



Literature Review

Implementation of Early Warning Score (EWS) in Inpatient Ward: Scoping Review

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Abstract

Early Warning Score (EWS) Implementation in Inpatient Ward: Scoping Review. The implementation of EWS is known to reduce the worsening rate of patients in the inpatient ward, accuracy in implementing can affect decision making in treating patients. Research shows that there is still little literature review that discusses the application of EWS. Therefore, it is necessary to conduct a scoping review related to the application of EWS. The purpose of this study was to identify how to apply EWS in inpatient wards in hospitals. The research method follows the framework of Arksey and O'Malley. The scoping review was conducted by 3 databases of PubMed, ScienceDirect, Scopus published from 2014-2023 in March, using English and Indonesian which discussed the implementation of EWS in hospitals using the keywords 'Nurse', 'Early Warning Score', 'Early Warning System', 'detect deterioration patient'. The results obtained as many as 179 potentially relevant articles, 7 articles identified. The findings revealed that the application of EWS carried out in the hospital consisted of recording observation sheets, frequency of patient monitoring according to the EWS score, actions according to the EWS protocol applied and the time of measurement of patient vital signs

Keywords : Nurse; Early Warning Score; Early Warning System; Detected worsening of the patient

1. Introduction

Rapidly deteriorating vital signs in hospitalized patients often lead to serious adverse events in patients, such as heart attack, sudden ICU admission, or unexpected death (Metcalf et al., 2017; Petersen, 2018). Patients who have poor conditions in the inpatient ward require more rigorous care. Every year, more than 330,000 deaths of hospitalized patients due to enyakit or comorbidity have been reported, the mortality rate of patients in inpatient wards reaches 51% to 80% due to cardiac arrest and 31% due to other diseases (Andersen et al., 2016; Diyah et al., 2018; Rossetti et al., 2021). In the United States, nearly 100,000 patients die in the hospital each year from medical injuries, of which 50% of medical injuries are preventable. In Utah and Colorado, 2.9% and 6.6% died, respectively, and 3.7% of undesirable events were found in New York, of which 13.6% died. The mortality rate of undesirable events in hospitalized patients in the United States per year ranges from 44,000 to 98,000 patients with a total of 33.6 million hospitalized patients (Iskandar, 2017). This is an urgency and a problem that should get more attention. Hospitalized patients who experience adverse conditions must be given appropriate measures, this is important to provide critical intervention services, namely the availability of standardized medical equipment faster and well-trained staff (Ministry of Health, 2022).

One of the strategies used in hospitals in providing safe health services to reduce the number of adverse conditions in patients in inpatient wards is to conduct early detection of patient emergencies by applying Early Warning Score (EWS) (Passa et al., 2021). EWS is a simple tool used to detect early



indications of clinical deterioration in hospitalized patients. This technique requires nurses to routinely evaluate various physiological indications, especially vital signs based on predefined criteria and laboratory result parameters, and can include subjective parameters such as nurse concerns (Douw et al., 2016; Fang et al., 2020; Trajkovska et al, 2019). This EWS system allows staff to identify the patient's condition worsening as early as possible using physiological criteria in the form of scoring (Ministry of Health, 2022). This EWS scoring system has demonstrated its clinical ability in complex clinical cases and in diverse pathologies (Martín-Rodríguez et al., 2020). The early warning score system aims to help nurses detect early signs of adverse conditions in patients and load algorithms that suggest interventions to manage and prevent further clinical deterioration (Wood et al, 2019). The EWS assessment itself relies on seven parameters to evaluate the patient's physiological reactions, which include breathing, systolic blood pressure, temperature, pulse, oxygen saturation, supplemental oxygen, and the patient's level of consciousness (Olang et al., 2019).

The use of EWS in Indonesian hospitals has been applied since 2018, hospitals are required to have an early detection system for patients. The EWS regulation is contained in the 2022 Ministerial Decree of the Republic of Indonesia on Patient Services and Care (PAP) 2.3 that hospitals implement a process of recognizing changes in the patient's deteriorating condition and documenting in medical records that are useful for staff to identify the patient's condition worsening as early as possible (Ministry of Health, 2022). Nurses working in inpatient wards should have adequate skills and training in identifying and assessing the patient's condition that undergoes changes resulting in a decrease in physiological parameters, as the nurse's lack of knowledge, attitude, and skill in recognizing deteriorating physiological indications can cause patients to experience significant clinical status and potentially result in unexpected adverse events (Pradnyana et al., 2021).

Nurses are medical personnel who deal directly with patients in the hospital. Nurses have an important role in patient care management and early detection of clinical deterioration that occurs in patients by doing basic things such as monitoring vital signs (Handayani et al, 2022). The role of nurses in implementing EWS is to score and detect as soon as possible in deciding whether there is a change in the frequency of clinical monitoring or improvement in clinical care needed. The application of EWS is important in patient service, EWS as a system in improving the identification of acutely ill patients including sepsis patients, as a communication suggestion between medical teams in providing medical services and as decision making in patient deterioration (Royal College of Physicians, 2017). The process of implementing EWS requires a good workflow and comes with strict rules. During the application process, it is important for all professionals to demonstrate dedication to ensuring the sustainable use of EWS. And it is very important to establish effective communication regarding goals and strategies to overcome potential obstacles that may arise during the implementation process (Bergs et al, 2015).

Research shows that the implementation of EWS in hospitals is still a lot of challenges and has not run according to standards. Various literature reviews have identified EWS knowledge. The effect of EWS education on nurses' knowledge, confidence, and performance is found in many systematic literature reviews (Palareti et al 2016). However, there is still little literature review that discusses the application of EWS. Narrative review The latest in December 2022 discussed the importance of EWS (Holland & Kellett, 2023). Therefore, it is necessary to do so Scoping Review to provide an in-depth and comprehensive overview of the application of EWS in inpatient wards. In this study, we identified various EWS methods that have been used in various healthcare facilities and investigated the effectiveness of EWS in detecting clinical changes in patients admitted to inpatient wards. In addition, this study also aims to analyze the factors that influence the implementation of EWS, completeness of recording, reporting and compliance, so with this study we hope to make an important contribution to further understanding of the implementation of EWS in an inpatient environment.

2. Research Methods

Scoping review is a literature study that follows the framework of Arksey and O'Malley. Activities are carried out in 5 stages, namely: identifying research questions, identifying relevant studies, selecting studies, making data charts and finally compiling, summarizing, and reporting the results (Arksey and O'Malley, 2005). This scoping review follows a 2010 prism statement. Articles that pass the selection are then assessed and summarized. We used the PCC framework to develop the eligibility criteria P is population, which includes patients. C is the concept of Early Warning Score, Early Warning System. C indicates context, which includes detection of patient deterioration. The search strategy uses 3 databases, namely PubMed, Scopus, and ScienceDirect. Keywords used include 'nurse', 'Early warning score', 'early warning system', 'detect deterioration patient'. The articles included in the review are articles that meet the following criteria: (1) the population is nurses, (2) the languages used are English and Indonesian (3) publications between 2014-2023 in March (3) discuss the application of intra-hospital EWS (5) the methods used are mixed method, quantitative and qualitative (6) articles with open access. The articles excluded are (1) articles discussing Pediatric Warning Score (PEWS), Maternity Warning Score (MEWS), Triage (2) population or sample of emergency nurses, intensive nurses, nursing students (3) case study. Literature search uses Boolean operators to get relevant results.

Figure 1. Prism flowchart 2010

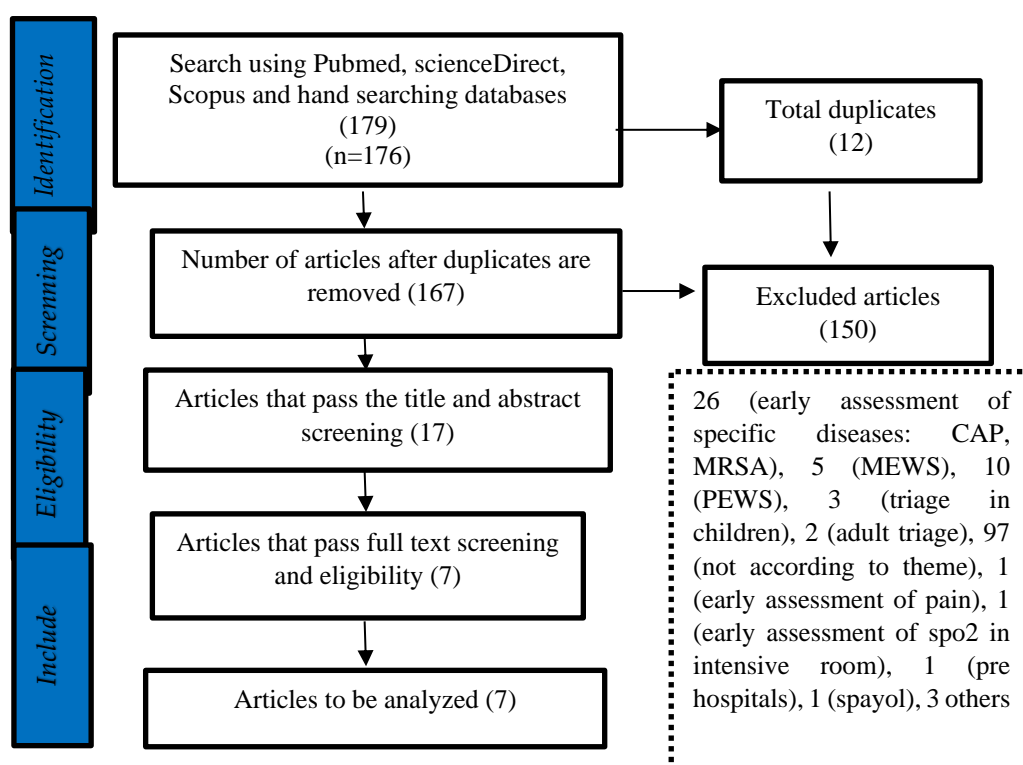


Table 1. Keywords and Boolean

Database	Keywords and Boolean
Scopus	nurse AND "Early warning score" OR "early warning system" AND "detect deterioration patient"
ScienceDirect	nurse AND "Early warning score" OR "early warning system" AND "detect deterioration patient"
Pubmed	nurse AND "Early warning score" OR "early warning system" AND "detect deterioration patient"

Sample sorting using PRISMA flowchart involves four main stages namely identification, screening, eligibility and included articles. A data-based search yielded 176 articles, hand searching for 3 articles. 150 irrelevant articles and 12 duplicates were identified using the Mendeley Reference Manager. Articles that passed the title and abstract screening as many as 17, then full text and feasibility screening were carried out so that the remaining 7 articles.

3. Results and Discussion

a. Result

In this study, it was found that 2 articles of EWS application were carried out in Denmark, 1 article was carried out in New Zealand, 1 article was carried out in South Africa and 3 articles in Indonesia. Researchers found that the application of EWS carried out in hospitals consisted of recording observation sheets, frequency of patient monitoring according to EWS scores, actions according to the EWS protocol applied and time of measurement of patient vital signs. Based on table 1, article 1, article 4 and article 7, most of the EWS monitoring was found according to the protocol with a presentation above 80% with the lowest presentation being 13%, namely at UICU (patients who went to the ICU without planning) with complete EWS recording of 87%. Article 2 is known that the recording of EWS is categorized as complete which is characterized by completeness above 80% except for physiological parameters of the level of consciousness (GCS). Other results obtained a match between the application of EWS carried out by nurses with time intervals in each EWS score category, where faster treatment was carried out on EWS with high scores. Qualitative research found in article 3 and article 6 is that the factors that affect the completeness of EWS documentation are the presence of stakeholders (ward managers) who are dedicated to the implementation of EWS, nurse ward managers as role models who feel that interprofessional teaching and training on clinically relevant knowledge and skills in a conducive and positive environment encourages further development of the implementation process EWS. Another theme is effective collaboration, an indication in the proper assessment of EWS.

Table 2. Analysis literature Review

Author name (year of publisher)	Article title	Place of study	Purpose of the study	Research design	Result
John Asger et.al., (2014)	Serious adverse events in a hospital using early warning score – What went wrong?	Denmark, in the department of surgery and internal medicine during a 6-month study period in 2013 (January 1- June 30)	To evaluate the performance of the new EWS system by reviewing all adverse events of patients in the hospital over a 6-month period	Observational data collected prospectively associated with serious adverse events	results obtained 77 UICU and 67 cases of CA and UD. Complete EWS records at 87% UICU, 94%CA and 75% UD. Patients were monitored according to escalation protocols at 13% UICU, 31% UD and 13% CA. Nurses increased their care for UICU category patients by 64% and contacted doctors by 60%. The proportion of protocol-compliant EWS deployments is 58% CA and 55% UD. Attending physicians provided adequate care in

						49% of UICU cases and 29% of CO cases. Senior staff were involved as per protocols in 53% and 36% of UICU and CO cases, respectively.
Claire et.al., (2017)	The effect of the quality of vital sign recording on clinical decision making in a regional acute care trauma ward	South Africa, patients in trauma acute care wards	To determine the effect of the importance of recording vital signs (MEWS) in hospitals and the quality of documentation in influencing clinical decision making.	Descriptive cross sectional (Vital signs recorded by nursing staff of all trauma patients in acute care trauma wards at regional hospitals in South Africa were collected from January 2013 to February 2013. The values measured by the researcher were taken within 2 hours of routine observation and the patient's initial information was also recorded)		Results from 181 newly treated patients. Completeness of recording was 81% for heart rate, 88% for breathing, 98% for blood pressure, 92% for temperature and 41% for GCS. The recorded heart rate was positively correlated with the researchers' measurements (Pearson correlation coefficient 0.76), while breathing rate was uncorrelated (Pearson correlation coefficient 0.02). In 59% of patients, the recorded respiratory rate (RR) was exactly 20 breaths per minute and 27% had a recorded RR of exactly 15. 7% of patients documented patients recorded a Glasgow Coma Scale (GCS) that deviated above a maximum value of 15
Gitte et.al., (2014)	Mandatory early warning scoring implementation evaluated with a mixed-methods approach	Four wards one for medical treatment, two for surgical treatment, and one for emergency inpatient of adult patients at a 750-bed urban university hospital in Copenhagen, Denmark	The aim of this study was to evaluate adherence to interventions that optimize monitoring practices in hospitals, by introducing early warning scores (EWS) of vital parameters	Priority is given to quantitative methods , evaluating compliance by calculating the time interval between successive measurements of vital parameters at the bedside, and evaluating appropriate patient management. bed management, and evaluate patient management accordingly. Qualitative semi-structured individual interviews of		Quantitative: a significant reduction in the time interval between measurements of vital parameters was found in 2011 compared to 2009. The vital parameter score was repeated within 8 hours in 71-77% of patients who scored a total modified EWS level of 0, 2 or 4. Qualitative: acquired themes, motivation and clinical suitability are identified as important to the implementation process. (High adherence to the intervention may be strongly associated with the clinical relevance of the intervention to the nurse's perception.) The ward manager / auditor

					inpatient ward managers were conducted to evaluate the implementation process and explore the explanations underlying the implementation outcomes according to the sequential planting strategy	team influences compliance in implementing EWS.
Muhammad Ramdhan	The Relationship between the Application of Early Warning Score (EWS) and Clinical Outcomes of patients in the Adult Inpatient Installation of RSUP Dr.Sardjito Yogyakarta	Adult Inpatient Ward of RSUP Dr. Sardjito Yogyakarta, Indonesia	The purpose of this study was to identify the relationship between the application of EWS and Clinical Outcomes of patients in adult inpatient RSUP Dr.Sardjito Yogyakarta	Correlational analytical research using a cross sectional approach.		The results of this study showed that the majority (95.0%) of EWS applications had been implemented and 52.3% did not experience unexpected outcomes. 80% of respondents were monitored every 4-6 hours and the length of stay of respondents in the hospital averaged \pm 9 days, 93.9% of respondents did not experience escalation of treatment, cardiac arrest (82.1%) and death (82.8%) during hospitalization. In addition, the results showed that the application of EWS was significantly related in anticipating patient outcomes.
Ehsan Ullal et.al., (2022)	Vital signs and early warning score monitoring: perceptions of clinical staff about current practices and introducing an electronic rapid response system	At Taranaki Base Hospital, Plymouth, Zealand.	The purpose of this study was to evaluate the perceptions of clinical staff (nurses and physicians) about the perceived strengths and weaknesses of rapid response systems (RRS)	The research design is descriptive		The majority of 60% of nurses report that, when called upon to assess a deteriorating patient, the nurse arrives at the patient's room within 5-30 minutes. (27%) said nurses arrived within 5 minutes. 87% of nurse arrivals within 30 minutes
Saharuddin (2020)	Evaluation of the application of Adult Early Warning Score (EWS) at Dr. Soetarto Hospital Yogyakarta	The location of this research is at Dr. Soetarto Hospital Yogyakarta, Indonesia	The purpose of this study was to evaluate the application of Early Warning Score (EWS) in adult inpatient wards at Dr. Soetarto Hospital Yogyakarta	This research is a mixed method research with an explanatory sequential design.		Evaluation results of the application of EWS for the completeness variable of 7 items, RR decreased on day 2 (87.6%), evaluation variable of 7 items filled in complete which was 59.6% increased until the third day and

R. Anggono Joko Prasoj (2021)	Conformity Analysis of Early Warning Score (EWS) Assessment of Adult Patients with EWS Response at Wates Hospital	The location of this research is at RSUD Wates, Indonesia	Knowing the relationship between EWS assessment and EWS response at Wates Hospital.	decreased on day 4 and increased again on day 5. The non-corresponding response variable was 16.1% increased on day 2 and decreased on day 3, but 7 items were not filled in and there was no response by 23.7%. The results of qualitative research obtained 2 themes, namely appropriate assessment as a strong indication of using facilities that are still minimal while still carrying out collaboration and independent actions; and Evaluation of implementation to improve improvements by establishing standard guidelines and periodic briefings so that they will be more competent in the use of EWS. From 221 patient medical records, 2129 observations were obtained. This study shows that most EWS assessments have been carried out in accordance with the provisions of 1,868 (87.7%) and most responses have been in accordance with the provisions of 1,499 observations (70.4%). There was a significant relationship between assessment and EWS response.
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Abbreviation:

UICU: patients admitted to the ICU without planning, CA: heart attack, UD: unexpected death, CO: combined CA and UD

3.2 Discussion

EWS has now become an important component in inpatient care management that provides a method for assessing and evaluating changes in a patient's clinical status, thus informing health professionals in determining the need for intervention to patients. One of the commonly used EWS is National Early Warning Score (NEWS) specifically developed to identify possible worsening of the patient's condition (O'Brien et al., 2020; Smith et al., 2013). The application of EWS is a scoring system that has been widely applied in various hospitals in the world, especially in intensive care

units, inpatient wards, and in emergency departments, which can help reduce adverse patient events, improve assistance and communication between professionals and reduce errors (Farenden et al., 2017; Uppanisakorn et al., 2018). NEWS recommends four trigger levels for clinical alerts requiring clinical assessment: a high score or a score greater than 7 with a frequency of continuous monitoring and treatment within 30 minutes (Royal College of Physicians, 2017). This is in line with the findings in the research of Ullah et al. (2022) which states that as many as 60% of nurses report that when called to assess the patient's deteriorating condition, the nurse arrives at the patient's room within 5-30 minutes and 27% comes within 5 minutes. So as many as 87% of nurses arrive within 30 minutes to the patient. In addition, 60% of nurses reported a vulnerable patient's condition quickly when called upon to assess a deteriorating patient.

Recording the physiological parameters of EWS is important as a medium of information between medical teams where the information must be fully documented (Royal College of Physicians, 2017). The results obtained are complete (> 80%), but in one of the articles mentioned that there are parameters that are not recorded completely. Of course, it needs to be the nurse's attention in order to ensure complete recording so that the affordhythm of the application of EWS can be done properly. The completeness of recording can also be influenced by external factors, such as the presence of stakeholders, namely the audit team of the implementation of EWS and also internal factors such as nurses, rooms / wards, staff characteristics or experiences and patient characteristics. Although the mutilation is complete, there are still parameters that are not recorded as complete. So an improvement is needed in terms of disabling physiological parameters in patients. Comprehensive recording and assessment of vital signs three times a day will result in improved detection of physiological abnormalities, a significant increase in emergency response requests, and the initiation of rapid response teams which is more reliable (Ludikhuize et al., 2014). Thus, this can increase the chances of preventing adverse events in patients and reduce mortality rates.

The implementation of EWS abroad and in Indonesia has mostly reached more than 80%, but 52.3% still obtained unexpected results such as unplanned reduction of patients to intensive space, increased mortality, response that was not explored according to protocol. EWS provides the basis for an integrated and systematic approach to first assessment and triage of acutely ill patients, and a simple track and trigger system to monitor clinical progress for all patients in the hospital (Royal College of Physicians, 2017). Researchers found in a study conducted by Prasajo (2021) which stated that there was a significant relationship between assessment and EWS response. Patients with higher EWS scores will increase the frequency of monitoring of patients. This is in accordance with the alogorhythm of the EWS system that the higher the EWS value, the higher the monitoring and response of the medical team to patients (Royal College of Physicians, 2017). A study conducted in Chicago found that patients with low EWS scores had a lower chance of having a heart attack, while patients with high EWS scores had an increased incidence of heart attacks. This is supported by the results of a study conducted by Morrison et al. which showed that patients who had a heart attack showed an average EWS score of >7.6 hours before the event and an average EWS score of >8 during the event of a heart attack (Morrison et al., 2013; Subhan et al., 2019). The results of these supporting studies are in accordance with Roberts & Djärv's statement stating that moderate or high EWS scores correlate with an increased risk of adverse events in hospitalized patients, such as heart attacks (Roberts & Djärv, 2017). This strengthens the statement that the higher the EWS score, the higher the monitoring and response of the medical team to patients, so that adverse events in patients can be avoided or prevented.

Research findings on several themes in qualitative research show the importance of stake holder and collaboration among medical teams in the application of EWS. Several studies validate EWS scores as a prognostic indicator for poor outcomes and as a tool for categorizing clinical instability, as well as identifying patients who require more intensive care upon admission to treatment wards in

large patient groups. Higher EWS scores at hospital time are associated with an increased likelihood of hospital death and emergency transfer due to worsening conditions in the intensive care unit (Spagnolli et al., 2017). The results of the study Martín-Rodríguez et al. add that increased scores are associated with higher mortality rates, both in the early stages and after 30 days, as well as an increased need for ICU treatment (Martín-Rodríguez et al., 2020). Thus, consideration must be carried out properly and carefully, especially during the first assessment and subsequent monitoring. In addition, a good interdisciplinary relationship between the Care Provider Professional (PPA) and the doctor in charge (DPJP) in a team can coordinate and maintain care continuity (Ministry of Health, 2022).

4. Conclusion

The integration of EWS and clinical assessment is critical to determining the safest and appropriate treatment and intervention plan for the patient's condition in the inpatient ward. Our scoping review concluded that the application of EWS in several locations studied has been implemented in accordance with NEWS standards, such as the rapid response of nurses in responding to calls when asked to assess and evaluate the deteriorating condition of patients, the recording of physiological parameters of EWS is mostly complete, and the application of EWS in hospitals in Indonesia and abroad has mostly reached 80%. However, the implementation process still needs to be improved in terms of completeness of recording, reporting and compliance so that the nursing care process can be carried out appropriately for the improvement of the quality of life of patients.

The results of this study are expected to provide important insights into the benefits of using EWS to ensure standardized assessment, improve clinical management, and provide appropriate care and interventions to patients in inpatient wards by health professionals. It is important for all health providers to prioritize expanding scientific information related to the practical implementation of EWS so that it will help improve the safety and quality of care in inpatient wards. In addition, it is expected that the results of this research will be used by educational institutions as a reference basis in the development of the application of EWS and can be used as a development of learning materials, especially in emergency nursing teaching subjects.

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