Original Article

Effectiveness of the Early Warning Score in Enhancing Nurses' Responsiveness to Critical Patients: A Quasi-Experimental Study in the Emergency Department

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ABSTRACT

Background: Emergency care services in Indonesia continue to face challenges in quickly identifying patients who are critically ill, which contributes to the high mortality rates in Emergency Departments (ED). While the Early Warning Score (EWS) has been proven effective for early detection of patient deterioration, there are limited studies on its implementation in Indonesian EDs, particularly in provincial hospitals. This highlights a gap in research that needs further attention.

Methods: This study used a quasi-experimental design with a pre-test and post-test control group at Dr. H. Moch Ansari Saleh Regional General Hospital, Banjarmasin. Twenty-three ED nurses participated. We measured nurse responsiveness by examining how quickly and accurately they took clinical actions after monitoring EWS. A prototype guideline for using EWS was also developed and integrated into the hospital's ED reporting system. The research followed CONSORT guidelines for quasi-experimental studies.

Results: Most participants were female (60.9%), aged between 19 and 44 years (95.7%), with the majority holding a Diploma III in nursing (65.2%). Before introducing the EWS, 83.3% of nurses in the intervention group responded in one minute or longer, with only 25% accuracy. After the EWS implementation, 91.7% responded in under one minute, with 91.7% accuracy. In the control group, one-minute or longer response times remained high at 90.9%, and accuracy improved slightly from 18.2% to 27.3%. Statistical tests showed significant improvement in response time ($p = 0.007$) and accuracy ($p = 0.005$) in the intervention group.

Conclusion: Introducing the Early Warning Score improved nurses' responsiveness in the ED, making their clinical actions faster and more accurate. Integrating EWS into daily practice with clear guidelines can help enable timely interventions and improve patient safety during emergency care.

***Keywords*:** Early Warning Score, Emergency Nursing, Critical Care, Patient Safety, Clinical Decision Making

Implications for Practice:

- Better Early Detection: EWS helps healthcare staff spot early signs that a critically ill patient's condition is getting worse.
- Faster and More Accurate Response: EWS enables nurses to act quickly and with more precision, helping ensure timely care in the Emergency Department.
- Consistent Patient Monitoring: EWS provides a transparent and standardized way to monitor patients, strengthening patient safety.

Introduction

The Emergency Department (ED) is a vital hospital unit that is the primary entry point for patients in critical and urgent conditions. The heavy workload, diverse case complexities, and the rapid changes in patients' clinical status demand an effective early detection system to minimize delays in treatment (WHO, 2021). According to the World Health Organization, nearly half of in-hospital cardiac arrest cases could actually be prevented if the early signs of clinical deterioration were recognized and acted upon systematically (WHO, 2021).

One of the tools that is effective in this regard is the Early Warning Score (EWS). This system has been widely adopted in countries such as the United Kingdom and Australia as a predictive approach for identifying patients at risk of deterioration. The National Institute for Health and Care Excellence (NICE) recommends using the National Early Warning Score 2 (NEWS2) as the national standard in the UK. Evidence shows that its implementation has reduced the incidence of cardiac arrests and unplanned intensive care admissions by 15–20% (Royal College of Physicians, 2022). The EWS system helps keep patients safe by allowing healthcare staff to spot early signs of worsening conditions. It also boosts how quickly and accurately nurses can respond, supporting the idea of a rapid response to patient needs.

At the national level, implementing the Early Warning Score (EWS) continues to face significant challenges. Data from Riskesdas (2023) indicate that mortality rates among emergency department patients experiencing sudden clinical deterioration reach 28.7%, predominantly due to delayed interventions. Although the Ministry of Health Regulation No. 47 of 2018 governs triage and early detection systems, their application varies widely across Indonesian hospitals, especially in regional healthcare facilities (Ministry of Health of the Republic of Indonesia, 2022).

In South Kalimantan, the Provincial Health Office (2023) reported a 12.5% increase in critical patient visits to emergency departments compared to the prior year, accompanied by an 18.3% rise in ICU referrals. These data underscore the ongoing risk of delayed early detection of patient deterioration in this region. Given these circumstances, evaluating the effectiveness of EWS at the local level is crucial, considering demographic factors, hospital resources, and nursing competencies in South Kalimantan that may influence the system's implementation.

There remains a gap in research, as limited studies have examined the use of EWS in Indonesian regional hospitals, resulting in insufficient empirical evidence on its effectiveness in improving nurse responsiveness to critically ill patients in emergency settings within a local context. Hence, this study focuses on assessing the implementation of EWS in South Kalimantan to determine its impact on the timeliness and accuracy of nursing interventions.

This study is grounded in the theories of patient safety and rapid response. Patient safety theory emphasizes the critical role of early detection and precise clinical decision-making in preventing complications and reducing mortality. Meanwhile, rapid response theory highlights healthcare professionals' ability—particularly nurses—to provide timely interventions based on early clinical signs, a process that can be enhanced via objective scoring systems such as EWS.

Taking into account global and national evidence, research gaps, and South Kalimantan's particular context, this study aims to evaluate the effectiveness of EWS in enhancing nurses' responsiveness to critically ill patients in emergency

departments, with particular focus on the accuracy and timeliness of nursing care

Methods

Study Design

This study employed a quasi-experimental pre-test and post-test design with a control group to evaluate the effectiveness of the Early Warning Score (EWS) in improving nurse responsiveness in the emergency department. Participants were divided into two groups. The intervention group received training on the EWS integrated with the electronic medical record (EMR) system and implemented the system in their nursing practice. Meanwhile, the control group performed conventional patient monitoring without using the EWS, although their responsiveness was still assessed for comparison. This research design enabled the evaluation of changes in both the speed and accuracy of nurses' responses before and after the intervention and comparisons between the two groups to determine the effectiveness of the EWS implementation..

Participants

The study involved 23 emergency department nurses from Dr. H. Moch Ansari Saleh Regional General Hospital in Banjarmasin who met specific inclusion and exclusion criteria. The inclusion criteria were: (1) willingness to participate and signing informed consent, (2) full-time shift work in the emergency department, and (3) having at least one year of professional nursing experience. The exclusion criteria included: (1) nurses who were on leave or absent during the study period, (2) those unwilling or refusing to participate in EWS training, and (3) nurses with physical limitations or health issues that could hinder their ability to perform clinical tasks. While patients served as the clinical context for the application of the EWS, the primary focus of analysis was directed toward evaluating the nurses' responsiveness (**Figure 1**).

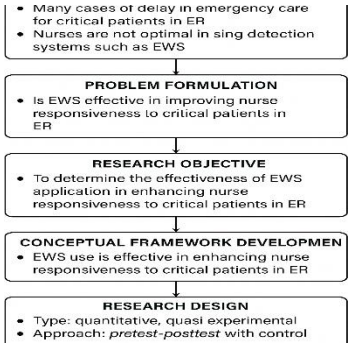

Figure 1 Flowchart diagram

Instruments

The study employed the Early Warning Score (EWS), a standardized scoring system integrated with EMR to detect early signs of patient deterioration. Data were collected by recording key vital parameters, including respiratory rate, oxygen saturation, blood pressure, pulse rate, body temperature, and level of consciousness.

Each parameter was assigned a score, and the total score reflected the level of patient acuity. Higher scores indicated a greater risk of deterioration, requiring urgent clinical intervention.

Intervention

The intervention group received structured training on using the EMR-based Early Warning Score (EWS), which included documentation of vital signs, score calculation, and follow-up actions according to clinical algorithms. Prior to the intervention, patient monitoring was carried out using conventional methods without EWS. The research team monitored compliance with the EWS protocol through direct supervision. Meanwhile, the control group continued with conventional patient monitoring without EWS intervention, although nurse responsiveness was still measured for comparison.

Data Collection

The intervention group consisted of 12 nurses, while the control group had 11 nurses. The evaluation was conducted using pre-test and post-test assessments to measure the speed and accuracy of their responses. Two trained accompanying nurses supported data collection, ensuring consistency in the procedures.

Data Analysis

The differences in responsiveness before and after the intervention were analysed using the Wilcoxon signed-rank test. Effect size was also calculated to assess the magnitude of the EWS intervention's impact on the speed and accuracy of nurses' responses. Reporting the effect size provides additional insight into how meaningful the changes were, beyond just relying on statistical significance.

Ethical Considerations

The study received ethical approval from the Research Ethics Committee of Muhammadiyah University of Banjarmasin (Approval No. 494/UMB/KE/VIII/2025). While, all the participants had given informed consent

Results

Table 1 describes the demographic characteristics of the respondents and examines the impact of implementing the electronic medical record (EMR)-based Early Warning Score (EWS) on the timeliness and accuracy of nurses' clinical responses. Most participants were in the productive age range of 19–44 years (91.7% in the intervention group and 100% in the control group), indicating their overall ability to effectively engage in the study procedures. Most respondents were female (58.3% in the intervention group and 63.6% in the control group). Regarding education, most had completed a Nursing Diploma (58.3% in the intervention group and 72.7% in the control group), reflecting adequate foundational knowledge to understand clinical instructions and apply the EWS system.

Before the intervention, most nurses required one minute or longer to respond (83.3% in the intervention group and 90.9% in the control group). After implementing the EWS, the intervention group showed notable improvement, with 91.7% responding within less than one minute, while only 18.2% did so in the control group.

Regarding response accuracy, before the intervention, most responses were classified as inaccurate (75% in the intervention group and 81.8% in the control group). After the EWS was introduced, accuracy in the intervention group increased significantly to 91.7%, whereas the control group's accuracy reached 72.7%.

Table 1 Respondents Characteristics respondents

No	Respondent Characteristics	Group	
		Intervention N (%)	Control N (%)
1	**Age**		
	19–44 years	11 (91.7%)	11 (100%)
	45–59 years	1 (8.3%)	0 (0%)
2	**Gender**		
	Male	5 (41.7%)	4 (36.4%)
	Female	7 (58.3%)	7 (63.6%)
3	**Education**		
	Diploma III	7 (58.3%)	8 (72.7%)
	Bachelor of Nursing	5 (41.7%)	3 (27.3%)

Table 2 illustrates that statistical analyses confirmed these differences were significant for both response time ($p = 0.007$) and accuracy ($p = 0.005$). These findings highlight that the EMR-based EWS effectively enhances nurses' ability to respond more quickly and accurately, which holds important implications for early detection and timely management of patient deterioration.

Table 2. Time responses of EWS

No	Time Responses	Category	Group		Statistical Test	p-value
			Intervention N (%)	Control N (%)		
A	**Speed**					
1	Before Intervention	<1 Menit	2 (16.7%)	1 (9.1%)	Wilcoxon Test	0.007
		≥ 1 Menit	10 (83.3%)	10 (90.9%)		
		Total	12 (100%)	11 (100%)		
2	After Intervention	<1 Menit	11 (91.7%)	2 (18.2%)		
		≥ 1 Menit	1 (8.3%)	9 (81.8%)		
		Total	12 (100%)	11 (100%)		
B	**Accuracy**					
1	Before Intervention	True	9 (75%)	9 (81.8%)	Wilcoxon Test	0.005
		False	3 (25%)	2 (18.2%)		
		Total	12 (100%)	11 (100%)		
2	After Intervention	True	1 (8.3%)	3 (27.3%)		
		False	11 (91.7%)	8 (72.7%)		
		Total	12 (100%)	11 (100%)		

Discussion

The study results show that most respondents were between 19 and 44 years old (91.7% in the intervention group and 100% in the control group), an age range typically associated with better cognitive and physical ability to understand instructions and carry out technology-based interventions, including the use of the Early Warning Score (EWS) system. This finding aligns with (Putri & Sari, 2021) who noted that individuals in this age group adapt more easily to health technology innovations, supporting the idea that age influences acceptance of digital interventions.

The majority of respondents were female (58.3% in the intervention group and 63.6% in the control group), reflecting the predominance of female nurses in clinical practice, consistent with national data indicating that over 70% of nurses in Indonesia are women (Ministry of Health RI, 2021). Gender may influence the level of attentiveness and sensitivity in nursing care, particularly in applying the EWS, which requires careful observation of patients' vital signs.

Regarding education, most respondents held a Diploma in Nursing (58.3% in the intervention group and 72.7% in the control group), providing a solid foundation to understand clinical instructions and use the electronic-based EWS system. (Sari et al, 2021) also found that nurses' education level is closely linked to the quality of emergency clinical decision-making.

Before the intervention, most nurses took one minute or longer to respond (83.3% in the intervention group and 90.9% in the control group), which could increase the risk of delayed emergency care. (Handayani & Fathoni, 2020) highlighted that delayed early detection of patients' critical conditions often increases hospital mortality.

After implementing the EMR-based EWS, the intervention group showed significant improvement, with 91.7% responding in under one minute compared to 18.2% in the control group. This highlights the effectiveness of the EWS in speeding up nurses' decision-making.

(Zhang et al, 2021) reported that digital EWS systems enable quick visualization of scores, reducing clinical response times.

Concerning response accuracy, before the intervention, most actions were classified as inaccurate (75% in the intervention group and 81.8% in the control group), indicating that clinical assessments were largely dependent on subjective judgment without digital support. (Mulyani et al, 2020) emphasized that manual decision-making is more prone to errors in interpreting patients' vital signs.

Following EWS implementation, accuracy increased substantially in the intervention group to 91.7%, compared to 72.7% in the control group. This demonstrates that using the EWS system not only accelerates response but also enhances the accuracy of nursing actions, consistent with (Lim et al, 2022), who reported that electronic EWS improves identification accuracy of critical conditions to over 85%.

Statistical analysis revealed significant differences in response speed ($p = 0.007$) and accuracy ($p = 0.005$), proving that the EMR-based EWS intervention positively affects nurse responsiveness. (Dewi & Pratiwi, 2021)noted that technology-based systems can minimize human error in monitoring patient conditions, thereby improving patient safety quality.

The EMR-based EWS implementation in this study aligns with global evidence indicating that EWS, particularly the National Early Warning Score (NEWS), has strong predictive validity for identifying critically ill patients. (Pimentel et al., 2021) reported that NEWS predicts mortality risk and the need for advanced care such as ICU referral up to 48 hours after emergency department admission. Comparative studies also show that NEWS is among the most reliable tools for predicting death or ICU referral within 24 hours across various diagnoses (Skrede et al., 2023). These findings support the current study's results, demonstrating that improved nurse responsiveness results not only from respondent characteristics but also from the proven effectiveness of the EWS system.

Systematic reviews link EWS use with better prediction accuracy for critical illness, early mortality, and ICU referrals (Mapp et al., 2022), consistent with this study's findings. However, (Subbe et al., 2019)warn that if NEWS/EWS models are not tailored to specific institutional needs, their usefulness may diminish, leading to low clinical adoption. This suggests that the success of EWS implementation here depended not only on the technology but also on nurse training and acceptance of innovation, contributing to the significant impact observed.

Overall, this study provides evidence for the effectiveness of digital technology in nursing practice, particularly through EMR-based EWS implementation, which enhances care quality and supports healthcare digital transformation. Therefore, expanding the use of EMR-based EWS in other health facilities and ongoing training is recommended to maximize benefits for nurses and patient safety.

This study has limitations, including a relatively small sample size, a single study site, and the potential Hawthorne effect, where nurses' behaviour may have been influenced by awareness of being observed. Thus, caution is advised in generalizing these findings, and larger multicentre studies are recommended to validate the results.

Implications and limitations

This study demonstrates that implementing the electronic medical record (EMR)-based Early Warning Score (EWS) enhances nurses' speed and accuracy in responding to critically ill patients in the emergency department. It highlights practical benefits such as improved patient

safety, strengthened nursing competency, greater workflow efficiency, and guidance for standardized hospital protocols. However, limitations include a small sample size, single-site setting, absence of direct patient outcome measures, possible Hawthorne effect, and varying nurse skills. Overall, the findings support EWS as an effective clinical tool and recommend larger, multisite studies to further validate its impact on patient outcomes..

Relevance to for Practice

The EMR-based Early Warning Score facilitates early detection of patient deterioration in emergency settings, enabling nurses to respond more promptly and accurately as per hospital protocols. It's clear scoring system supports objective clinical decision-making, strengthens nurse-physician coordination, and streamlines activation of emergency response teams when high scores are detected. Digital integration of EWS within EMRs also enhances routine documentation, service evaluation, and digital transformation efforts in healthcare facilities. Nurse training ensures consistent and effective system use, ultimately improving patient safety and overall quality of care

Conclusion

The implementation of the Early Warning Score (EWS) among emergency department nurses significantly improves the speed and accuracy of clinical responses. After the intervention, 91.7% of nurses were able to respond in less than one minute, with an accuracy rate of 91.7%, compared to the control group, which only achieved 72.7% accuracy. Wilcoxon analysis revealed significant differences in response speed ($p = 0.007$) and accuracy ($p = 0.005$), confirming the effectiveness of EWS in supporting faster and more precise clinical responses, with direct implications for enhancing patient safety in the emergency department

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CrediT Authorship Contributions Statement

Ernawati : Research proposal, conduct of the study, and report writing
Sri Purwanti Ariani : Data collection
Pramunika : Data collection

Conflicts Of Interest

The authors declare no financial interests or personal relationships that could have influenced the work reported in this paper. There are no conflicts of interest.

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Supplementary Materials

Supplementary File S1: Questionnaire contains the full questionnaire used for data collection.

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