Effectiveness of Early Warning Score (EWS) Implementation in Improving the Accuracy of Early Preeclampsia Detection in Antenatal Care

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Abstract

Preeclampsia remains a major contributor to the maternal morbidity and mortality rates, in which the delayed detection at the primary healthcare level often leads to late referrals and further severe complications. Objective: This study aimed to evaluate the effectiveness of an Early Warning Score (EWS) implementation for improving the accuracy of early preeclampsia detection during Antenatal Care (ANC) services at a Community Health Center. Methods: This study employed a pre-experimental one-group pretest-posttest design. A total of 20 pregnant women were selected through the total sampling. Detection accuracy was defined as the precision in systematically integrating vital signs and subjective clinical symptom assessments compared to conventional methods. Data were analyzed using a paired sample t-test with a significance level of 0.05. Results: The findings showed a significant improvement in the mean accuracy score for early detection from 62.45 (pretest) to 78.90 (posttest), with a mean difference of 16.45 ($p < 0.05$). Power analysis revealed a Cohen's d value of 2.12, indicating that the EWS intervention had a large clinical effect size in enhancing the provider detection sharpness. Conclusion: The EWS implementation proved to be significantly effective for improving the accuracy of early preeclampsia detection within the scope of ANC services at the Mandala Community Health Center. Integrating EWS into the routine ANC practices is highly recommended to support a timely clinical decision-making and to prevent severe maternal complications

Keywords: Early Warning Score, Preeclampsia, Antenatal Care, Early Detection, Maternal Health

INTRODUCTION

Preeclampsia is among the pregnancy complications that remain a serious issue in the maternal health care services. This condition is characterized by an increase in the blood pressure occurring after 20 weeks of gestation and is accompanied by organ dysfunction, such as impairment of the kidneys, liver, and central nervous system (Agrawal, 2021). Preeclampsia significantly contributes to high maternal morbidity and mortality rates, particularly in the developing countries. Numerous studies over the past decade have shown that preeclampsia is often detected late because its early symptoms are non-specific and tend to be overlooked by both pregnant women and healthcare providers (Ayetey, 2021). In fact, some complaints (e.g., severe headache, visual disturbances, edema, and epigastric pain) can be interpreted as the early preeclampsia indicators through assessment in a systematic and structured manner (Brown, 2023; Umar, 2024).

Based on the World Health Organization (WHO, 2023), it has been reported that most of the maternal deaths are caused by some complications occurring during pregnancy, childbirth, and the postpartum period. Most of these complications originate during pregnancy and are essentially preventable or manageable if detected early. Meanwhile, some health conditions may have existed prior to pregnancy and can worsen due to the suboptimal monitoring in antenatal care services. Hypertensive disorders of pregnancy, including preeclampsia and eclampsia, along with other obstetric complications, remain the leading causes of maternal mortality and are estimated to account for approximately 75% of total maternal deaths (Veri, 2025).

Maternal Mortality Ratio (MMR) remains a serious global public health issue. WHO reported that in 2023, approximately 260,000 women died during pregnancy, childbirth, and the postpartum periods. Most of these deaths around 92% occurred in low- and lower-middle-income countries, even though most of these cases were actually preventable through adequate access to and quality of healthcare services. Geographically, Sub-Saharan Africa and South Asia contributed the largest proportion of global maternal deaths, accounting for approximately 87% or around 225,000 deaths. Sub-Saharan Africa accounted for about 70% (182,000 cases), while South Asia contributed approximately 17% (43,000 cases). From 2000 to 2023, a number of countries experienced significant reductions in MMR, particularly in Eastern Europe and South Asia, with the declines at 75% and 71%, respectively. Although maternal mortality rate in Sub-Saharan Africa remained relatively high, the region also recorded a substantial reduction of approximately 40% during the same period (WHO, 2025).

In Indonesia, MMR is among the key indicators for assessing the level of public health, as it is strongly affected by access to and quality of the healthcare services. Data from the 2024 Indonesian Health Profile showed a considerable decline in terms of MMR, from 390 per 100,000 live births in 1991 to 189 per 100,000 live births in 2020, close to a target of 2024 National Medium-Term Development Plan at 183. Nevertheless, the accelerated efforts to further reduce the maternal mortality rate are still urgently needed in order to achieve the 2030 Sustainable Development Goals (SDGs) target at 70 per 100,000 live births (Ministry of Health of the Republic of Indonesia, 2024).

In North Sumatra Province, there were 202 cases of the reported maternal deaths in 2023, including 51 deaths that occurred during pregnancy. From a total of 245,349 live births, the MMR in North Sumatra Province in 2023 was recorded at 82.33 per 100,000 live births. Medan City reported the highest number of maternal deaths, with 27 cases out of 33,497 live births, resulting in an MMR of 75 per 100,000 live births. This figure represented an increase

compared to 2022, which recorded 9 maternal deaths, and 2021 with 18 cases. The leading causes of maternal death in this area were predominantly hemorrhage, preeclampsia/eclampsia, and other obstetric complications. A high MMR is affected by various factors, including the general health status of mothers, educational level, and the quality of healthcare services received during pregnancy (Sumut, 2023).

Based on (Jordao, 2023), a high incidence of the preeclampsia-related complications in primary healthcare facilities is partly attributable to its suboptimal early detection. In many Community Health Centers, antenatal care services still primarily focus on blood pressure measurement and proteinuria screening, without being supported by an assessment system that comprehensively integrates vital signs and clinical symptoms. As a result, the preeclampsia cases are often identified only after it has developed into a more severe stage, thereby increasing the risk of serious complications, delayed referral, and maternal death (Pratiwi, 2024).

Based on this background, a preliminary survey conducted at the Mandala Community Health Centre indicated that antenatal care (ANC) services have not fully implemented an integrated early preeclampsia detection system. Routine examinations still focus on blood pressure measurements and urine protein tests, while the recording and assessment on clinical symptoms (e.g., severe headaches, visual disturbances, edema, and epigastric pain) have not been systematically conducted. Furthermore, there is no standardized risk assessment instrument available to combine vital signs and clinical complaints of pregnant women to detect potential preeclampsia. This situation has the potential to lead to delays in case identification and untimely treatment and referral.

Implementation of the Early Warning Score (EWS) emerged as a structural solution to overcome these obstacles. The EWS allows health workers to conduct a more comprehensive risk assessment by assigning a score to each vital parameter and clinical symptom, thus facilitating an early identification of the deteriorating maternal health before getting critical. Therefore, this study aimed to highlight the effectiveness of EWS implementation in improving the accuracy of early preeclampsia detection in ANC services at Community Health Centers. Through this approach, diagnostic accuracy is expected to be improved, allowing for timely intervention and referral to reduce the risk of maternal mortality.

METHODS

This study used a quantitative approach with a pre-experimental design using a one-group pretest-posttest design. This design aimed to evaluate the effectiveness of the intervention in the same group by comparing early detection rates before (pre-test) and after (post-test) the EWS implementation. The study was conducted at the Mandala Community Health Center, involving health workers assigned to the ANC service (Sugiyono, 2021).

The population in this study was all pregnant women visiting the Mandala Community Health Centre for having prenatal checkups. The sampling technique used was a total sampling with 20 respondents. The researchers applied strict inclusion criteria, namely pregnant women with a gestational age of 20 weeks and the predisposing risk factors for preeclampsia. Although the sample size was limited (n=20), the justification for this selection was based on the in-depth research focusing on high-risk cases during the observation period. To support the validity of results in a small sample, data analysis did not only rely on the statistical significance values, but also its effect size calculations (Hidayat, 2022).

The independent variable in this study was implementation of the EWS system, while the dependent variable was early preeclampsia detection. Accuracy of the early detection is operationally defined as the accuracy of personnel in systematically integrating physiological parameters (blood pressure) and subjective clinical symptoms (headache, visual disturbances, epigastric pain, and edema). The assessment was conducted by converting the observation results into a numerical score (0–100) based on the precision of identification. The "mean" reported in this study represented the aggregate average of these numerical scores across all respondents. The research instrument was a modified EWS observation sheet that underwent content validity testing through expert judgment by clinical experts. To ensure data reliability and minimize inter-observer bias, all healthcare workers involved were given a brief training on the standard procedures for using the instrument before starting the data collection (Notoadmodjo, 2022).

Data were analyzed using a paired sample t-test to assess the difference in mean scores before and after the intervention. Additional analysis was performed by calculating the 95% Confidence Interval (CI) and Effect Size using Cohen's d formula. Reporting the effect size is crucial in this study to demonstrate the magnitude of the clinical impact of EWS implementation despite having the limited sample size, thus providing an objective picture regarding the clinical significance strength of the research results (Notoadmodjo, 2022).

RESULT

Respondent characteristics in this study included maternal age, education level, parity, and gestational age. The study involved 20 pregnant women receiving ANC services at a Community Health Center.

Table 1. Respondent Characteristics (and=20)

No	Respondent Characteristics	Total	
		f	%
1	**Age**		
	< 20 years	2	10
	20–35 years	14	70
	> 35 years	4	20
	Total	**20**	**100**
2	**Education**		
	Primary education	6	30
	Secondary education	10	50
	Higher education	4	20
	Total	**20**	**100**
3	**Parity**		
	Primigravida	7	35
	Multigravida	13	65
	Total	**20**	**100**
4	**Gestational Age**		
	20–27 weeks	8	40
	28–36 weeks	9	45
	≥ 37 weeks	3	15
	Total	**20**	**100**

Based on Table 1, the majority, 14 respondents (70%), were in the 20–35 age group. In terms of education level, the majority, 10 of respondents (50%), had secondary education. Based on its parity, the majority, 13 respondents (65%) were multigravida. Meanwhile, based on the gestational age, the majority, 9 respondents (45%), were in the 28–36-week range.

These characteristics indicate that most of those respondents were in the healthy reproductive age group and had previous pregnancy experience, so that the EWS implementation is expected to help health workers in improving the accuracy of early detection of preeclampsia more systematically.

Table 2. Average Accuracy of Early Preeclampsia Detection Before and After EWS Implementation

Group	Mean	Standard Deviation	95% Confidence Interval (CI)	p-value	Cohen's d
Pre-test EWS	62.45	8.32	12.85 – 20.05	0.001	2.12
Post-test EWS	78.90	7.15			

Based on Table 2, the results of this study showed a significant increase in the accuracy of preeclampsia early detection after the EWS implementation. The average accuracy score increased from 62.45 in the pre-test to 78.90 in the post-test. Statistically, this increase was highly significant with a p value of 0.001 ($p < 0.05$).

The 95% Confidence Interval (CI) ranged from 12.85 to 20.05. This indicated that an increase in accuracy of at least 12.85 points consistently occurred in the population, thus ensuring high reliability despite being conducted on a limited sample (n=20). Furthermore, the effect strength calculation results showed a Cohen's d value of 2.12, categorized as a very large effect size. Clinically, these findings demonstrated that the EWS instrument had a significant effect in helping healthcare workers systematically integrate physical parameters and subjective clinical symptoms. Therefore, the use of EWS is effective in minimizing the risk of failure in early preeclampsia detection in primary care, compared to the conventional methods**.**

Table 3. Results of the Paired Sample t-test on the Accuracy of Early Preeclampsia Detection

	Mean Difference	**t-test**	**p-value**
Pre test–Post test EWS	16.45	7.32	0.001

The results of the Paired Sample t-test showed a p-value = 0.001 ($p < 0.05$), indicating a significant difference between the accuracy of early detection of preeclampsia before and after the EWS implementation.

DISCUSSION

The results of the study showed that the EWS implementation had a significant effect on increasing the accuracy of early preeclampsia detection in ANC services at the Community Health Center. Based on the analysis, the average accuracy score for early preeclampsia detection increased from 62.45 before the intervention to 78.90 after the intervention, with a mean difference of 16.45 points. The results of the Paired Sample t-test produced a p-value <0.05, indicating that the difference was statistically significant. These findings indicated that the EWS implementation significantly improved the ability of health workers to recognize the preeclampsia risk from an early stage.

Based on Hammad (2025), this improvement in the detection accuracy reflects that the use of EWS facilitates a more structured risk assessment process, compared to conventional ANC examinations. Prior to the EWS implementation, early preeclampsia detection was dominated by blood pressure measurements and proteinuria screening, potentially overlooking several important clinical symptoms (Handayani, 2023). After the EWS implementation, the assessment was carried out by systematically integrating vital signs and clinical complaints, which was reflected in the increase in the average value of detection accuracy in most respondents.

The results of this study are in line with the findings (Smith, 2020; Dewi, 2025) who reported that delays in preeclampsia detection were often due to the absence of a comprehensive risk assessment system in the antenatal care. Magee et al. emphasized that a

score-based approach can increase a clinical awareness of the non-specific early symptoms. In this study, the 16.45-point increase in detection accuracy scores strengthens the evidence that a structured assessment system, such as the EWS, can improve the quality of preeclampsia screening in primary care.

Based on a study, (Mamuroh, 2023) also showed that some symptoms (e.g., severe headache, visual disturbances, edema, and epigastric pain) are early indicators of preeclampsia that have predictive value when systematically assessed. The increased detection accuracy in this study indicated that the EWS helps ensure that these symptoms are part of the measured risk assessment, without being overlooked. Thus, according to (Lowe, 2020), EWS serves as a clinical tool to bridge the gap between subjective complaints of pregnant women and clinical decision-making by health workers.

The findings of this study are also relevant to the guidelines (Kalafat, 2021) which emphasizes the importance of blood pressure monitoring accompanied by continuous evaluation of clinical symptoms in preventing preeclampsia complications. The EWS implementation supports these recommendations by providing an objective and easily applicable assessment framework at the community health center level, thus potentially improving consistency in clinical practice among healthcare workers.

From a public health perspective, the results of this study support (Vickers, 2021; Von, 2022) who states that most of the maternal deaths due to hypertension in pregnancy can be prevented through an early detection and appropriate treatment. The increased accuracy of early preeclampsia detection demonstrated in this study has implications for potentially reducing referral delays and preventing serious complications, without directly measuring these clinical outcomes.

Although the study results demonstrate the effectiveness of EWS, interpretation of these findings requires a careful consideration of the relatively small sample size of 20 respondents. Therefore, while the differences found are statistically significant, the generalizability of the study results is limited. Further researches with larger sample sizes and more robust research designs are needed to confirm the consistent effect of EWS on early preeclampsia detection across various healthcare settings.

CONCLUSION

EWS implementation has been shown to significantly improve the ability of healthcare workers to identify the risk of preeclampsia early in primary care. The use of this instrument has a strong clinical effect in standardizing the assessment of maternal emergencies through

the integration of physiological parameters and subjective patient symptoms. With a more structured early warning system, a risk of the delayed treatment in pregnant women can be effectively minimized.

As a practical implication, this EWS format needs to be integrated into routine ANC procedures at Community Health Centers to ensure consistency of its service. For future development, research with a larger population scale is needed to strengthen the validity of these findings within a more comprehensive health system.

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