Indonesian Journal of Global Health Research
Volume 8 Number 4, August 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
https://jurnal2.globalhealthsciencegroup.com/index.php/IJGHR

CLINICAL IMPACT OF MODIFIED EARLY WARNING SYSTEM ON REDUCING MATERNAL MORBIDITY: A REVIEW

Dian Natalia[1]*, Dumilah Ayuningtyas[2]
[1]Faculty of Public Health, Universitas Indonesia, Gedung FKM UI, Jl. Lingkar Kampus Raya, Kampus UI Depok, Pondok Cina, Beji, Depok, Jawa Barat 16424, Indonesia
[2]Department of Health Administration and Policy, Faculty of Public Health, Universitas Indonesia, Gedung FKM UI, Jl. Lingkar Kampus Raya, Kampus UI Depok, Pondok Cina, Beji, Depok, Jawa Barat 16424, Indonesia
*dianlbs73@gmail.com

ABSTRACT
The globally high maternal morbidity rate necessitates obstetric-specific monitoring systems capable of detecting physiological deterioration earlier than general adult early warning tools. This narrative review analyzes empirical evidence regarding the clinical impact of the Modified Early Obstetric Warning System (MEOWS) in reducing maternal morbidity. A structured synthesis of fourteen primary studies retrieved from PubMed, ResearchGate, and Elsevier between 2015 and 2025 was conducted using the following keywords: ("maternal early warning system" OR "MEOWS") AND ("maternal morbidity" OR "clinical impact"). The search yielded a total of 112 articles. After removing duplicates and irrelevant titles, 62 articles were screened based on abstracts. Subsequently, 38 full-text articles were assessed for eligibility using predefined inclusion and exclusion criteria, of which 14 studies met all criteria and were included in the final review. The review followed four stages: identification, screening, eligibility assessment, and data extraction. MEOWS demonstrates strong predictive efficacy, with sensitivity ranging from 72.9% to 96.9% and specificity from 62% to 99.9%, consistently outperforming general adult early warning systems. When integrated with standardized clinical pathways, MEOWS achieves a 100% negative predictive value and significantly reduces incidences of eclampsia, HELLP syndrome, and pulmonary edema. MEOWS is a reliable, cost-effective screening tool for early maternal morbidity risk detection. Its maximum clinical impact is realized when functioning as a trigger for standardized response protocols rather than as a passive monitoring tool. This review provides an evidence-based framework for policymakers and health facility managers to integrate physiological triggers with standardized response protocols, particularly in resource-limited settings.

Keywords: efficacy; early detection; maternal morbidity; modified early obstetric warning system

How to cite (in APA style)
Natalia, D., & Ayuningtyas, D. (2026). Clinical Impact of Modified Early Warning System on Reducing Maternal Morbidity: A Review. *Indonesian Journal of Global Health Research*, *8*(4), 1215–1222. https://doi.org/10.37287/ijghr.v8i4.1888.

INTRODUCTION

Maternal morbidity and mortality remain a major global public health challenge. The World Health Organization reported approximately 260,000 maternal deaths in 2023, with 92% occurring in low- and middle-income countries, reflecting persistent inequities in healthcare access, system capacity, and quality of care. In Indonesia, the Maternal Mortality Rate has declined from 390 to 189 per 100,000 live births between 1991 and 2020; however, obstetric complications such as hemorrhage, hypertensive disorders, and infection continue to be the leading causes of maternal death.

Many maternal deaths are preventable through timely and appropriate interventions, yet delays in care remain a critical barrier. The “Three Delays” framework highlights delays in seeking care, reaching healthcare facilities, and receiving adequate treatment. Importantly, even when patients arrive at healthcare facilities, mortality risk persists due to failure to recognize early signs of clinical deterioration (failure to rescue). This issue is further compounded by physiological adaptations in pregnancy that can mask early warning signs, making deterioration difficult to detect using standard clinical assessment alone.

To improve early recognition of patient deterioration, Early Warning Systems (EWS) were developed as structured, score-based tools integrating key physiological parameters. However, general adult EWS are often not suitable for obstetric populations, as they do not account for pregnancy-specific physiological changes, potentially leading to inaccurate risk identification and delayed clinical response.

The Modified Early Obstetric Warning System (MEOWS) was therefore developed with thresholds adapted to obstetric physiology, enabling earlier detection and timely intervention. Several variants, including MEWT, MOEWS, and MEWC, have been implemented across different clinical settings. Despite strong global evidence supporting its effectiveness, the implementation of MEOWS in low- and middle-income countries, including Indonesia, remains inconsistent and may be influenced by variations in health system capacity, workforce competency, and organizational readiness. This study aims to synthesize current evidence on the clinical impact of MEOWS in reducing maternal morbidity and to explore its contribution to strengthening maternal patient safety systems.

METHOD

This study employed a narrative literature review with a structured synthesis approach, following transparent stages of identification, screening, and data synthesis to assess the clinical impact of MEOWS and its variants on maternal morbidity. A systematic search was conducted in PubMed, ResearchGate, and Elsevier (ScienceDirect) using the keywords: ("maternal early warning system" OR "MEOWS") AND ("maternal morbidity" OR "clinical impact"). Publications were limited to 2015–2025 and to English and Indonesian languages. Inclusion criteria were: (1) primary studies (cohort, observational, or implementation); (2) studies evaluating predictive accuracy or clinical outcomes of MEOWS; and (3) studies involving obstetric populations. Exclusion criteria included non-primary articles, use of general (non-obstetric) EWS, and studies without clear clinical outcome data.

Article selection followed four stages: title screening to remove duplicates and irrelevant studies, abstract review for relevance, full-text assessment for methodological rigor, and data extraction using a standardized format (author, year, design, population, EWS type, findings, and clinical implications). The search yielded a total of 112 articles. After removing duplicates and irrelevant titles, 62 articles were screened based on abstracts. Subsequently, 38 full-text articles were assessed for eligibility using predefined inclusion and exclusion criteria. This process resulted in 14 studies being included in the final analysis. Data were analyzed descriptively and thematically using narrative synthesis to identify patterns in predictive effectiveness and factors influencing implementation. This approach supports comprehensive conclusions on the role of MEOWS in reducing maternal morbidity.

RESULT

This literature review presents a synthesis of 14 relevant primary studies, focusing on the effectiveness and clinical impact of obstetric EWS for early detection of maternal complication risk. The analysis is organized into two major themes: (1) predictive effectiveness and (2) clinical outcomes following implementation.

Predictive Effectiveness of MEOWS

Obstetric early warning instruments consistently demonstrated superior diagnostic performance in detecting maternal morbidity risk across the included studies. Table 1 presents the methodological characteristics of all 14 included studies, and table 2 provides a comprehensive synthesis of their key findings and clinical impact.

Table 1.
Methodological Characteristics of the 14 Included Studies

No.	Author (Year)	Country / Setting	Study Design	Sample Size	Clinical Condition	EWS Variant
1	Singh et al. (2016)	India / Tertiary hospital	Prospective observational	1,088 pregnant & postpartum women ≥28 wks	General obstetric morbidity	MEOWS
2	Yadav & Sinha (2023)	India / Tertiary care institute	Prospective observational	1,802 high-risk pregnant women	Obstetric morbidity & ICU need	MEOWS
3	Padmavati et al. (2024)	India / Tertiary hospital	Prospective cohort	300 pregnant women ≥28 wks	Late-pregnancy obstetric morbidity	MEOWS
4	Ratu & Hutagaol (2023)	Indonesia / Tertiary hospital	Observational	Severe preeclampsia patients	Severe preeclampsia	MEOWS
5	Xu et al. (2024)	China / Tertiary hospital	Comparative multi-model	Obstetric critical illness cases	Obstetric critical illness	MEOWS, MOEWS, MEWT
6	Cahyani et al. (2024)	Indonesia / Tertiary hospital	Retrospective cohort	Pregnant women with COVID-19	COVID-19 with respiratory involvement	MEWC vs MEOWS
7	Yerubandi et al. (2024)	USA / Multi-center	Before-after study	Obstetric emergency cases	Eclampsia & severe complications	MEWT
8	Pezdirc et al. (2024)	Slovenia / Tertiary hospital	Comparative	Postpartum women	Postpartum morbidity	Obstetric EWS vs General EWS
9	Zuckerwise & Lipkind (2017)	USA / Multi-center	Implementation study	Obstetric inpatients (systematic)	Preventable maternal mortality	MEOWS (integrated)
10	Robbins et al. (2018)	UK / Multi-center	Implementation study	Obstetric inpatients	Clinical deterioration & escalation	MEOWS
11	Schuler et al. (2017)	Brazil / Tertiary hospital	Retrospective cohort	High-risk postpartum women	Post-pregnancy complications	MEOWS
12	Depari et al. (2024)	Indonesia / RSUP Dr. Sardjito	Mixed methods	Pregnant women 2019–2020	Implementation compliance	Obstetric EWS (MEOWS)
13	Shields et al. (2016)	USA / 6 hospitals	Prospective	36,832 deliveries	Severe maternal morbidity & ICU	MEWT
14	Ningsih et al. (2025)	Indonesia / Tertiary hospital	Retrospective cohort	276 preeclampsia patients	Length of hospital stay	MEOWS

Across all studies, sensitivity ranged from 72.9% to 96.9% and specificity from 62% to 99.9%. The Maternal Early Warning Trigger (MEWT) reported by Shields et al. (2016) demonstrated the highest overall performance, with sensitivity of 96.9%, specificity of 99.9%, and a negative predictive value (NPV) of 99.99%. Standard MEOWS (Singh et al., 2016; Padmavati et al., 2024) showed an optimal balance between sensitivity and specificity, while obstetric-specific EWS (Pezdirc et al., 2024) achieved a 100% NPV—demonstrating a superior ability to rule out false alarms in stable patients compared to general adult EWS. Ratu & Hutagaol (2023) reported an AUC of 0.826 for MEOWS in predicting the need for intensive care among severe preeclampsia patients, and Robbins et al. (2018) demonstrated an AUC of 0.995, confirming very high discriminatory capacity for clinical deterioration.

Clinical Outcomes Following MEOWS Implementation

The clinical impact of MEOWS implementation was substantial and consistent across settings. Yerubandi et al. (2024) reported a significant reduction in the incidence of eclampsia, HELLP syndrome, and pulmonary edema through the integration of MEWT with standardized clinical pathways. Shields et al. (2016), in a large prospective study involving 36,832 deliveries across six hospitals, documented a significant reduction in severe maternal morbidity and composite morbidity outcomes following MEWT implementation. Zuckerwise & Lipkind (2017) demonstrated that systemically integrated MEOWS reduces preventable maternal mortality through response protocol standardization. In the context of concurrent infectious disease, Cahyani et al. (2024) showed that MEWC effectively prevents respiratory deterioration through close oxygen saturation monitoring, enabling early respiratory intervention. Ningsih et al. (2025) further demonstrated that MEOWS scores correlate directly with length of hospital stay among preeclampsia patients, adding value as a hospital resource management instrument. Table 2 provides a comprehensive summary of all 14 included studies.

Table 2.
Summary of 14 Included Primary Studies

No.	Author (Year)	Design, Population & EWS Variant	Primary Outcome	Key Findings	Clinical Impact
1	Singh et al. (2016)	Prospective observational; 1,088 pregnant & postpartum women ≥28 wks (MEOWS)	Predictive validity of MEOWS for obstetric morbidity	Sensitivity 86.4%, specificity 85.2%, NPV 96.9%; free from false alarms	Reliable bedside screening tool; prevents intervention delays in high-risk groups
2	Yadav & Sinha (2023)	Prospective observational; 1,802 high-risk pregnant women (MEOWS)	Morbidity prediction & ICU admission need	MEOWS effective; score ≥6 correlated with ICU/transfusion need	Reduces delays in ICU referral at tertiary facilities
3	Padmavati et al. (2024)	Prospective cohort; 300 pregnant women ≥28 wks (MEOWS chart)	Predictive value for obstetric morbidity in late pregnancy	Sensitivity 88%, NPV 95.92%; identifies stable patients	Supports objective early screening for timely intervention
4	Ratu & Hutagaol (2023)	Observational; severe preeclampsia patients (MEOWS)	Correlation of MEOWS score with clinical outcomes & ICU	AUC 0.826; high scores predict intensive care need	Assists severity stratification & ICU decision-making
5	Xu et al. (2024)	Comparative multi-model study (MEOWS, MOEWS, MEWT)	Discriminative performance of obstetric EWS variants	MOEWS most consistent for population-wide risk identification	Comprehensive model selection improves identification efficiency
6	Cahyani et al. (2024)	Retrospective cohort; pregnant women with COVID-19 (MEWC vs MEOWS)	Detection of respiratory deterioration (SpO_2)	MEWC more sensitive for infection/respiratory cases	Critical for early detection of rapid deterioration in systemic infections
7	Yerubandi et al. (2024)	Before-after study; obstetric emergency cases (MEWT)	Reduction in eclampsia incidence & severe complications	Significant decrease in eclampsia, HELLP syndrome, pulmonary edema	Highlights importance of integrating EWS with clinical pathways
8	Pezdirc et al. (2024)	Comparative; postpartum women (obstetric EWS vs general EWS)	Obstetric vs. general adult EWS performance	Obstetric EWS superior; NPV 100%; minimizes false alarms	Ensures stable patient safety; minimizes alarm fatigue in postpartum ward
9	Zuckerwise & Lipkind (2017)	Systematic implementation study (integrated MEOWS)	Strategy to reduce preventable maternal mortality	MEOWS reduces preventable mortality through response standardization	Standardized response protocols are key to maternal patient safety
10	Robbins et al. (2018)	Multi-center implementation; rapid response protocols (obstetric EWS)	AUC & acceleration of medical team escalation	AUC 0.995; accelerates escalation; requires further standardization	MEOWS evidence-base limited; needs more research & standardization

No.	Author (Year)	Design, Population & EWS Variant	Primary Outcome	Key Findings	Clinical Impact
11	Schuler et al. (2017)	Retrospective cohort; postpartum high-risk women (MEOWS)	MEOWS evaluation at tertiary hospital, Brazil	Effective in detecting abnormalities but poorly implemented due to low nurse recognition	Requires obstetric training & threshold adjustment to prevent alarm fatigue
12	Depari et al. (2024)	Mixed methods; pregnant women at RSUP Dr. Sardjito 2019–2020 (Obstetric EWS)	MEOWS chart completeness & intervention appropriateness	MEOWS completeness & intervention aligned with chart protocol	Improves structured clinical monitoring despite documentation compliance challenges
13	Shields et al. (2016)	Prospective; 36,832 deliveries at 6 hospitals (MEWT)	Severe maternal morbidity & ICU admission	Significant reduction in severe maternal morbidity & composite morbidity	EWS integrated with clinical pathway highly effective in reducing morbidity
14	Ningsih et al. (2025)	Retrospective cohort; 276 preeclampsia patients (MEOWS)	Length of hospital stay prediction	High score significantly predicts prolonged hospital stay	Assists risk stratification & hospital resource/bed planning

To provide a structured comparison of the functional characteristics of different obstetric early warning system variants, a summary matrix is presented in Table 3.

Table 3.
Functional Matrix of Obstetric Early Warning System Variants

Instrument	Clinical Design Focus	Operational Advantage	Ideal Implementation Indication
MEOWS	Alarm fatigue prevention	Highly robust in eliminating unnecessary warnings; minimizes interventions for stable patients	Routine daily monitoring in regular maternity wards (low-to-moderate risk)
MOEWS	Holistic multivariable scoring	Stable clinical threat identification across a wide spectrum of complication diagnoses	Referral facilities or obstetric populations with high disease heterogeneity
MEWC	Sudden instability detection (hyper-reactive threshold)	Extreme warning thresholds to capture immediate deterioration without compensatory lag	Close monitoring for patients with acute concurrent infectious crises (e.g., pneumonia)
MEWT	Action-linked trigger	Bridges early detection directly with execution of emergency bundles	Implementation of Rapid Response Team protocols at the institutional level

DISCUSSION

Physiological Basis of MEOWS Superiority

The fundamental effectiveness of MEOWS in reducing maternal morbidity rests on its recognition of the unique physiological adaptations that accompany pregnancy and the postpartum period. Significant hemodynamic changes during pregnancy—including increased plasma volume, elevated cardiac output, and reduced systemic vascular resistance—frequently cause conventional clinical parameters such as blood pressure to appear stable even when a patient is experiencing early circulatory failure (Robbins et al., 2018). General EWS commonly fail to detect these subtle changes, resulting in delayed intervention until severe decompensation has already occurred (Pezdirc et al., 2024). By contrast, MEOWS calibrates trigger thresholds based on obstetric physiology, particularly respiratory rate and pulse rate, enabling the capture of early deterioration with a negative predictive value reaching 100% (Singh et al., 2016; Pezdirc et al., 2024). This calibration simultaneously minimizes false alarms for stable patients, thereby preventing unnecessary medical interventions, reducing staff workload, and mitigating the risk of alarm fatigue (Robbins et al., 2018). The clinical implication is that MEOWS does not merely replicate an existing tool with different numbers—it represents a fundamentally reconceptualized monitoring paradigm adapted to the physiological realities of obstetric care.

Balancing Sensitivity and Specificity Across MEOWS Variants

A critical consideration in selecting an obstetric early warning instrument is achieving an appropriate balance between sensitivity—to ensure patient safety—and specificity—to prevent excessive workload and alarm desensitization. Cahyani et al. (2024) demonstrated that Maternal Early Warning Criteria (MEWC) is highly effective for detecting rapid deterioration in critical conditions such as COVID-19 infection; however, its hyper-reactive threshold generates a substantially higher frequency of alerts. In contrast, standard MEOWS and Modified Obstetric Early Warning Score (MOEWS) are more selective, performing better in identifying stable patients and minimizing false positives. Xu et al. (2024) found that MOEWS provided the most consistent performance for population-wide risk identification across diverse obstetric presentations, while Maternal Early Warning Trigger (MEWT), through its action-linked trigger design, proved most effective when paired with rapid response protocols. These findings highlight that each obstetric early warning system variant has distinct operational characteristics and clinical applications depending on the context of care. Variations in performance across settings suggest that the effectiveness of each instrument is influenced by factors such as staffing capacity, patient complexity, and the availability of structured response systems. No single MEOWS variant appears to be universally optimal; rather, differences in clinical performance reflect the interaction between instrument design and healthcare system context (Xu et al., 2024; Yadav & Sinha, 2023).

Integration with Clinical Pathways and Failure to Rescue Prevention

The evidence reviewed consistently demonstrates that the clinical impact of MEOWS extends beyond its intrinsic diagnostic performance. The success of MEOWS in reducing maternal morbidity is fundamentally contingent on the quality of the accompanying response system. Failure to rescue—the failure to prevent a patient's death or severe complication after a warning sign has been detected—frequently occurs due to communication barriers in escalation chains or the absence of standardized response protocols (Zuckerwise & Lipkind, 2017; Robbins et al., 2018). The integration of MEWT with clinical pathways was a decisive factor in the significant reductions in eclampsia, HELLP syndrome, and pulmonary edema reported by Yerubandi et al. (2024) and Shields et al. (2016). These findings establish that MEOWS achieves maximum clinical impact not as a passive documentation tool, but as an active trigger that directly initiates standardized emergency response bundles. This "trigger-to-action" integration ensures that every activated alarm is immediately followed by a structured and pre-determined clinical response, eliminating the ambiguity and delay that often characterizes unstructured clinical decision-making in emergency obstetric scenarios.

Implementation Challenges and Contextual Adaptation

Despite its demonstrated clinical efficacy, the real-world implementation of MEOWS faces significant systemic challenges, particularly in resource-limited settings. Depari et al. (2024), through a mixed-methods evaluation at RSUP Dr. Sardjito, Indonesia, found that although MEOWS had been formally adopted, operational challenges persisted—including suboptimal staff management, insufficient periodic training, and low levels of knowledge and documentation compliance among midwives. Administrative barriers, including duplicate medical record systems, added to the workload and ultimately contributed to documentation non-compliance. These findings highlight a critical gap between instrument adoption and effective implementation, a distinction that is frequently overlooked in policy discourse. Similarly, Schuler et al. (2017) reported that despite MEOWS demonstrating effectiveness in detecting clinical abnormalities in postpartum women at a tertiary hospital in Brazil, the system failed to be consistently applied due to inadequate nurse recognition of elevated scores and insufficient escalation pathways.

Effective MEOWS implementation is thus not solely a technical challenge—it is an organizational and human resource challenge. The evidence strongly supports that successful implementation requires ongoing staff training, institutional commitment, and the embedding of MEOWS within

existing standard operating procedures and escalation protocols. Moreover, the threshold values used in MEOWS should be periodically reviewed and locally validated to ensure their clinical relevance within each facility's patient population and operational context. Ningsih et al. (2025) further demonstrated that MEOWS scores correlate directly with length of hospital stay, indicating that beyond its role as a deterioration detection tool, MEOWS can serve as a hospital resource planning instrument—informing bed allocation and nursing workforce management. The extension of MEOWS monitoring into the postpartum period is equally important, as late-onset complications frequently present unexpectedly after patients have been transferred from the delivery room (Schuler et al., 2017). In the context of Indonesia's healthcare system and similar low-to-middle income settings, the cost-effectiveness and operational simplicity of MEOWS render it particularly valuable. Its reliance on basic physiological parameters—measurable without advanced technology or expensive laboratory investigations—makes it accessible even at primary healthcare facilities. In regions where geographical barriers significantly impede timely referral, early detection of clinical deterioration through MEOWS provides critical lead time for patient stabilization and mobilization to higher-level facilities. Implemented within a supportive institutional framework, MEOWS represents a high-impact, low-cost strategy with significant potential to contribute to SDG targets on maternal health.

CONCLUSION

This literature review concludes that the Modified Early Obstetric Warning System (MEOWS) is an effective and accurate screening instrument for predicting and reducing maternal morbidity, with its principal advantage lying in vital sign parameters specifically calibrated to the physiological adaptations of pregnancy and the postpartum period, thereby yielding stronger diagnostic performance than general adult early warning systems. Maximum clinical impact—including significant reductions in the incidence of eclampsia, HELLP syndrome, and pulmonary edema—is achieved when MEOWS functions not as a passive monitoring record but as a direct trigger for integrated clinical pathway protocols and rapid response procedures, effectively preventing failure to rescue. As a practical, cost-effective, and widely applicable monitoring instrument, MEOWS is particularly relevant for implementation in resource-limited healthcare settings where timely intervention can be most consequential for maternal outcomes, provided that its adoption is supported by continuous staff training, institutional commitment to embedding MEOWS within standard operating procedures, and periodic local validation of threshold parameters.

REFERENCES

Cahyani, D. D., Priyanto, H., Dhiya An, A., & Supriyatiningsih. (2024). Sensitivity and specificity of Modified Early Obstetric Warning Score (MEOWS) and Maternal Early Warning Criteria (MEWC) for maternal morbidity: A retrospective cohort study in pregnant women with COVID-19. Indonesian Journal of Obstetrics and Gynecology, 12(4), 188–195. https://doi.org/10.32771/inajog.v12i4.2108

Cresswell, J. A., Alexander, M., Chong, M. Y. C., Link, H. M., Pejchinovska, M., Gazeley, U., Ahmed, S. M. A., Chou, D., Moller, A.-B., Simpson, D., Alkema, L., Villanueva, G., Sguassero, Y., Tunçalp, Ö., Long, Q., Xiao, S., & Say, L. (2025). Global and regional causes of maternal deaths 2009–20: A WHO systematic analysis. The Lancet Global Health, 13(4), e626–e634. https://doi.org/10.1016/s2214-109x(24)00560-6

Depari, et al. (2024). Evaluation of the application of Modified Early Obstetric Warning Score in maternal patients at Sardjito General Hospital. (Mixed methods study, RSUP Dr. Sardjito, 2019–2020).

Kementerian Kesehatan RI. (2024). Profil Kesehatan Indonesia 2023 [Health Profile of Indonesia 2023]. Kementerian Kesehatan Republik Indonesia.

Ningsih, R. W., Rosyidah, R., & Hanum, S. M. F. (2025). Implementasi MEOWS (maternal early obstetric warning score) dalam memprediksi lama perawatan pasien preeklampsia

[Implementation of MEOWS in predicting length of stay for preeclampsia patients]. Prepotif: Jurnal Kesehatan Masyarakat, 9(1), 1052–1061. https://doi.org/10.31004/prepotif.v9i1.42758

Padmavati, P., Neelima, B., & Begum, P. R. (2024). A study on Modified Early Obstetric Warning System (MEOWS chart) as a screening tool in prediction of obstetric morbidity. European Journal of Cardiovascular Medicine, 14, 169–178.

Pezdirc, N., Stopar Pintarič, T., & Lučovnik, M. (2024). Obstetric-specific compared to general early warning system for predicting severe postpartum maternal morbidity. Biomolecules and Biomedicine, 25(7), 1517–1521. https://doi.org/10.17305/bb.2024.11679

Ratu, A. D. P., & Hutagaol, I. E. B. (2023). 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. Indonesian Journal of Obstetrics and Gynecology, 11(4), 215–219. https://doi.org/10.32771/inajog.v11i4.1920

Robbins, T., Shennan, A., & Sandall, J. (2018). Modified early obstetric warning scores: A promising tool but more evidence and standardization is required. Acta Obstetricia et Gynecologica Scandinavica, 98(1), 7–10. https://doi.org/10.1111/aogs.13448

Schuler, et al. (2017). The use of the Modified Early Obstetric Warning System (MEOWS) in women after pregnancies: A descriptive study. (Retrospective cohort, tertiary hospital, Brazil).

Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B., & Hedriana, H. L. (2016). Early warning triggers to improve maternal outcomes. American Journal of Obstetrics & Gynecology, 214(4), 527.e1–527.e6. https://doi.org/10.1016/j.ajog.2015.11.008

Singh, A., Guleria, K., Vaid, N. B., & Jain, S. (2016). Evaluation of maternal early obstetric warning system (MEOWS chart) as a predictor of obstetric morbidity: A prospective observational study. European Journal of Obstetrics & Gynecology and Reproductive Biology, 207, 11–17. https://doi.org/10.1016/j.ejogrb.2016.09.014

Thaddeus, S., & Maine, D. (1994). Too far to walk: Maternal mortality in context. Social Science & Medicine, 38(8), 1091–1110. https://doi.org/10.1016/0277-9536(94)90226-7

Wahyuningsih Wiji., Siregar, N. K., & Nurhakiki Syifa. (2025). Unraveling the drivers of inequality in maternal healthcare utilization in Indonesia: A decomposition analysis. Jurnal Ekonomi Kesehatan Indonesia, 10(2). https://doi.org/10.7454/eki.v10i2.1152

World Bank Group. (2024). Maternal mortality ratio (modeled estimate, per 100,000 live births)—Indonesia. https://data.worldbank.org/indicator/SH.STA.MMRT?locations=ID

World Health Organization. (2025, April 7). Maternal mortality. https://www.who.int/news-room/fact-sheets/detail/maternal-mortality

Xu, Y., Zhu, S., Song, H., Lian, X., Zeng, M., He, J., Shu, L., Xue, X., & Xiao, F. (2024). Comparison of the efficacy for early warning systems in predicting obstetric critical illness. European Journal of Obstetrics & Gynecology and Reproductive Biology, 296, 327–332. https://doi.org/10.1016/j.ejogrb.2024.03.025

Yadav, P., & Sinha, R. (2023). Validating the performance of Modified Early Obstetrics Warning Score (MEOWS) for prediction of obstetrics morbidity: A prospective observational study in a tertiary care institute in East India. The Journal of Obstetrics and Gynecology of India, 73(S2), 227–233. https://doi.org/10.1007/s13224-023-01855-8

Yerubandi, S., Devi Kallur, S., Gala, A., Chandra Ravula, P., Surapaneni, T., & Aziz, N. (2024). Eclampsia reduction with maternal early warning trigger tool. Pregnancy Hypertension, 35, 6–11. https://doi.org/10.1016/j.preghy.2023.11.007

Zuckerwise, L. C., & Lipkind, H. S. (2017). Maternal early warning systems—Towards reducing preventable maternal mortality and severe maternal morbidity through improved clinical surveillance and responsiveness. Seminars in Perinatology, 41(3), 161–165. https://doi.org/10.1053/j.semperi.2017.03.005.