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# EVALUATION OF MODIFIED EARLY OBSTETRIC WARNING SYSTEM (MEOWS) CHART AS AN EARLY PREDICTOR OF MATERNAL MORBIDITY

Obstetrics & Gynaecology

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## ABSTRACT

**Background:** Early recognition of maternal deterioration is essential to reduce obstetric morbidity and mortality. The Modified Early Obstetric Warning System (MEOWS) chart is a structured bedside tool designed for early identification of high-risk patients. **Objectives:** To evaluate the effectiveness of the MEOWS chart as a screening tool for predicting obstetric morbidity.**Methods:** A prospective observational study was conducted among 50 pregnant and postpartum women (>28 weeks gestation up to delivery). Participants were categorized into triggered (n=18) and non-triggered (n=32) groups based on MEOWS scores. Statistical analysis included Chi-square test, sensitivity, specificity, predictive values, and p-value <0.05 as significant.**Results:** Obstetric morbidity occurred in 61.1% of the triggered group compared to 3.1% in the non-triggered group ($\chi^2$=17.22, p=0.00003). Hypertensive disorders were the most common morbidity. Blood pressure and heart rate were the most frequent triggering parameters. Increasing MEOWS scores correlated with severity of morbidity. **Conclusion:** MEOWS is a sensitive and clinically useful tool for early identification of obstetric morbidity and can improve maternal surveillance when used routinely.

## KEYWORDS

Meows, Obstetric Morbidity, Early Warning System, Maternal Risk Prediction

## INTRODUCTION

Pregnancy is a complex physiological state marked by significant alterations in the circulatory, respiratory, hematologic, and endocrine systems. While these modifications are essential for supporting fetal growth and preparing for childbirth, they may hide early signs of clinical deterioration, therefore impeding the identification and management of potentially life-threatening maternal issues.[1] Globally, maternal morbidity and mortality remain significant public health concerns, particularly in low- and middle-income countries, were delays in diagnosis and treatment result in adverse outcomes. [2] The World Health Organization estimates that 810 women die per day from preventable causes related to pregnancy and childbirth, mostly owing to hypertensive disorders, obstetric hemorrhage, sepsis, and cardiac complications.[3]

The Modified Early Obstetric Warning System (MEOWS) was developed as a standardized bedside tool to facilitate the swift detection of abnormal physiological signs in pregnant and postpartum women. It utilizes fundamental clinical indicators—such as heart rate, blood pressure, breathing rate, temperature, and neurological response—to provide a score that may prompt early therapeutic intervention. [4] Previous studies have demonstrated the efficacy of MEOWS in predicting maternal morbidity, reducing the need for intensive care admissions, and improving overall maternal outcomes.[5] Nevertheless, information regarding its deployment in many healthcare settings, particularly in resource-limited regions, remains insufficient.[6]

This study aimed to evaluate the effectiveness of the MEOWS chart as a screening tool for predicting obstetric morbidity among pregnant and postpartum women, considering the substantial maternal morbidity burden and the need for efficient, cost-effective monitoring instruments.[7,8] This study aims to assess the feasibility and usefulness of integrating MEOWS into conventional obstetric care by measuring sensitivity, specificity, and predictive values.

### Methodology

This was prospective observational study carried out in the Obstetrics department of Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore from March 2025 to May 2025. The study sought to assess the Modified Early Obstetric Warning System (MEOWS) chart as a predictive instrument for obstetric morbidity. Fifty women participated in the research. Participants comprised pregnant women from 28 weeks of gestation to delivery.

The Objective of the study was to determine the maternal outcome based on Modified Early Obstetric Warning System (MEOWS) scoring system which is used as a screening tool in pregnant woman

**Inclusion criteria** were to consider all Pregnant women beyond 28 weeks of gestational age and up to delivery. The women who were already diagnosed with morbidity and Obstetric women admitted to ICU were *excluded* from the study.

The research was executed after authorization from the Institutional Ethics Committee (Approval No: SIMS&RC/EC-19/PG-12/2025-26). After taking informed consent in writing from all the study subjects the demographic data of age, gravida status, domicile, employment, and educational background was documented. Comprehensive obstetric, medical, surgical, and familial histories were acquired. Upon admission, a clinical examination was conducted, and vital parameters were recorded, including oral temperature, heart rate, respiratory rate, blood pressure (systolic and diastolic), oxygen saturation (via pulse oximetry), neurological response (AVPU: Alert, responds to Voice, responds to Pain, Unresponsive), proteinuria (urine dipstick test), characteristics of lochia, and color of amniotic fluid. The MEOWS chart was utilized for scoring, with red triggers denoting highly aberrant values and yellow triggers signifying moderately abnormal values. Patients were classified into a triggered group (n = 18) and a non-triggered group (n = 32).

**Follow-Up and Outcomes**: Participants were observed throughout their hospital admission and monitored till delivery. Obstetric morbidity (e.g., hypertensive disorders, haemorrhage, anaemia, eclampsia, gestational diabetes) and fetal outcomes were documented. Data were entered into Microsoft Excel and analyzed utilizing SPSS version 22.0. Continuous variables were expressed as mean ± standard deviation and evaluated using an unpaired Student's t-test. Categorical variables were represented as percentages and examined with the Chi-square test. The diagnostic efficacy of the MEOWS chart was evaluated by determining sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). A p-value of less than 0.05 was deemed statistically significant.

### Results:

The study subjects were divided into triggered Group consisting of 18 patients (35%) and Non-triggered Group consisting of 32 patients (65%). (Table 1) The Most Common Morbidity were Hypertensive disorders of pregnancy (21.9%) and anemia (16.35%)

The Trigger Contributors were

- Heart Rate (Red Trigger): 13%
- BP (Yellow Trigger): Systolic 79%, Diastolic 63%
- Obstetric Morbidity & MEOWS Score: Higher scores correlated with more severe morbidities like eclampsia, hemorrhage

**Tables 1: Distribution of the study subjects**

| Group | Morbidity (Yes) | Morbidity (No) | Total |
|---|---|---|---|
| **Trigger (18)** | 11 | 7 | 18 |
| **Non-trigger (32)** | 1 | 31 | 32 |
| **Total** | **12** | **38** | **50** |

Chi-square value ($\chi^2$) ≈ 17.22 with Degrees of freedom (df) = 1.

Statistical analysis using the Chi-square test revealed a Chi-square value of 17.22 with 1 degree of freedom, and a p-value of 0.00003, indicating a highly statistically significant difference between the two groups. This suggests that the presence of obstetric morbidity is strongly associated with triggering of the MEOWS score.

**Table 2: Association between trigger and Non trigger group**

| Obstetric Morbidity | Triggered group No.(%) | Non Trigerred group ( %) | Chi square value | P value |
|---|---|---|---|---|
| **Hypertensive disorder of Pregnancy** | 3 | 4 | **17.22 With df = 1** | **0.00003** |
| **Acute asthma** | 1 | 0 | | |
| **Gestational DM** | 2 | 1 | | |
| **Anaemia** | 3 | 1 | | |
| **Heart disease** | 1 | 0 | | |
| **Eclampsia** | 1 | 0 | | |
| **NIL** | 7 | 26 | | |
| **Total** | 18 | 32 | | |

**Table 3:Frequency of trigger of individual physiological parameters of MEOWS chart for study population (n=50)**

| Parameters | Red trigger No. | Yellow trigger No. | White Trigger (Non-Trigger) | All trigger |
|---|---|---|---|---|
| **RR** | 1 | 1 | 48 | 50 |
| **Saturation** | 0 | 0 | 50 | 50 |
| **Temperature** | 1 | 0 | 49 | 50 |
| **HR** | 3 | 1 | 46 | 50 |
| **Systolic BP** | 1 | 9 | 40 | 50 |
| **Diastolic BP** | 1 | 9 | 40 | 50 |
| **Neuro response** | 0 | 0 | 50 | 50 |
| **Total** | 7 | 11 | 32 | |

**Table 4: Obstetric morbidity according to total MEOWS score**

| Obstetric Morbidity | MEOWS = 0 | MEOWS 1–4 | MEOWS 5–6 | MEOWS ≥7 | Total |
|---|---|---|---|---|---|
| Hypertensive disorder | 0 | 0 | 3 | 4 | 7 |
| Acute asthma | 0 | 0 | 1 | 0 | 1 |
| Gestational DM | 0 | 0 | 0 | 3 | 3 |
| Anaemia | 0 | 1 | 2 | 1 | 4 |
| Heart disease | 0 | 0 | 1 | 0 | 1 |
| Eclampsia | 0 | 0 | 0 | 1 | 1 |
| NIL | 0 | 31 | 2 | 0 | 33 |
| **Total** | **0** | **32** | **9** | **9** | **50** |

The study comprised 50 women, with 18 (36%) assigned to the triggered group and 32 (64%) to the non-triggered group. In the triggered group, 11 of 18 women (61.1%) had obstetric morbidity, whereas only 1 of 32 women (3.1%) in the non-triggered group did have morbidity. (Table 2). The difference was statistically significant ($\chi^2$ = 17.22, df = 1, p = 0.00003), indicating a robust correlation between MEOWS triggers and the incidence of morbidity.

Higher MEOWS scores were predominantly observed among women with obstetric morbidities such as hypertensive disorders, gestational diabetes mellitus, and anaemia, whereas most women without morbidity (NIL group) had lower MEOWS scores (1–4). This indicates that increasing MEOWS score correlates with worsening clinical condition and higher risk status (table 4).

## DISCUSSION:

This study assessed the Modified Early Obstetric Warning System (MEOWS) chart as a predictive tool for obstetric morbidity in a sample of 50 women. The results indicated that MEOWS has significant predictive value, as 61.1% of triggered women experienced morbidity, in contrast to just 3.1% in the non-triggered cohort. The association was statistically significant ($\chi^2$ = 17.22, p = 0.00003), underscoring the chart's efficacy as a straightforward, sensitive bedside instrument for early risk classification. Our findings correspond with those of Singh et al. (2016), who indicated that MEOWS exhibited a sensitivity of 89% and a specificity of 79% in identifying maternal morbidity within an Indian obstetric cohort. Their investigation highlighted hypertension diseases and bleeding as significant contributors to morbidity, findings that align with our data, in which hypertensive disorders were prominent.[7] Shields et al. (2016) in another study similarly concluded that that the use of a maternal early warning trigger tool lowered maternal morbidity, especially with hypertensive diseases and sepsis, so underscoring the need of early physiological monitoring.[8]

Similar contribution from Ryan et al. (2017) discovered that MEOWS had a high sensitivity (96%) in predicting ICU hospitalization over 24 hours, particularly in the presence of red triggers, which aligns with our observation that elevated MEOWS scores were associated with severe morbidity, including eclampsia.[9] Another study conducted by Tuyishime et al. (2020) in Rwanda validated the feasibility of using MEOWS in resource-limited environments, demonstrating significant predictive value and clinical acceptability; nevertheless, their research highlighted infection-related morbidity, which was absent in our cohort.[10]

Conversely, Robbins et al. (2019) contended that while MEOWS has potential, the data is inconsistent across healthcare systems. Their assertion indicated that excessive dependence on MEOWS may result in unwarranted treatments for women with benign anomalies, a constraint not evident in our analysis owing to distinct stratification between triggered and non-triggered groups.[5]

Another comprehensive multicentric research conducted by Friedman et al. (2018) underscored the significance of institutional procedures in the use of MEOWS. Variable prediction accuracy was seen based on the consistency of tool use by healthcare personnel, highlighting the need of training and system assistance.[11] A review by *Cole* (2014) noted that although MEOWS enhances bedside identification of worsening, technology cannot replace clinical judgment. This corresponds with our findings, indicating that morbidity was observed in some women with low scores, suggesting that MEOWS should augment, rather than supplant, physician evaluation.[6] Tavares et al. (2008) also assessed early warning scores in pre-ICU environments and discovered a lower sensitivity than our study (28.9%), indicating that MEOWS may be more effective in obstetric-specific groups than in general medical patients.[12]

Our findings align with the predominant body of research endorsing MEOWS as a robust and reliable instrument for forecasting obstetric morbidity. Discrepancies in prediction values among studies underscore the necessity for further standardization and modification of the scoring system to regional health situations.

**Summary:**

The MEOWS triggers strongly correlated with obstetric morbidity. The Hypertensive disorders were the most frequent morbidity observed in our study. Blood pressure and heart rate were the most common parameters contributing to triggers. Increasing MEOWS score was associated with greater severity of morbidity.

## CONCLUSION

The Modified Early Obstetric Warning System is a sensitive and clinically effective tool for predicting obstetric morbidity. It demonstrates strong statistical association with maternal complications and correlates with severity of illness. Routine implementation of MEOWS in obstetric units can enhance early detection of deterioration, improve patient monitoring, and potentially reduce maternal morbidity.

**Limitations of the study:** This was single centre study with a small sample size and short follow- up duration which did not evaluate the effect of response time after trigger detection due to time constraints. Nonetheless, opportunities for further assessment of the

aforementioned constraints may be pursued to refine and enhance the MEOWS chart, transforming it into a highly structured and efficient implementation tool for acceptance as a standard hospital protocol for patient welfare.

**Recommendations:** A MEOWS chart should be routinely implemented in all obstetric wards, accompanied by frequent training programs for personnel engaged in prenatal care to incorporate it into standard obstetric monitoring protocols. Additional validation through bigger multicentric trials will enhance the efficacy of patient care applications to reduce the global burden of maternal morbidity.

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