: https://doi.org/10.1097/mej.0000000000000630.
28. Liu VX, Lu Y, Carey KA, Gilbert ER, Afshar M, Akel M, et al. Comparison of early warning scoring systems for hospitalized patients with and without infection at risk for in-hospital mortality and transfer to the intensive care unit. JAMA Netw Open. 2020 [cited 2022 Sep 30]; 3(5):e205191. DOI: https://doi.org/10.1001/jamanetworkopen.2020.5191.
29. Jang JG, Hur J, Hong KS, Lee W, Ahn JH. Prognostic Accuracy of the SIRS, qSOFA, and NEWS for Early Detection of Clinical Deterioration in SARS-CoV-2 Infected Patients. J Korean Med Sci. 2020 [cited 2022 Sep 30]; 35(25):e234. DOI: https://doi.org/10.3346/jkms.2020.35.e234.
30. Hwang TS, Park HW, Park HY, Park YS. Prognostic Value of Severity Score Change for Septic Shock in the Emergency Room. Diagnostics (Basel). 2020 [cited 2022 Sep 30]; 10(10):743. DOI: https://doi.org/10.3390/diagnostics1010.