

## Research Article

## The Use of Maternal Early Obstetric Warning Score (MEOWS) as a Tool to Predict Treatment Needs in the Intensive Care Unit in Severe Preeclampsia Patients

### Penggunaan Maternal Early Obstetric Warning Score (MEOWS) sebagai Parameter Prediksi Kebutuhan Perawatan Intensive Care Unit (ICU) Pasien Preeklamsia Berat

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#### Abstract

**Objective:** To determine the cut-off point of the Modified Early Obstetric Warning System (MEOWS) scores for severe preeclampsia patients to enhance clinical surveillance and responsiveness for determining the appropriate level of care.

**Methods:** A retrospective cross-sectional study design was employed, involving 282 samples selected from medical record data of research subjects at Arifin Achmad Hospital in Pekanbaru. The research variables included preeclampsia (PEB), MEOWS score, and the place of care. The research sample was categorized into two groups: those with high MEOWS scores (MEOWS  $\geq$  8) and those with low MEOWS scores (MEOWS < 8). Data were processed and statistically analyzed using SPSS, with sensitivity and specificity measurements conducted using the Receiver Operating Characteristic (ROC) curve.

**Results:** Statistically significant differences were found in the MEOWS score thresholds between the two groups. The calculated cut-off point for the MEOWS score was determined to be 7.57 (rounded to 8). There was a significant association between MEOWS scores  $\geq$  8 and the need for Intensive Care Unit (ICU) care (Relative Risk [RR] 0.35; 95% Confidence Interval [CI]: 0.157–0.788;  $p = 0.009$ ) as well as the risk of Intrauterine Fetal Demise (IUID) (RR 1.04; 95% CI 1.02–1.06).

**Conclusion:** The MEOWS score can serve as a valuable parameter for early detection of ICU care requirements in severe preeclampsia patients, thereby enhancing clinical surveillance and responsiveness.

**Keywords:** ICU, MEOWS, severe preeclampsia.

#### Abstrak

**Tujuan:** Mencari batasan nilai (cut off point) skor MEOWS pasien PEB dalam menentukan tempat perawatan untuk peningkatan surveilans klinis serta daya tanggap.

**Metode:** Penelitian dilakukan dengan desain studi potong lintang retrospektif pada 282 sampel dari data rekam medis subjek penelitian di RSUD Arifin Achmad Pekanbaru. Variable penelitian berupa PEB, Skor MEOWS dan tempat perawatan. Sampel penelitian dibagi menjadi dua kelompok, yaitu skor tinggi (MEOWS  $\geq$  8) dan rendah (MEOWS < 8). Data kemudian diolah dan dianalisa secara statistik menggunakan SPSS. Pengukuran sensitifitas dan spesifitas menggunakan kurva Receiver Operating Characteristic (ROC).

**Hasil:** Perbedaan batasan nilai skor MEOWS antar kelompok memiliki perbedaan yang bermakna secara statistik. Hasil perhitungan mendapatkan cut off point skor MEOWS adalah 7.57 (dibulatkan menjadi 8). Terdapat hubungan bermakna antara skor MEOWS  $\geq$  8 dengan kebutuhan perawatan di ICU (RR 0,35; CI 95%: 0,157–0,788;  $p=0,009$ ) dan risiko terjadinya IUID (RR 1,04; 95% CI 1,02 – 1,06).

**Kesimpulan:** Skor MEOWS dapat digunakan sebagai parameter untuk deteksi dini kebutuhan perawatan ICU pada pasien preeklamsia berat, untuk peningkatan surveilans klinis serta daya tanggap.

**Kata kunci:** MEOWS, ICU, PEB.

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## INTRODUCTION

Severe preeclampsia is one of the leading causes of maternal death.<sup>1-6</sup> Preeclampsia is a pregnancy-related condition characterized by new-onset hypertension that occurs after 20 weeks of gestation, often in the later months, with or without proteinuria.<sup>7,9</sup> The course of severe preeclampsia is complex, and it can deteriorate at any point during pregnancy. Therefore, there is a need for a user-friendly method to

detect it.<sup>7-11</sup> Modified Early Obstetrics Warning Score (MEOWS) is one of the parameters that can be used for early detection of high-risk obstetric patients, to prevent or reduce the risk of aggravation that occurs, by placing patients according to the level of care and needs of the patient.<sup>12-15</sup> MEOWS was introduced in obstetric units in the United Kingdom to reduce maternal mortality by enhancing the early detection of clinical signs of deterioration in women at risk of critical illnesses.<sup>16-18</sup>

Score	3	2	1	0	1	2	3
Temperature		≤35 °C	35-35.9 °C	36-37.4 °C	37.5-37.9 °C	38.0-38.9 °C	≥39 °C
Systolic BP	≤69	70-79	80-89	90-139	140-149	150-159	≥160
Diastolic BP			≤49	50-89	90-99	100-109	≥110
Pulse		<40	40-49	50-99	100-109	110-129	≥130
Respiratory Rate	≤10			11-19	20-24	25-29	≥30
AVPU				Alert	Responds to Voice	Responds to Pain	Unconscious
Urine output mLs/hr	<10	<30		Not Measured			

**Figure 1.** Modified Early Obstetrics Warning Score (MEOWS)<sup>14</sup>

In 2017, female deaths due to pregnancy or childbirth occurred daily, with an estimated 810 women losing their lives. Data from the Ministry of Health reveals that Indonesia ranks second among ASEAN countries with the highest Maternal Mortality Rate (MMR).<sup>2</sup> The alarming MMR figures have prompted the government to implement structural interventions, one of which is the inclusion of MMR reduction targets in the National Medium-Term Development Plan (RPJMN) for 2020-2024, emphasizing the importance of providing appropriate levels of care.<sup>6</sup> The objective of this study is to determine the cut-off point for MEOWS scores in severe preeclampsia patients, aiming to enhance clinical surveillance and responsiveness in determining the appropriate level of care.

## METHODS

This research was conducted at RSUD Arifin Achmad in Pekanbaru, Riau Province, using a retrospective cross-sectional study design. The study sample consisted of 282 participants who met the inclusion and exclusion criteria. Inclusion criteria included pregnant patients diagnosed

with severe preeclampsia and superimposed preeclampsia, who were receiving treatment at Arifin Achmad Hospital. Exclusion criteria encompassed patients with a history of heart disease, lung disease, liver, and/or kidney disease. The measurement instrument employed was the MEOWS score. Subsequently, the samples were categorized into two groups: those with high MEOWS scores (MEOWS ≥ 8) and those with low MEOWS scores (MEOWS < 8).

The research data comprised secondary data extracted from patients' medical records. Subsequently, this data was collected, processed, and statistically analyzed using the Statistical Package for Social Sciences (SPSS) software, version 25, from Chicago, IL, USA. The analysis aimed to determine relationships between variables using the Pearson test. Sensitivity and specificity measurements were conducted utilizing the Receiver Operating Characteristic (ROC) curve to assess the relationship between the MEOWS score and ICU care. The analysis yielded a cut-off point for the MEOWS score, along with an associated Area Under the Curve (AUC) value.

**RESULTS**

The primary objective of this study is to determine the cut-off point for MEOWS scores in patients with Preeclampsia (PEB). This cut-off point will serve as a predictive tool used to determine the appropriate level of care for PEB patients, thereby enhancing clinical surveillance and responsiveness. Table 1 presents the characteristics of the study subjects, including an average age of  $33.26 \pm 5.42$  years, an average parity of  $1.97 \pm 0.95$ , a Body Mass Index (BMI) of  $26.77 \pm 3.25$  (kg/m<sup>2</sup>), 100% utilization of care guarantee insurance, 77.0% receiving treatment in the ICU room, and an incidence of Intrauterine Fetal Demise (IUFD) in 96.1% of cases. The research data underwent normality and homogeneity tests, followed by the Pearson test to determine whether there was a significant difference in the means of the two sample groups. The data was statistically processed parametrically and is presented in the form of detailed tables and curves.

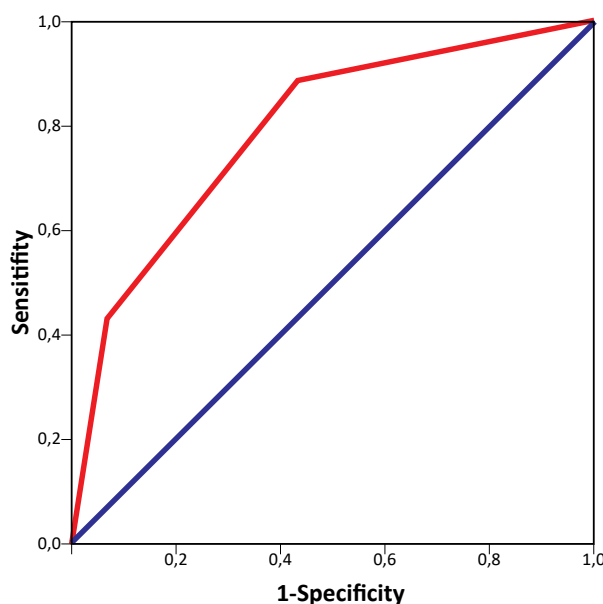
**Table 1.** Characteristics Participants

Variable	Value (n=282)	RR (CI 95%)
Age (years old)	33.26±5.42	2.40 (2.34 – 2.46)
Parity	1.97±0.95	1.19 (1.14 -1.23)
Body Mass Index (Kg/m <sup>2</sup> )	26.77±3.25	1.60 (1.52 – 1.69)
Guarantee	100	1.01 (1.002 – 1.03)
Place of Care		
ICU	23.0	1.77 (1.72 – 1.82)
Non-ICU	77.0	
IUFD	3.9	1.04 (1.02 -1.06)

The data is then analyzed to assess diagnostic tests. The analysis used to evaluate the diagnostic test's ability employs the Receiver Operating Characteristic (ROC) curve to determine accuracy, sensitivity, and specificity levels through the Area Under the Curve (AUC). Test performance is considered good if  $AUC \geq 0.7$ . The results of the ROC curve analysis in this study (Figure 2) yielded an AUC value of 0.826 for the MEOW score (95% CI, 0.699 – 0.953) (Table 2). This indicates that the MEOW score has a high diagnostic value in predicting the need for ICU care in patients with severe preeclampsia

**Table 3.** Relationship between the MEOWS and the Need for Treatment in the ICU

MEOW score	ICU treatment		%	RR (95% CI)	P-value
	Yes	No			
> 8 (high)	16	12	4.3	0.35 (0.157 – 0.788)	0.009
< 8 (low)	53	201	18.8	1 (referent)	

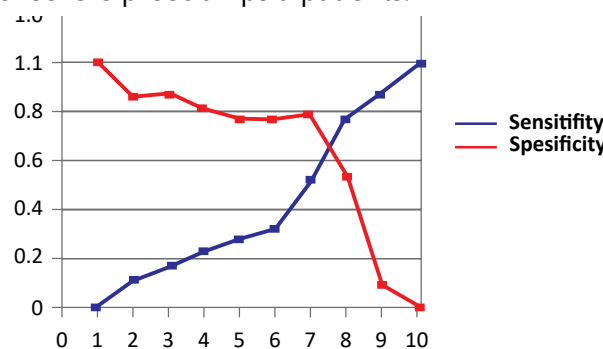


**Figure 2.** ROC curve

**Table 2.** Area Under the Curve

Area	Std. Error	Asymptotic Sig	Asymptotic CI 95%
0.826	0.065	0.000	0.699 – 0.953

The number of samples in this study amounted to 282. The characteristics of the  $IGD \geq 8$  MEOWS score were 28 subjects and the  $IGD < 8$  MEOWS score was 254 subjects. Patients treated in the ICU amounted to 65 subjects and those treated other than in the ICU amounted to 217 subjects. Figure 2 shows the optimal cut-off sensitivity and specificity image between MEOW scores with ICU care is 7.57 (rounded to 8). This study can be one of the screenings in determining the level of care of severe preeclampsia patients.



**Figure 3.** cut off point value MEOWS

**Table 4.** Relationship between the MEOWS the risk of occurrence of IUFD

MEOW score	IUFD		%	RR (95% CI)	P-value
	Yes	No			
> 8 (high)	5	23	8.2	8.98 (2.545 – 31.721)	0.000
< 8 (low)	6	248	2.1	1 (referent)	

Table 3 data shows that the p-value of 0.009 ( $p < 0.05$ ), means that there is a relationship between MEOW scores and ICU care in this study. with an RR value of 0.35 indicates that patients with high MEOWS scores are 0.35 times more likely to be admitted to the ICU than those with low MEOWS scores. Secondary outcomes of this study were illustrated through Table 4 which showed patients with high MEOWS scores had a 0.35 times higher likelihood of ICU care infants than those with low MEOWS scores.

## DISCUSSION

The characteristics of the study subjects revealed an average age of  $33.26 \pm 5.42$  years, an average parity of  $1.97 \pm 0.95$ , a Body Mass Index (BMI) of  $26.77 \pm 3.25$  (kg/m<sup>2</sup>), with 100% utilizing care guarantee insurance, 77.0% receiving treatment in the ICU room, and an incidence of Intrauterine Fetal Demise (IUFD) at 96.1%. According to studies by the World Health Organization (WHO), there is a global infant mortality rate of 10,000,000 individuals annually. Indonesia has the highest perinatal death rate, underscoring the need for extensive and high-quality improvements in healthcare services. Multiple factors, including maternal, fetal, and placental factors, contribute to infant mortality<sup>19-21</sup>. Maternal factors encompass the mother's age, gestational age, and illnesses such as preeclampsia, eclampsia, diabetes mellitus, and premature rupture of membranes (PROM). Hypertensive disorders during pregnancy are responsible for approximately 5% of intrauterine deaths. It has been demonstrated that the risk of fetal mortality is higher in mothers diagnosed with preeclampsia during the preterm period.<sup>21</sup>

The results of the ROC curve analysis in Figure 2 of this study yielded an AUC (Area Under the Curve) value for the MEOW score of 0.826 (95% CI, 0.699 – 0.953) (Table 2). Figure 2 illustrates the optimal cut-off point, balancing sensitivity, and specificity, for MEOW scores in relation to ICU care, which was found to be 7.57 (rounded to 8). The analysis employed the Receiver Operating Characteristic (ROC) curve to assess the diagnostic test's accuracy, sensitivity, and

specificity by measuring the AUC. A diagnostic test is considered to have good diagnostic value when  $AUC \geq 0.7$  [15-17]. These findings indicate that MEOW scores exhibit a high diagnostic value for predicting the need for ICU care in severe preeclampsia patients.

The proportion of MEOWS scores associated with ICU care showed a p-value of  $< 0.05$  and an RR of 8.98 (95% CI; 2.545 – 31.721), indicating that patients with high MEOWS scores were 0.35 times more likely to be admitted to the ICU than those with low MEOWS scores. Similarly, the proportion of MEOWS scores in relation to the incidence of IUFD had a p-value of  $< 0.05$  with an RR of 8.98 (95% CI; 2.545 – 31.721). Methods such as the Early Warning Score, early warning system, and rapid response system have been known since 1999. However, the Early Warning System used at that time was considered challenging to apply to obstetric patients due to the physiological changes they undergo during pregnancy and the postpartum period. In 2013, the Intensive Care National Audit and Research Centre Case Mix Programme Database developed the Modified Early Obstetrics Warning Score (MEOWS) to facilitate the early detection of high-risk obstetric patients. This is achieved through a combination of statistical scoring and clinical decisions. This study serves as a valuable screening tool for determining the level of care required for severe preeclampsia patients. It is consistent with research conducted at Norfolk and Norwich University Hospital and Sardjito Hospital, which suggests that MEOWS can effectively predict the need for ICU.<sup>14,18</sup>

## CONCLUSION

The MEOW score can serve as a parameter for the early detection of ICU treatment needs in severe preeclampsia patients, enhancing clinical surveillance and responsiveness.

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