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The Prognostics Accuracy of Early Warning Score Screening in Patients with COVID-19: A Literature Review

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Abstract.
The accuracy of an early warning score (EWS) in early identification of a patient's condition can help healthcare workers to promptly and appropriately identify therapy for the patient; it is also used to determine which patients will go to the emergency room, and to monitor the patient's condition while in the hospital. There are no comprehensive syntheses of the current prognostics accuracy of EWS screening in patients with COVID-19. This review aimed to identify published articles that described EWS accuracy and parameters used in EWS screening. A systematic search of four databases (Science Direct, Pubmed, Google Scholar, and Proquest) was conducted to identify articles describing prognostics accuracy of EWS screening in patients with COVID-19. The EWS, its parameter and its components were extracted and narratively synthesized to identify patterns and themes across the types of EWS. A total of 10 articles describing EWS systems were identified. It was found that the National Early Warning Score (NEWS), National Early Warning Score 2 (NEWS2), Standardized Early Warning Score (SEWS), and Modified Early Warning Score (MEWS) had accurate results ranging from 81-92% sensitivity, specificity of 78-84%, and accuracy of 90-96%. Finally, those EWS systems were shown to perform remarkably well in recognizing a patient's clinical status at time of admission to the hospital and in determining the appropriate treatment.

Keywords: accuracy, early warning score, COVID-19

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1. Introduction

Coronavirus disease 2019 (COVID-19) is defined as a life-threatening illness that is caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1]. It can lead to severe COVID-19, and it is a common reason for admission to the intensive care unit (ICU,) which has a high death rate [2]. The COVID-19 outbreak is still evolving worldwide scale. COVID-19 has caused more than 211 million confirmed illnesses and over 4.4 million deaths as of August 22, 2021 [3]. As a result, for COVID-19 patients, early detection of deteriorating patients is critical because it allows limited resources to be directed to those patients in most clinical need. Risk classification and early identification of patients at high risk of clinical deterioration at admission, on the other hand, remain

significant issues. To offer high-quality care and effectively allocate resources, frontline health personnel are continually faced with the problem of identifying the severity and prognosis of COVID-19 patients [4]. As a result, a simple and effective risk prediction tool is needed to assess the probability of COVID-19 patients deteriorating.

The Early Warning Score (EWS) is a risk prediction tool for detecting health concerns in hospital patients early on. This tool is a notion that standardizes the evaluation approach and sets the scoring of physiological indicators to improve patient safety and clinical outcomes. EWS is a simple assessment method used in hospitals to establish a patient's physiological score before an emergency. EWS was created to identify which patients need to be closely monitored and what actions must be taken [5]. EWS screening includes seven parameters, which are as follows: age, respiration rate, oxygen saturation, blood pressure, pulse, awareness, and temperature. Other studies employ alternative approaches to screen COVID-19 patients and use EWS [6]. The NEWS/NEWS2 scoring system is based on common physiological indicators that may be easily and quickly acquired at the bedside. Each indicator is given a hand, with 0 being deemed normal and a total score ranging from 0 to 23. Patients with a score of 7 or more would be considered at high clinical risk and would prompt a high-level clinical alert, with a score of 5 or more representing the crucial threshold for urgent response [7][8]. Therefore, this review aims to identify published articles that [1] described EWS accuracy, and [2] described parameters used in EWS screening for a patient with COVID-19.

2. Methods

To structure the review, we used the PRISMA statement [9]. From December 2019 to March 2021, we searched Science direct, Pubmed, Google scholar, and Proquest for pertinent papers. The following are the essential inclusive criteria: [1] included adult patients with confirmed SARS-CoV-2 infection, [2] used the NEWS2 or NEWS to predict clinical worsening (such as the need for intensive respiratory assistance, admission to the ICU, or in-hospital death), and [3] collected enough data to evaluate predictive accuracy. There was a restriction on the English language used. Figure 1 lists the precise search methodologies and the inclusion and exclusion criteria.

Two writers used the JBI's critical appraisal tool to assess the risk of bias and applicability concerns of the included papers (10). We performed thematic analysis to evaluate EWS accuracy and parameters used in EWS screening.

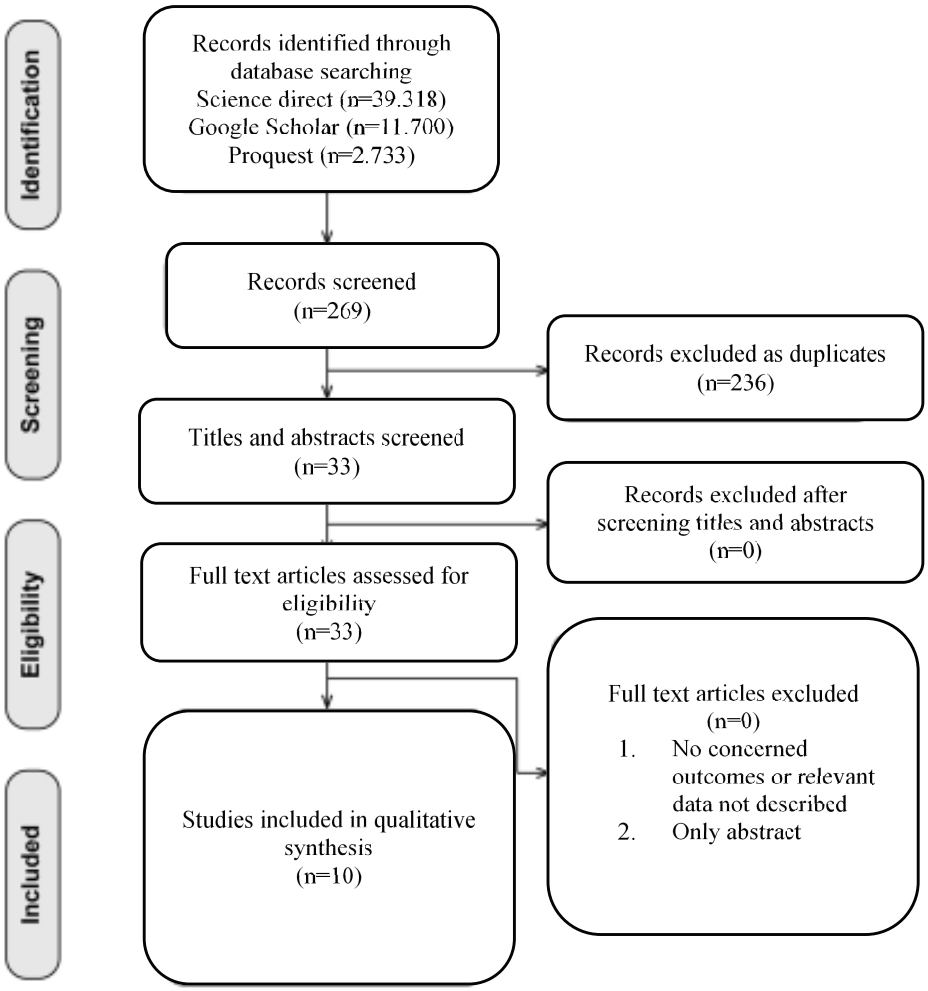

Figure 1: Flow diagram of study inclusion.

3. Results

3.1. Study Selection and Characteristics

Initially, a total of 53.751 published studies were found. After deleting duplicate articles and reviewing the abstracts, we found 33 studies after deleting the same reports and examining the abstracts, and 23 studies were rejected for reasons in the full-text assessments. Finally, our review covered ten studies (Figure 1). The basic information and characteristics of the included studies are shown in Table 1. Two studies had a sample size of fewer than 100 patients, while eight studies had more than 100 patients. Most studies used the original NEWS.

Table 1: Characteristics of the included studies.

References	Design	Sample	Outcome
Yang et al. (2020)	Cohort study	113	The EWS score (88%) is significant in determining the patient's status before hospital admission and death.
Jang et al. (2020)	Cohort study	110	NEWS is superior to qSOFA in predicting death for up to 28 days.
Covino et al. (2020)	Cohort study	334	NEWS is entirely accurate in determining the condition of patients before they enter the ICU (71.4%) vs. (57.8-82.7%); hence about (95%) is very accurate. While REMS is precise in predicting patient mortality during hospitalization (96.1 percent), it is not as good for predicting death after discharge (80.4-99.9 percent).
Gidari et al. (2020)	Cohort study	71	NEWS2 is utilized in hospitals to detect early ICU admission using thresholds 5 and 7 with a score of 0.90 standard assessment (0.04; 95 percent (0.82– 0.97) and computations (r 0.91, 95 percent CI 0.70-0.97, p.0001).
Hu et al. (2020)	Cohort study	367	SEWS 0.841 (95% CI: 0.765- 0.916), NEWS 0.809 (95% CI: 0.727-0.891), NEWS2 0.809 (95% CI: 0.727-0.891), HEWS 0.821 (95% CI: 0.748-0.895), and assessments from MEWS 0.670 (95% CI: 0.573-0.767) this cannot be used to detect covid-19 because it is less significant
Myrstad et al. (2020)	Cohort study	66	NEWS2 is very significant (84%) in predicting a patient's beginning state till death at the hospital (0.822, 95% CI 0.690–0.953).
Kostakis et al. (2020)	Cohort study	6523	The performance of the NEWS2 system for early identification of covid-19 is quite considerable (0.842-0.894) from the time the patient arrives at the hospital until the time the patient leaves.
Saberian et al. (2020)	Cross sectional study	557	qSOFA received a score of >0 (sensitivity and specificity of 25.0 and 85.68 percent, respectively), and NEWS received a score of >2 (sensitivity and specificity of 83.61 and 32.67 percent, respectively). PRESEP received a score of > 1 (sensitivity and specificity of 83.61 and 32.67 percent, respectively) (sensitivity and specificity were 54.10 and 55.56 percent, respectively).
Wang et al. (2020)	Cohort study	235	MEWS's scoring method is significantly higher than SIR, APACHE II, and PSI
Baker et al. (2021)	Cohort study	296	The early score assessment of the MEWS and qSOFA metode techniques can exceed the score for early monitoring of the condition of patients with COVID-19.

3.2. Quality Assessment

Table 3 shows the summary results of the quality assessments by using JBI's critical appraisal tool. Ten studies received a quality score ranging from 91% to 100%.

Table 2: Quality assessment.

References	Design	Quality Score
Yang et al. (2020)	Cohort study	10/11 (91%)
Jang et al. (2020)	Cohort study	10/11 (91%)
Covino et al. (2020)	Cohort study	10/11 (91%)
Gidari et al. (2020)	Cohort study	10/11 (91%)
Hu et al. (2020)	Cohort study	10/11 (91%)
Myrstad et al. (2020)	Cohort study	10/11 (91%)
Kostakis et al. (2020)	Cohort study	10/11 (91%)
Saberian et al. (2020)	Cross-sectional Study	8/8 (100%)
Wang et al. (2020)	Cohort study	10/11 (91%)
Baker et al. (2021)	Cohort study	10/11 (91%)

3.3. Results of the Synthesis

Health workers' decisions must be accurate and high quality, employing a tried-and-true screening procedure (11). To identify COVID-19 patients with mild to severe symptoms, an excellent early detection system is to apply an evaluation screening system based on the Early Warning Score. The National Early Warning Score (NEWS)(12), National Early Warning Score 2 (NEWS2) (13)(14)(15), Standardized Early Warning Score (SEWS), and Modified System are all screening methods for assessing patient problems using the EWS approach to identify patients who require particular care. Four studies used the NEWS2 to predict clinical deterioration for patients with COVID-19. The researchers employed the NEWS, qSOFA, REMS, HEWS, SEWS, PRESEP(16), APACHE-II, PSI, and MEWS (17) in the other studies to predict clinical deterioration. The screening accuracy of the early warning score method shows the accuracy in screening patients when they will enter the hospital and determine treatment; the results show sensitivity (81%-92%), specificity (78%-84%), and accuracy (90%-96 %). It can be explained that the EWS method of screening is used as a hospital standard with the goal of early detection of the patient's condition, determining the patient's admission to the ICU. Using the screening system scoring from the EWS method, patient death has several assessment targets: inform the minimum value to the maximum value (0.6317 – 0.8120 %).

4. Discussion

It's crucial to identify which COVID-19-infected individuals are at high risk of deterioration as soon as feasible, particularly in low-resource settings, so that all available resources can be put to good use. Several screening methods have been created to identify

patients who require special care using the EWS approach, including the National Early Warning Score (NEWS), National Early Warning Score 2 (NEWS2), and Standardized Early Warning Score (SEWS), and Modified System Early Warning Score (MEWS). The EWS-based scoring system will aid health care workers in distributing patients so that actions can be tailored to the patient's emergency (18). The NEWS scoring method provides accurate findings in predicting patients with a sensitivity of positive predictive value (PPV) and negative predictive value (NPV) to forecast cases of covid-19 with an assessment in identifying severe conditions of patients using the NEWS screening system; the results obtained 5 are moderate symptoms, while the issue of covid-19 with severe symptoms received the NEWS assessment results ≥7. The early warning score method's parameter indicators define the precision with which the patient's condition is screened. The National Early Warning Score (NEWS), National Early Warning Score 2 (NEWS2), The Standardized Early Warning Score (SEWS), and the Modified Early Warning Score (MEWS) have identical oxygen saturation, temperature, and blood pressure measures. The NEWS2 system revealed typical temperature conditions (36°C - 37°C), an average oxygen saturation score (88-92%), and a regular evaluation of blood pressure, according to Gidari et al.'s analysis. The MEWS technique was utilized by Wang et al. (2020) to achieve normal temperature findings (36.4°C - 37.5°C) (17), as well as an average oxygen saturation score (88 - 92%) and normal blood pressure (115/90 mmHg). Covino et al. (2020) also employed NEWS to test patients for an average temperature (36°C-38°C), 37 normal oxygen saturation levels (90-96%), and normal blood pressure (110/89 mmHg to 120/90 mmHg). [6].

5. Conclusion

We evaluate the literature to see how accurate the EWS predicts clinical worsening in COVID-19 patients. The sensitivity, specificity, and accuracy of different screening methods such as the National Early Warning Score (NEWS), National Early Warning Score 2 (NEWS2), Standardized Early Warning Score (SEWS), and Modified Early Warning Score (MEWS) can be seen in terms of 81-92 percent sensitivity, 78-84 percent specificity, and 90-96 percent accuracy. Our findings suggest NEWS2 monitoring as a diplomatic technique for screening COVID-19 patients upon hospital admission.

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