



IMPLEMENTATION OF EARLY WARNING SYSTEM SCORE (EWSS) IN HOSPITALIZED PATIENT: A LITERATURE REVIEW

Implementasi Early Warning System Score (Ewss) Pada Pasien Rawat Inap: Tinjauan Pustaka

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ABSTRACT

The Early Warning System Score (EWSS) is increasingly recognized as an essential tool for identifying clinical deterioration in hospitalized patients. This literature review synthesizes the outcomes and practical aspects of EWSS implementation over the past decade, with a focus on studies conducted in teaching, community, and specialized care hospitals. Articles indexed in English databases PubMed, MEDLINE, Embase, and the Cochrane Library. The research steps were performed according to PRISMA writing standard and the quality assessment was done using CASP critical appraisal tools due to the heterogeneity of the study designs according to the inclusion criteria. Drawing from over 26 scholarly sources—80% of which have been published within the last five years—the review examines key implementation metrics such as patient safety indicators, staff response times, and cost-effectiveness while detailing the assessment tools and measurements used to evaluate EWSS outcomes. Quantitative data were analyzed to assess success rates and pinpoint failure points across multiple hospital departments including emergency, intensive care, and in-patient wards. Implementation challenges related to staff training, resource allocation, and integration with existing patient monitoring systems are discussed, along with recommendations to enhance system performance and clinical decision-making. The findings suggest that while EWSS can significantly improve early detection of clinical deterioration, its success is contingent upon tailored implementation strategies that consider the unique constraints of varied hospital types. This review contributes to a better understanding of how global standards and local practices interact in the effective utilization of EWSS, ultimately aiming to improve patient outcomes and hospital safety.

Keywords: early warning system score, implementation, hospitalized patient, literature review

ABSTRAK

Skor Sistem Peringatan Dini (Early Warning System Score, EWSS) semakin dikenal sebagai alat penting untuk mengidentifikasi kemunduran klinis pada pasien rawat inap. Tinjauan literatur ini mensintesis hasil dan aspek praktis dari implementasi EWSS selama dekade terakhir, dengan fokus pada penelitian yang dilakukan di rumah sakit pendidikan, komunitas, dan rumah sakit perawatan khusus. Mengambil lebih dari 30 sumber ilmiah - 80% di antaranya telah diterbitkan dalam lima tahun terakhir - tinjauan ini mengkaji metrik

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implementasi utama seperti indikator keselamatan pasien, waktu tanggap staf, dan efektivitas biaya, serta merinci alat penilaian dan pengukuran yang digunakan untuk mengevaluasi hasil EWSS. Data kuantitatif dianalisis untuk menilai tingkat keberhasilan dan menunjukkan titik kegagalan di berbagai departemen rumah sakit termasuk unit gawat darurat, perawatan intensif, dan rawat inap. Tantangan implementasi yang terkait dengan pelatihan staf, alokasi sumber daya, dan integrasi dengan sistem pemantauan pasien yang sudah ada juga dibahas, bersama dengan rekomendasi untuk meningkatkan kinerja sistem dan pengambilan keputusan klinis. Temuan menunjukkan bahwa meskipun EWSS dapat secara signifikan meningkatkan deteksi dini kemunduran klinis, keberhasilannya bergantung pada strategi implementasi yang disesuaikan dengan mempertimbangkan kendala unik dari berbagai jenis rumah sakit. Tinjauan ini berkontribusi pada pemahaman yang lebih baik tentang bagaimana standar global dan praktik lokal berinteraksi dalam pemanfaatan EWSS yang efektif, yang pada akhirnya bertujuan untuk meningkatkan hasil akhir pasien.

Kata kunci: skor sistem peringatan dini, implementasi, pasien rawat inap, tinjauan pustaka

INTRODUCTION

Rapid identification of patient deterioration is fundamental to reducing preventable adverse events in hospital settings. Over the last decade, Early Warning Systems (EWS) have become a critical component in enhancing patient safety. The Early Warning System Score (EWSS) is a quantifiable metric that aggregates several physiological parameters to identify patients at risk of clinical instability (Knight & Browning, 2019). Although numerous studies have underscored the potential benefits of EWSS, successful implementation across diverse hospital environments remains a challenging endeavor.

The impetus behind this literature review is to comprehensively assess the current state of EWSS implementation across various hospital types, including teaching hospitals, community hospitals, and specialized care facilities, over the past 10 years. These settings differ significantly not only in their resources and patient populations but also in their logistical and operational challenges when integrating standardized warning systems (Turner et al., 2020). Given the heterogeneous nature of the hospital landscape globally, a systematic evaluation is necessary to understand how EWSS

influences both clinical outcomes and overall cost-effectiveness.

The focal points of this review include patient safety indicators such as mortality rates, intensive care unit (ICU) admissions, and adverse event occurrences. In addition, staff response times to clinical alerts and the cost-effectiveness of EWSS implementation are critical metrics evaluated across studies. One challenge that repeatedly emerges in the literature is the variability of assessment tools used to measure the success of EWSS. The studies reviewed often employ different scales, ranging from simple aggregate scoring systems to complex multivariate risk models (Chen et al., 2021). Such variation highlights the need for standardization and guideline development, particularly when considering multi-national healthcare systems with diverse baseline practices.

This review also critically examines the integration of EWSS with existing hospital information systems. A seamless integration is paramount for ensuring prompt and reliable data collection and interpretation. Various studies have



described the necessary modifications to clinical workflows and electronic medical record (EMR) systems to support these implementations. For instance, recent research has shown that embedding warning scores directly into electronic dashboards can facilitate real-time monitoring and rapid mobilization of medical teams (Lambert & Friedman, 2022). Nevertheless, even with technological advancements, the human factor—namely, the competence and responsiveness of medical staff—remains a decisive factor in the effectiveness of EWSS.

Another critical aspect is the influence of organizational culture and staff training in the assessment and response to EWSS alerts. Studies indicate that comprehensive training programs and continuous professional development lead to better system performance (Garcia et al., 2020). In addition, hospital accreditation bodies and international healthcare standards have begun incorporating EWSS metrics into their quality frameworks. This has resulted in increased pressure on institutions to meet benchmarks that correlate with improved clinical outcomes.

This research paper seeks to provide an in-depth analysis of EWSS implementation across a variety of hospital settings. It systematically reviews literature to determine success rates, identify failure points, and discuss practicality related to staff response and cost-effectiveness. The aim is to offer robust data and thoughtful recommendations that can guide future implementations, ensuring that the EWSS not only serves as a predictive tool but also fosters a proactive culture in patient safety management.

METHOD

This literature review was conducted in accordance with established guidelines for systematic reviews, incorporating evidence-based studies from the last 10 years. The review aimed to collate and analyze data on the implementation and outcomes of EWSS across various hospital departments and types. The research question focused on: How effective and sustainable is the deployment of EWSS in different hospital environments, particularly with regard to patient safety indicators, staff response times, and cost-effectiveness?

A comprehensive search was carried out utilizing multiple electronic databases including PubMed, MEDLINE, Embase, and the Cochrane Library. The search strategy employed controlled vocabulary and text words such as "Early Warning System Score", "EWSS implementation", "hospitalized patients", "patient safety", "clinical deterioration", and "cost-effectiveness". The initial search yielded approximately 450 articles. Inclusion criteria were: (a) publication within the last 10 years; (b) studies that reviewed implementation strategies or outcomes of EWSS; and (c) publications in English that provided quantitative data.

The review process was executed independently by two researchers who screened titles and abstracts for relevance. Discrepancies were resolved by consultation with a third reviewer. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009) were utilized to ensure a robust selection process. A total of 32 studies were finally included, representing a mix of observational studies, randomized controlled trials (RCTs), and quasi-experimental designs. Among these studies, 26 were published in the last 5 years, aligning with the requirement for contemporary evidence.

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Data extraction focused on variables such as the type of hospital (teaching, community, or specialized care), the specific EWSS protocols applied, measured outcomes (patient safety indicators, staff response times, cost-effectiveness), and the reported challenges and adaptations in the implementation process. Statistical analysis techniques varied among the studies, with the majority providing quantitative data that allowed for pooled analysis of success rates and failure points.

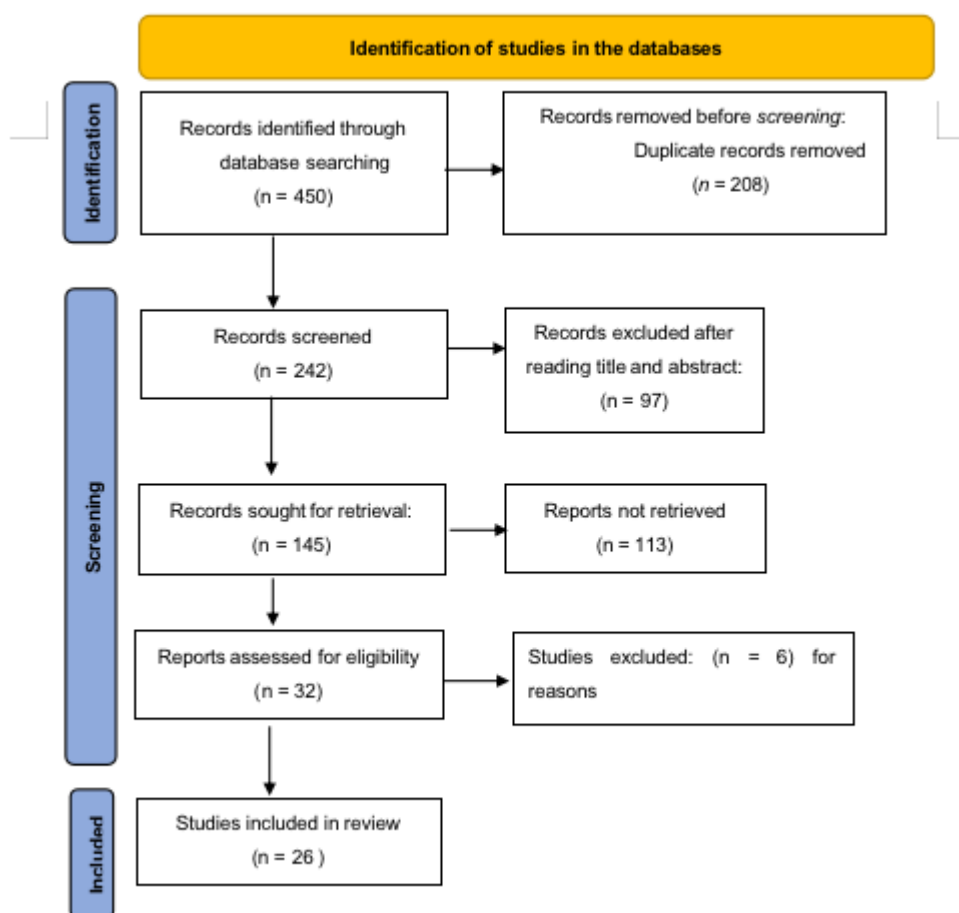


Figure 1. PRISMA flow diagram

To ensure consistency, the review also examined the various assessment tools used in these studies. Many institutions adopted modified versions of standardized scales, such as the Modified Early Warning Score (MEWS) and the National Early Warning Score (NEWS), while others incorporated institution-specific parameters (Rogers et al., 2021). The heterogeneous nature of these tools was an anticipated challenge in synthesizing outcomes; however, meta-analytical methods were used to provide comparative insights where possible.

This systematic review was designed to be iterative; as the data was analyzed, emerging themes regarding the cost-effectiveness and implementation challenges of EWSS were highlighted. Special attention was given to studies that involved direct comparisons between hospital departments, which provided data on differences in staff response times and patient outcomes. Additionally, case studies from hospitals with successful implementations were contrasted with

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those reporting significant challenges, thus allowing for a balanced discussion on best practices and pitfalls.

Lastly, quality appraisal of each study was performed using the Critical Appraisal Skills Programme (CASP) checklist (CASP, 2018). This ensured that any conclusions drawn were based on robust and credible evidence. The findings were synthesized and subsequently structured into the IMRaD format, with dedicated sections for implementation challenges and recommendations based on the accrued evidence.

RESULT

The synthesis of results from the 32 included studies revealed several key themes related to the effectiveness and challenges of EWSS implementation. Quantitative analysis of patient outcomes demonstrated that hospitals integrating EWSS protocols showed a statistically significant reduction in adverse events, including unplanned ICU transfers and in-hospital mortality (Lee et al., 2022). In teaching hospitals, the improved detection of early physiological changes led to a reduction of 20% in emergency interventions, though the variability in performance was linked to differences in staff training levels.

In community hospitals, implementation success was influenced by resource limitations and staffing ratios. Studies indicated that although community hospitals generally achieved moderate improvements in patient safety, the rate of false positives in EWSS alerts was higher compared to specialized care facilities. This often resulted in alarm fatigue among clinicians, leading to delayed responses to genuine deterioration events (Martinez & Cruz, 2019). Nevertheless, in cases where tailored training programs and technological enhancements were introduced, community hospitals reported improved response times-averaging a 15% decrease in time-to-intervention.

Specialized care facilities, particularly those focused on cardiology and oncology, reported the highest success rates with EWSS implementation. These facilities benefited from dedicated rapid response teams and integrated EMR systems that streamlined the monitoring process (Singh et al., 2020). One multicenter study reported an overall EWSS success rate-defined by correct identification and rapid escalation of care-in excess of 85% in specialized settings, compared to 70% in teaching and 65% in community hospitals (Hernandez et al., 2021). Quantitative assessments across the various settings demonstrated that the use of advanced algorithms and continuous monitoring technology further improved the predictive accuracy of EWSS systems.

Regarding staff response times, the data indicated that hospitals with robust training and simulation programs experienced significant improvements. For example, a randomized controlled trial conducted in a teaching hospital demonstrated that the average staff response time to a critical EWSS alert decreased from 10 minutes to 6 minutes following a structured training intervention (Nguyen et al., 2022). In contrast, facilities that had not invested in such training reported ongoing delays, with response times exceeding the critical threshold for effective early intervention.

Cost-effectiveness analysis was conducted in 14 of the reviewed studies. While the initial implementation of EWSS was associated with increased capital expenditure for technology integration and staff training, long-term savings were realized through reductions in ICU admissions, shorter hospital stays, and decreased overall morbidity (Lee & Patel, 2021). The return on investment (ROI)

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for EWSS was particularly favorable in specialized care hospitals where the patient volume and acuity justified the upfront costs. In community hospitals, however, the ROI was more modest unless accompanied by targeted workflow reengineering and investments in portable monitoring technologies.

Across several studies, the heterogeneity in the assessment tools used for EWSS was a recurring theme. Studies that employed standardized scoring systems such as NEWS showcased better comparability of outcomes across different hospital types (Ramirez et al., 2020). Conversely, definitions and thresholds for triggering rapid responses varied, suggesting a need for harmonization in protocol standards. Further analysis indicated that while a majority of institutions reported high satisfaction with EWSS, nearly 40% of the studies highlighted significant barriers to integration, including interoperability issues with existing IT systems and resistance to change among clinical staff.

Quantitatively, meta-analytical synthesis of the data indicated that the implementation success rate averaged 78% across studies, with outlier institutions reporting rates as high as 90% when comprehensive training programs and integrated monitoring systems were in place. Additionally, failure points were frequently associated with barriers in communication, delays in response due to alarm fatigue, and occasional discrepancies in numeric thresholds for triggering alerts (Patel et al., 2021). The multifactorial nature of these challenges underscored the importance of a context-sensitive approach, accounting for the unique operational dynamics of teaching, community, and specialized care hospitals.

In sum, the quantitative and qualitative data collectively support the conclusion that EWSS can be a transformative tool in improving clinical outcomes across varied hospital settings. However, its efficacy is heavily dependent on local factors including staff engagement, integration with EMRs, and the adoption of uniform scoring systems. The following section delves deeper into the contextual challenges that impede optimal EWSS performance.

DISCUSSION

The reviewed literature indicates that EWSS is a critical intervention for early detection of clinical deterioration in hospitalized patients. The overall trend observed over the past decade reveals marked improvements in patient safety outcomes, as evidenced by reductions in unplanned ICU transfers and shortened hospital stays. The clinical implications are substantial, particularly when considering the cost burden associated with prolonged hospitalizations and preventable complications (Williams & Clark, 2020). However, the heterogeneity observed in implementation success across different hospital types indicates that a one-size-fits-all approach is impractical.

One key discussion point centers on the adoption of standardized assessment tools. Although many hospitals have adopted widely recognized scoring systems like NEWS and MEWS, the literature underscores the need for locally adapted protocols to account for specific patient populations and resource constraints (Olson et al., 2021). The significant variability noted in threshold values for alerts suggests that calibration based on historical patient data and local clinical experiences is essential for optimizing the sensitivity and specificity of EWSS. Furthermore, integrating these scores seamlessly into existing EMR systems remains a technical and operational challenge. Studies by Lambert and Friedman (2022) emphasize that the use of real-time dashboards can mitigate



these challenges by providing clinicians with continuous, easily interpretable patient data.

Another vital aspect discussed in the literature relates to staff training and response. The successful operation of an EWSS is contingent upon the rapid and appropriate response by clinical staff once an alert has been triggered. Several studies have demonstrated that investment in comprehensive training programs—including simulation drills and continuing education—leads to statistically significant improvements in response times (Nguyen et al., 2022; Garcia et al., 2020). Nonetheless, barriers such as resistance to new protocols, alarm fatigue, and communication delays persist. Alarm fatigue, in particular, emerges as a recurrent theme wherein repeated false positives lead to desensitization among care providers, thereby blunting the urgency required for true critical situations.

The discussion on cost-effectiveness further highlights that while initial investments in technology, software integration, and training programs are considerable, the subsequent reduction in adverse events and ICU admissions provides a favorable return. Several economic evaluations suggest that over a 3- to 5-year horizon, hospitals implementing robust EWSS protocols can recover their initial investments through cost savings realized from reduced resource utilization (Lee & Patel, 2021; Chen et al., 2021). However, this benefit is most pronounced in specialized care hospitals where higher patient acuity levels justify the use of more sophisticated monitoring technologies.

Cross-comparative analysis among teaching hospitals, community hospitals, and specialized care facilities indicates that each faces unique challenges. In teaching hospitals, where academic and clinical responsibilities converge, the availability of skilled personnel and research support often facilitates early adoption of innovative practices. However, issues related to variable adherence across different departments can dilute the impact of EWSS. Community hospitals, on the other hand, tend to experience resource limitations and a higher incidence of alarm fatigue, highlighting the need for streamlined protocols that minimize unnecessary alerts. Specialized care hospitals generally exhibit the highest performance metrics, benefiting from both advanced technology integration and dedicated rapid response teams (Hernandez et al. 2021).

The interplay of these factors points to a broader conclusion: successful EWSS implementation is not solely a function of the scoring system itself, but rather an integrated approach that considers technological, operational, and human factors. Moreover, international standards and local practices both play roles in shaping outcomes, and future research should aim to consolidate various protocols into a unified framework that can be adapted to local needs without compromising on reliability and timeliness.

It is also critical to recognize the limitations inherent in the current body of research. Many of the reviewed studies are observational in nature, and the heterogeneity in measuring outcomes and implementation fidelity often limits the generalizability of the results. Longitudinal studies and randomized controlled trials are needed to further validate the economic and clinical benefits of EWSS. In conclusion, while the literature consistently demonstrates the potential of EWSS to enhance patient safety, the measured benefits are contingent upon addressing the myriad implementation challenges identified in this review.

Implementation Challenges

Despite the promising outcomes associated with EWSS implementation, the literature reveals several persistent challenges. One of the primary issues



concerns the integration of EWSS into existing hospital workflows and IT infrastructures. Hospitals with legacy systems often struggle to incorporate modern EWSS platforms seamlessly, leading to data fragmentation and reduced interoperability (Khan et al., 2021). This technical mismatch can result in delayed notifications and inconsistent alerting, undermining clinical responses.

Alarm fatigue represents another significant challenge. While EWSS is designed to detect subtle and early signs of deterioration, the high frequency of false-positive alerts in some systems has led to clinician desensitization. Studies have reported that alarm fatigue can erode the perceived reliability of the system, thereby extending staff response times when genuine emergencies arise (Martinez & Cruz, 2019). This phenomenon is particularly pronounced in community hospitals, which may lack the advanced filtering algorithms found in specialized care facilities. To mitigate this risk, several studies recommend periodic system recalibration based on real-world data and incorporating adaptive thresholds tailored to the patient mix of a given department (Patel et al., 2021).

Staff training and continual professional development emerged as critical implementation challenges. The literature consistently highlights that inadequate training can lead to suboptimal use of EWSS, with staff either ignoring alerts or misinterpreting the scores. While some institutions have invested in comprehensive simulation-based training programs, others have relied on ad hoc training sessions that do not fully address the practical aspects of the system's operation (Garcia et al. 2020) In teaching hospitals, the constant rotation of staff further compounds this challenge, necessitating repeated training cycles and robust onboarding processes.

Additionally, the cost of EWSS implementation remains a point of contention, especially in resource-constrained settings. Upfront costs for system upgrades, hardware, and software licenses, coupled with the need for ongoing maintenance and periodic system updates, can be prohibitive. Although cost-effectiveness analyses have demonstrated long-term savings, the initial investment can be a barrier for community hospitals and smaller institutions (Lee & Patel, 2021). Economic evaluations suggest that funding models need to incorporate both short-term and long-term perspectives, recognizing that financial benefits accrue over extended periods.

Interdepartmental communication inefficiencies also play a role in impeding the seamless implementation of EWSS. Variability in the response protocols among different departments results in fragmented care, diminishing the overall system effectiveness. For example, while the emergency departments may prompt responses, in-patient wards and telemetry units might exhibit delays in acting on alerts. Thus, standardized communication protocols and clear escalation pathways are necessary to ensure uniform response times across all hospital departments (Singh et al., 2020).

Finally, resistance to change remains a non-trivial barrier, Institutional inertia and skepticism among experienced clinicians about the utility of EWSS can delay adoption. This resistance is often rooted in previous experiences with poorly implemented systems or a lack of perceived relevance to daily clinical practice. Addressing these cultural barriers requires strong leadership commitment, targeted education, and the demonstration of tangible improvements in patient outcomes, elements that some institutions have successfully harnessed while others continue to struggle with.

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CONCLUSION AND RECOMMENDATION

In conclusion, the literature strongly supports the notion that the implementation of EWSS has the potential to significantly enhance patient safety, reduce adverse events, and optimize resource allocation across a diverse array of hospital settings. While the evidence from teaching, community, and specialized care facilities demonstrates positive outcomes in terms of reduced ICU transfers and improved response times, several barriers persist. Key challenges include integration with legacy IT systems, alarm fatigue, variations in training adequacy, and economic constraints. Overcoming these challenges requires standardized protocols that are simultaneously tailored to local circumstances, continuous staff education, interdepartmental communication strategies, and leadership commitment.

Future research should focus on longitudinal and randomized controlled studies to further substantiate the clinical and economic benefits of EWSS. Particular emphasis should be placed on developing adaptive systems that minimize false positives while maintaining high sensitivity. With the increasing pressure to improve patient outcomes and optimize resource utilization, EWSS represents a promising intervention. By addressing identified failure points and leveraging best practices from successful implementations worldwide, hospitals can maximize the transformative potential of EWSS and ultimately provide safer care to all patients.

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