ORIGINAL ARTICLE

# Validation of the Turkish version of the Modified Early Obstetric Warning System (MEOWS) chart

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## ABSTRACT

**BACKGROUND:** The Modified Early Obstetric Warning System (MEOWS) is a score-based or color-coded system that detects changes in physiological parameters and enables earlier diagnosis and care of worsening obstetric patients. The aim of this study is to evaluate the tool's performance and contribute to its use in Türkiye by translating MEOWS into Turkish.

**METHODS:** This prospective and descriptive study, approved by the local ethics committee, included 350 obstetric in-patients who gave birth at Samsun Training and Research Hospital, Gynecology and Children's Hospital between April and August 2022. The study involved patients with a gestational week greater than 28 weeks and up to six weeks postpartum.

**RESULTS:** The average age of the patients was 28.9±5.9 (18-40) years, with trigger values occurring in 34.6% (n=121) and morbidity occurring in 30.9% (n=108) of the cases. The most common trigger among the individual physiological indicators was high systolic blood pressure (28.3%). When the performance of MEOWS was evaluated, a statistically significant correlation was found between trigger and morbidity (Kappa=0.605; p<0.001). The sensitivity of MEOWS in estimating morbidity was 77.78% (95% confidence interval [CI]: 68.76-85.21%), specificity was 84.71% (95% CI: 79.55-89.00%), Positive Predictive Value (PPV) was 69.42% (95% CI: 62.40-75.64%), Negative Predictive Value (NPV) was 89.52% (95% CI: 85.67-92.43%), and accuracy was 82.57% (95% CI: 78.18-86.40%).

**CONCLUSION:** MEOWS was found to be an effective screening tool for predicting morbidity in this study and performs well in Turkish with sufficient sensitivity, specificity, and accuracy. However, the inclusion of long-term results would provide a more comprehensive understanding of the effectiveness of MEOWS.

**Keywords:** Chart; Modified Early Obstetric Warning System (MEOWS); morbidity; obstetrics; validation study.

## INTRODUCTION

Preventing maternal deaths is a significant concern in many parts of the world, especially in low-income nations where resources are scarce. The majority of prenatal deaths are attributable to preventable causes, making early diagnosis and patient recognition crucial. The most effective method for preventing maternal deaths in healthcare is to detect and identify a patient's physiological responses before the resulting alterations become irreversible and fatal. As such, early warning systems are intended to facilitate earlier recognition and care of patients who are deteriorating.[1]

Early warning systems, using data from simple bedside observation charts, are based on the premise that physiological responses of the human body to illness occur prior to the onset of critical illness. These systems rely on the periodic measurement of fundamental vital parameters during patient

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monitoring. If the patient triggers predetermined abnormal physiological values during follow-up, the patient's primary healthcare provider is equipped to recognize the scenario and notify the relevant clinician. Consequently, timely action may prevent catastrophic outcomes.[2]

Morgan and Wright first developed early warning systems in 1997.[3] The use of early warning systems in obstetric patients, now employed in many clinics and patient groups, began following the recommendation for routine implementation of the Maternal Early Warning System chart by the United Kingdom's mother and child health secret investigation report of data between 2003 and 2005.[3,4] The Modified Early Obstetric Warning System (MEOWS) is a score-based or color-coded system designed to detect changes in physiological markers and to facilitate early patient detection and management. It was initially validated by Sigh et al., and then its validity and reliability were assessed in other nations, particularly those associated with low socioeconomic status.[1,2,5]

According to the Turkish Ministry of Health, the maternal death rate in our country in 2019 was 13.1 per 100,000 live births.[6] While this rate is relatively low compared to countries facing significant economic challenges like India and Nigeria, it is three to four times higher than the rate observed in numerous European nations.[7] In our country, obstetrics clinics do not commonly use early warning systems, and a literature search revealed that there is no Turkish version of the MEOWS.

The purpose of this study was to translate MEOWS into Turkish, evaluate the performance of MEOWS as a screening tool for obstetrics patients in Türkiye clinics, and thereby facilitate its use in our country.

## MATERIALS AND METHODS

### Study Design

The Ondokuz Mayis University Clinical Research Ethics Committee (KAEK 2022/137) approved this prospective and descriptive study, which was also registered in the ClinicalTrials.gov registry (n° NCT05678920). Three hundred fifty inpatients presenting to Samsun Training and Research Hospital, Gynecology and Children's Hospital between April 2022 and August 2022, who were more than 28 weeks pregnant and up to six weeks postpartum, were included in the study. We included a more specific group of postpartum patients to facilitate the standardization of results. Therefore, patients were not selected based on their disease; only a specific group of patients was included. The morbidities are the conditions that the selected group of patients had and are in line with other studies validating this scale (Table 1). The study was carried out in accordance with the Declaration of Helsinki. Informed consent was acquired from all participants.

The research was carried out in three stages. The first stage involved translating the MEOWS into Turkish and culturally adapting it. The second stage used the study scale and addressed deficiencies through a pilot study on 30 patients. The third and final stage involved collecting and analyzing patient data until the specified sample size was reached (Supplement 1).

**Table 1.** Definitions of obstetric morbidities

- **Obstetric Hemorrhage**: Documented estimated blood loss greater than 1500 mL, necessity for blood transfusion, and reduction in hemoglobin value greater than 3 g/dL.
- **Gestational Hypertension:** Diastolic blood pressure of 90 mmHg or systolic blood pressure of 140 mmHg or higher, measured twice at least 4-6 hours apart after the 20th week of pregnancy.
- **Preeclampsia:** Systolic blood pressure above 160 mmHg or diastolic blood pressure above 110 mmHg, with associated proteinuria (0.3 g/day) or hypertension (140/90 mmHg), and at least one of the following symptoms: headache, visual impairment, epigastric discomfort, clonus, or a blood platelet count of less than 100,000 per milliliter.
- **Suspected Infection:** Patients with clinical suspicion of infection who receive antibiotic treatment regardless of whether the culture results are positive or negative (excluding prophylactic antibiotic use).
- **Pulmonary Emboli:** Diagnosis in patients whose pulmonary angiography or ventilation perfusion scintigraphy shows a significant risk of embolism.
- **Intracranial Bleeding:** Bleeding identified through computed tomography or magnetic resonance imaging.
- **Acute Asthma:** Presence of asthma documented in the patient's medical history, accompanied by an audible expiratory wheeze.
- **Gestational Diabetes Mellitus:** Variable carbohydrate intolerance that either began or was first identified during the current pregnancy.
- **Diabetic Ketoacidosis:** Characterized by hyperglycemia, metabolic acidosis, and the presence of urinary ketones.
- **Myocardial Infarction:** Symptoms include altered electrocardiogram (ECG) readings and a rise in serum troponin levels.
- **Pulmonary Edema:** Symptoms include shortness of breath, crepitations, and the requirement for diuretics.
- **Anesthesia Complications:** Includes high-level spinal or epidural anesthesia and aspiration following difficult or unsuccessful intubation.

### Translation and Cultural Adaptation of MEOWS into Turkish

The five-step methodology described by Guillemin et al.[8] and Beaton et al.[9] was used as a guide for translating MEOWS into Turkish. The scale, originally in English, was translated by three qualified translators. A knowledgeable scholar reviewed the translations for semantic integrity and application. The translated scale was then translated back-translated into English by two professors of English. It was determined whether the items on the translated scale were equivalent to the original scale items. A final examination was conducted with a Turkish linguistics and health expert (an academician-level obstetrician). Subsequently, the necessary adjustments were made, and a pilot study was conducted to determine the intelligibility of the items among the target population (Fig. 1).

### Pilot Study

The attendants (midwives or nurses following the patient) completing the charts were informed of the importance of entering the data correctly. They were advised to alert the clinician whenever a dangerous value (marked in red or yellow) was detected and to follow the action plan on page two of the chart. Both the attendant who completed the paperwork and the doctor who followed the patient were informed that compliance with the charts would be monitored. To reduce bias, however, the aforementioned healthcare professionals were not involved in related studies. Once the target number of 30 patients was reached, the pilot trial concluded. After the pilot study, any incomprehensible items were identified. Inter-rater reliability was evaluated using kappa statistics. Data on the 30 participants who took part in the pilot were excluded from the study.

### Procedure and Data Collection

Patients' respiratory rate, peripheral oxygen saturation, inspired oxygen concentration, body temperature, heart rate, systolic and diastolic blood pressure, level of consciousness (awake, awakened by audible or painful stimuli, or unresponsive), pain (0=no pain, 1=mild pain with movement, 2=intermittent pain/moderate pain with movement) and nausea (0=no nausea, 1=mild nausea, 3=severe nausea, 4=vomiting) statuses were recorded. Additionally, the patient's vaginal hemorrhage and lochia were noted. Mild stimulus areas (triggers) were designated as two simultaneous yellow triggers

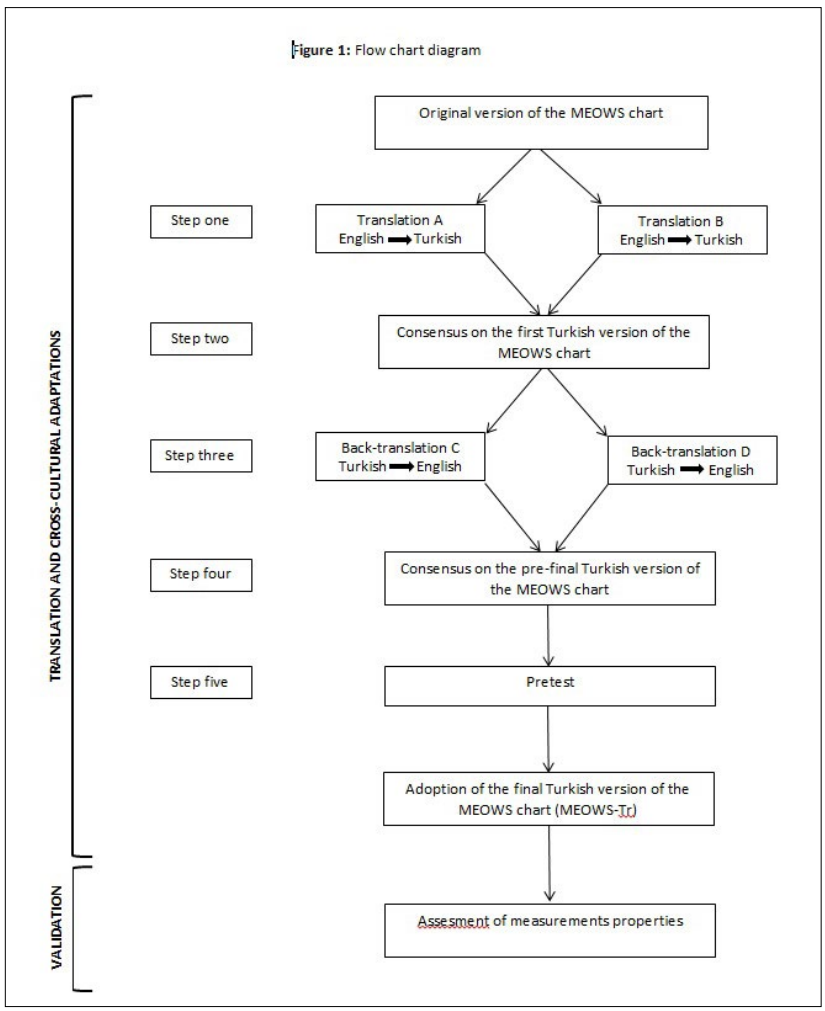


**Figure 1.** Flow chart diagram.

and severe stimulus areas as a single red trigger (Table 2).

The following is the standard protocol for routine patient follow-up for women who have given birth at our hospital:
− In patients who had a normal delivery: every 4 hours for 24 hours, then twice a day until the patient is discharged,
− In patients with postpartum hemorrhage: every hour for the first 4 hours, then every 2 hours for 12 hours, then every 4 hours after 12 hours,

− In patients who have undergone a cesarean section: every hour for the first 6 hours, every 2 hours for the following 12 hours, then at 4-hour intervals up to 48 hours.

In the event of a trigger or triggers, the patient was monitored according to the action plan detailed on the second page of the MEOWS form. The status of the patients (mortality, death, intensive care unit stay, and discharge in good health) throughout the 30 days following the completion of the form was documented.

### Statistical Analysis

Prior to the study, a power analysis was undertaken to determine the sample size. A minimum sample size of 326 was calculated using the following parameters: 95% confidence interval (1-$\alpha$), 80% test power (1-$\beta$), sensitivity of 0.89, and specificity of 0.79. Data were stored on a computer protected by a password and analyzed using IBM SPSS Version 23. The Kolmogorov-Smirnov test was used to assess conformity to normal distribution. To compare categorical variables between groups, Chi-square, Yates correction, and Fisher's exact test were utilized. The Mann-Whitney U test was used to compare non-normally distributed data between paired groups. The effectiveness of the MEOWS in predicting morbidity was analyzed using diagnostic tests. For quantitative data, the analysis findings were reported as mean ± standard deviation, median (first quartile – third quartile), and frequency (percent) for categorical data. The significance threshold was set at $p<0.05$.

## RESULTS

The data of 350 obstetric patients who gave birth were analyzed. The average age of patients was 28.9±5.9 (18-40) years, and the median age was 28.0 (24.0-33.0) years. Stimulus (trigger) values were found in 34.6% (n=121) of the patients, while morbidity was observed in 30.9% (n=108).

When patients were analyzed based on the mode of delivery, 51.7% (n=181) were delivered by cesarean section (C/S), while 48.3% (n=169) had vaginal deliveries. C/S was performed as an emergency procedure in 27% of patients. Due to obstetric hemorrhage and anemia, blood transfusion was administered to 13.9% of all patients. Forceps were used on ten (5.9%) patients who had vaginal deliveries.

There was a statistically significant correlation ($p<0.001$) between morbidity and the presence of a trigger (a single red area or two simultaneous yellow areas). Morbidity occurred among 10.5% of patients with no trigger and in 69.4% of patients with a trigger. There was a statistically significant difference between the distribution of morbidities based on the status of the trigger ($p<0.001$). This is due to the fact that conditions such as obstetric hemorrhage, pregnancy-induced hypertension, and suspected infection, which are more common than other morbidities, are more likely to cause triggers.

There was a statistically significant difference between the distributions of births with intervention based on the status of the trigger ($p<0.001$). This was due to the frequencies of repeated C/S and emergency C/S. While 34.7% of individuals with a trigger had emergency C/S, only 3.1% of those without a trigger did. There was a significant difference between the emergency and elective distributions of C/S based on the triggers ($p<0.001$). Among all cesarean deliveries, 11.7% of those without a trigger and 71.7% of those who had a trigger underwent emergency cesarean sections, 88.3% of those without a trigger and 28.3% of those who had a trigger underwent elective cesarean sections (Table 3).

When days of hospitalization were compared, those without

**Table 2.** Cut-off limits of trigger zones for individual parameters

| Parameters | Red Trigger | Yellow Trigger |
|---|---|---|
| Temperature (°C) | <35 or >38 | 35-36 |
| Systolic BP (mmHg) | <90 or >160 | 150-160 or 90-100 |
| Diastolic BP (mmHg) | >100 | 90-100 |
| Heart Rate (beats/min) | <40 or >120 | 100-120 or 40-50 |
| Respiratory Rate (breaths/min) | <10 or >30 | 21-30 |
| Oxygen Saturation (%) | 95 | – |
| Pain Score (0-3) | – | 2-3 |
| Neuroresponse | Unresponsive or Pain | Responsive to Voice |

BP: Blood Pressure; min: Minute.

**Table 3.** Comparison of morbidity and cesarean section (C/S) status by trigger

| | Trigger | | Total | Test Statistic | p |
|---|---|---|---|---|---|
| | Yes n (%) | No n (%) | | | |
| Morbidity | | | | | |
| Yes | 84 (69.4) | 24 (10.5) | 108 (30.9) | 128.91 | <0.001* |
| No | 37 (30.6) | 205 (89.5) | 242 (69.1) | | |
| Morbidity | | | | | |
| Acute Asthma | 2 (2.4) | 0 (0) | 2 (1.9) | | |
| Anemia | 14 (16.7) | 1 (4.2) | 15 (13.9) | | |
| Gestational DM | 9 (10.7) | 5 (20.8) | 14 (13) | | |
| GIHT | 23 (27.4)[a] | 0 (0)b | 23 (21.3) | 43.117 | <0.001* |
| Obstetric Hemorrhage | 8 (9.5)[a] | 16 (66.7)[b] | 24 (22.2) | | |
| Preeclampsia | 13 (15.5) | 2 (8.3) | 15 (13.9) | | |
| Suspected Infection | 15 (17.9)[a] | 0 (0)b | 15 (13.9) | | |
| C/S | | | | | |
| Yes | 61 (50.4) | 120 (52.4) | 181 (51.7) | 0.125 | 0.723* |
| No | 60 (49.6) | 109 (47.6) | 169 (48.3) | | |
| Delivery Type | | | | | |
| Elective C/S | 19 (15.7)[a] | 113 (49.3)[b] | 132 (37.7) | 80.484 | <0.001* |
| Emergency C/S | 42 (34.7)[a] | 7 (3.1)[b] | 49 (14) | | |
| Vaginal | 60 (49.6) | 109 (47.6) | 169 (48.3) | | |
| C/S | | | | | |
| Emergency | 43 (71.7) | 14 (11.7) | 57 (31.7) | 63.803 | <0.001** |
| Elective | 18 (28.3) | 106 (88.3) | 124 (68.3) | | |

*Chi-square test; **Yates correction applied. C/S: Cesarean Section; GIHT: Gestational Induced Hypertension; DM: Diabetes Mellitus.

a trigger had a median stay of 2.0 days, while those with a trigger had a median stay of 3.0 days in the hospital (p<0.001). There was no statistically significant difference between the median age (p=0.546) and body mass index (BMI) (p=0.182) of the patients when compared according to the presence or absence of a trigger (Table 4).

The most common trigger among individual physiological markers was elevated systolic blood pressure (28.3%). It was followed by pain (19.1%), elevated diastolic blood pressure (5.7%), elevated heart rate (3.4%), nausea (3.4%), elevated respiratory rate (1.1%), and elevated body temperature (0.3%) (Table 5).

**Table 4.** Comparison of age, first systolic and diastolic blood pressure, body mass index (BMI), and number of hospitalization days by triggers

| | Trigger | | | | | |
|---|---|---|---|---|---|---|
| | Yes | | No | | | |
| | Mean±SD | Median (Q1-Q3) | Mean±SD | Median (Q1-Q3) | Test Statistic | p |
| Age (years) | 29.3±5.9 | 29.0 (25.0-34.0) | 28.6±6.0 | 27.0 (24.0-33.0) | 13313.000 | 0.610 |
| BMI (kg/m2) | 28.7±5.3 | 28.0 (26.0-31.0) | 28.3±5.4 | 27.0 (24.0-30.0) | 12655.000 | 0.182 |
| Hospitalization (days) | 3.6±1.6 | 3.0 (2.0-5.0) | 2.6±1.1 | 2.0 (2.0-3.0) | 8677.000 | <0.001 |

*Mann-Whitney U test applied. BMI: Body Mass Index; SD: Standard Deviation.

**Table 5.** Evaluation of individual physiological parameters on the Modified Early Obstetric Warning System (MEOWS) (distributions of most common trigger causes)

| | n | % |
|---|---|---|
| Respiratory Rate | | |
| High | 4 | 1.1 |
| Normal | 346 | 98.9 |
| Temperature | | |
| Normal | 348 | 99.4 |
| Low | 1 | 0.3 |
| High | 1 | 0.3 |
| Heart Rate | | |
| Normal | 337 | 96.3 |
| Low | 1 | 0.3 |
| High | 12 | 3.4 |
| Systolic Blood Pressure | | |
| Normal | 251 | 71.7 |
| High | 99 | 28.3 |
| Diastolic Blood Pressure | | |
| Normal | 325 | 93.1 |
| Low | 4 | 1.1 |
| High | 20 | 5.7 |
| Pain Score | | |
| 2-3 | 67 | 19.1 |
| 0-1 | 283 | 80.9 |
| Nausea | | |
| 2-3 | 12 | 3.4 |
| 0-1 | 338 | 96.6 |

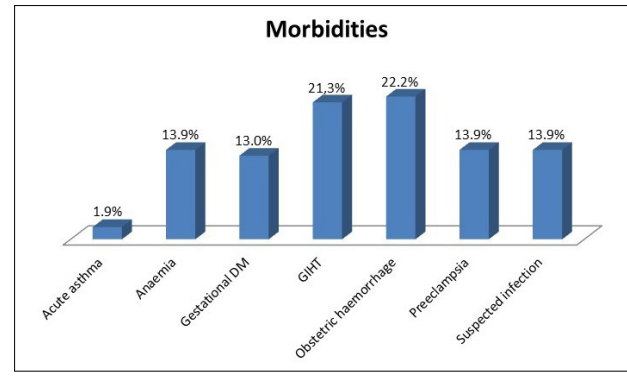


**Figure 2.** Distribution of morbidities.

No admission to the critical care unit (high-level obstetric unit), cardiorespiratory arrest, or death was observed among the individuals.

There was no association between morbidity and patients with a high respiratory rate, a high pulse, or a high nausea level (p>0.050). Morbidity was associated with high systolic blood pressure. Those with high systolic blood pressure were found to have 3.688 times increased morbidity compared to those with normal systolic blood pressure (p<0.001). Similarly, those with high diastolic blood pressure were 3.512 times more likely to have morbidity compared to those with normal diastolic blood pressure (p<0.001). Furthermore, morbidity was found to be associated with a high pain score, with those having a high pain score being 1.62 times more likely to experience morbidity than those with a score between 0 and 1 (p=0.009) (Table 6, Fig. 2).

When considering the MEOWS scale's efficacy as a screening tool, the presence of a trigger and morbidity had a high level of concordance (Kappa=0.605; p<0.001). Furthermore,

**Table 6.** Examination of morbidity risk in the presence of abnormal physiological parameters

| | Morbidity | | | |
|---|---|---|---|---|
| | Yes | No | Relative risk (%95 CI) | p |
| Respiratory Rate (High) | 3 (75.0) | 1 (25.0) | 2.471 (1.373-4.449) | 0.089*** |
| Heart Rate (High) | 7 (58.3) | 5 (41.7) | 1.952 (1.178-3.236) | 0.053*** |
| Systolic BP (High) | 64 (64.6) | 35 (35.4) | 3.688 (2.717-5.005) | <0.001* |
| Diastolic BP (High) | 19 (95) | 1 (5) | 3.512 (2.864-4.306) | <0.001** |
| Pain Score (2-3) | 30 (44.8) | 37 (55.2) | 1.625 (1.172-2.251) | 0.009** |
| Nausea (2-3) | 2 (16.7) | 10 (83.3) | 0.531 (0.149-1.902) | 0.356*** |
| Temperature (Low) | 1 (100) | 0 (0) | | |
| Temperature (High) | 1 (100) | 0 (0) | | |
| Heart Rate (Low) | 1 (100) | 0 (0) | | |
| Diastolic BP (Low) | 1 (25.0) | 3 (75.0) | 0.806 (0.147-4.433) | 1.000*** |

*Chi-square test; **Yates correction applied; ***Fisher's exact test. BP: Blood Pressure.

**Table 7.** Examining the compatibility between trigger and morbidity

| | Morbidity | | Sensitivity | Specificity | PPV | NPV | Accuracy | Kappa |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | (95% CI) | (95% CI) | (95% CI) | (95% CI) | (95% CI) | (p) |
| **Trigger** | | | | | | | | |
| Yes | 84 (69.4) | 37 (30.6) | 77.78 (68.76-85.21) | 84.71 (79.55-89.00) | 69.42 (62.40-75.64) | 89.52 (85.67-92.43) | 82.57 (78.18-86.40) | 0.605 (p<0.001) |
| No | 24 (10.5) | 205 (89.5) | | | | | | |

PPV: Positive Predictive Value; NPV: Negative Predictive Value.

when the MEOWS's ability to detect morbidity was analyzed, it was found to have a sensitivity of 77.78%, a specificity of 84.71%, a Positive Predictive Value (PPV) of 69.42%, a Negative Predictive Value (NPV) of 89.52%, and an accuracy of 82.52% (Table 7).

## DISCUSSION

Oftentimes, maternal morbidity and mortality in obstetric patients are preventable. However, there is a need for obstetric early warning systems that alert medical personnel to potential imminent critical situations. Such solutions can result in an increase in maternal safety and a decrease in maternal mortality rates. MEOWS is a screening instrument developed exclusively for obstetric patients.[10-12]

While screening tests identify patients at high risk for morbidity, diagnostic tests aim to confirm the presence of morbidity with absolute certainty. To be valuable, a screening instrument must be reliable and validated. Validation of screening tools, such as early warning systems, is based on their sensitivity, specificity, Positive Predictive Value (PPD), Negative Predictive Value (NPV), and accuracy.[2]

In the context of our study, sensitivity is the proportion of patients with confirmed morbidity who have triggered the MEOWS scale. According to previous studies, MEOWS has a higher sensitivity value than other early warning systems. The most important reason for this is that MEOWS is a morbidity-based evaluation system. In our investigation, the sensitivity of the screening method we validated was 77.78%. Singh et al.[2] completed the first validation of the MEOWS in England and reported its sensitivity to be 89%.

In a study conducted in India-where patients come from diverse cultures and lower income levels-Singh et al.[13] reported the sensitivity of MEOWS as 86.4%, similar to the aforementioned study. On the other hand, in a study conducted in Rwanda-a nation with one of the highest maternal mortality rates-the sensitivity value of the MEOWS was found to be as low as 28.9% when predicting morbidity. However, the authors also noted that the MEOWS scale was administered in English and not in the country's native language.[5]

In a separate study where the MEOWS scale was used for purposes other than morbidity estimation, Ryan et al.[11] reported that the predictive values of this scale were low for admission to the intensive care unit. The authors stated that yellow trigger values were ineffective in predicting intensive care unit (ICU) admission, whereas red triggers were more successful. The authors therefore stressed the importance of adjusting the scale's threshold values. In their evaluation of the diagnostic performance of MEOWS for maternal sepsis with chorioamnionitis, Edwards et al.[14] found that the sensitivity ranged from 40% to 100%, the specificity and positive predictive values were poor, and the test failed in cases of severe sepsis. They concluded that MEOWS should be regulated and standardized for sepsis diagnosis. However, it should be noted that MEOWS is a scale used for morbidity estimation and that it can only be expected to fail when used for different purposes.

In our investigation, the causes of morbidity were obstetric hemorrhage (22.2%), pregnancy-induced hypertension (21.3%), suspected infection (13.9%), preeclampsia (13.9%), anemia (13.9%), gestational diabetes (13%), and acute asthma (1.9%). In the initial validation of MEOWS performed by Singh et al., the causes of morbidity were reported as bleeding (43%), pregnancy-induced hypertension (HT) (31%), and infection (20%).[2] Similarly, Singh et al.[13] reported the top three causes of morbidity as pregnancy-induced hypertension (69.49%), anemia (14.2%), and obstetric hemorrhage (9.6%).

It is known that hemorrhage and hypertension are the leading causes of maternal morbidity and mortality worldwide, as well as in our country.[15,16] Similarly, hemorrhage and hypertensive disease of pregnancy rank first and second among the causes of morbidity in our study. In defining hypertension in pregnancy, we examined preeclampsia and pregnancy-induced hypertension as distinct groups due to their distinct clinical histories. We believe that this alternative classification is the reason why the calculated sensitivity value was lower than anticipated.

Specificity is determined by the capacity of the triggers to detect morbidity. Each trigger agent should ideally be able to

demonstrate a morbidity. In addition to causing unnecessary worry and anxiety, a false positive trigger in the maternity warning system would limit the efficient utilization of healthcare staff. On the contrary, a false negative result could have devastating consequences for the patient. The MEOWS chart has been demonstrated to be effective in terms of triggers. In our study, the specificity value was computed to be 84.71%, which is comparable to the values found in the aforementioned articles.[2,11,13]

In our study, the most prevalent trigger factors were high systolic blood pressure (28.3%), pain (19.1%), high diastolic blood pressure (5.7%), high pulse (3.4%), nausea (3.4%), high respiratory rate (1.1%), and high body temperature (0.3%). These values demonstrate the success of the triggers. However, we believe one issue is worth emphasizing. When the sample of patients includes many postoperative patients, as our study does, pain as a trigger, especially when it is acute postoperative pain, is independent and not associated with a morbidity. While this does not have a negative impact for the purposes of postoperative pain management, it does indeed have a negative impact on the specificity of the scale. Therefore, we suggest that the pain trigger be reevaluated and that acute postoperative pain be evaluated separately.

In the presence of a trigger, the Positive Predictive Value indicates the likelihood that a patient will experience morbidity. Positive and Negative Predictive Values demonstrate the accuracy of the MEOWS. Our study's PPV of 69.42% is greater than that reported by Singh et al.,[2] who validated MEOWS for the first time, and other previous studies.[5,11,13,14] A high PPV suggests the effectiveness of triggers in determining morbidity, hence enhancing the value of our study. Similarly, the high NPV implies that the triggers do not activate in the absence of the disease, and the normal patient can also be analyzed satisfactorily.

In our experience from this study, we have found that MEOWS is an easy-to-use scale that users (midwives and nurses) can employ without difficulty. In addition, the adaptation of this scale is quite simple, as it includes only normal follow-up parameters. After the use of the scale, no complaints were received by the employees regarding the difficulty of use or increased workload after the scale was put into use. However, the application of early warning systems such as MEOWS requires cooperation and involvement across disciplines. As a result, hospital management must urge midwives, nurses, and physicians in charge of patient follow-up to utilize the MEOWS scale and to incorporate its use into the hospital's follow-up system. The widespread implementation of these principles in patient follow-up will also be a precursor to their eventual incorporation into our national health program.

## CONCLUSION

The MEOWS scale is an effective screening instrument for evaluating obstetric morbidity. According to the results of our study, the Turkish MEOWS scale demonstrates high levels of sensitivity, specificity, and accuracy. However, data on the long-term outcomes of patients followed up with MEOWS were not included in the article. The inclusion of long-term outcomes would provide a more comprehensive understanding of the effectiveness of MEOWS.

### Limitations

The study was conducted in a single center. Therefore, we cannot be certain that the scale's capability of predicting morbidity will be generalizable to other hospitals with varied patient demographics and healthcare personnel. The results of the study may not be representative of other settings due to different hospital practices, patient demographics, and regional health systems. The second limitation is that the study did not comprehensively examine how factors such as the socioeconomic status of patients and regional healthcare differences in Türkiye may influence the implementation and outcomes of the MEOWS. These factors may play an important role in understanding the broader implications of MEOWS and how it can be effectively adopted in various contexts.

**Ethics Committee Approval:** This study was approved by the Ondokuz Mayis University Clinical Research Ethics Committee (Date: 24.03.2022, Decision No: 2022/137).

**Peer-review:** Externally peer-reviewed.

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ORİJİNAL ÇALIŞMA - *ÖZ*

# Düzeltilmiş obstetrik erken uyarı sistemi ölçeğinin Türkçe versiyonunun doğrulanması

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AMAÇ: Düzeltilmiş Obstetrik Erken Uyarı Sistemi Ölçeği (MEOWS), obstetrik hastalarda fizyolojik parametrelerdeki değişiklikleri tespit etmek ve kötüleşen hastaların daha erken tanınmasını ve yönetilmesini sağlamak için kullanılan puan tabanlı ya da renk kodlu bir sistemdir. Çalışmanın amacı, aracı olarak bu ölçeğin performansını değerlendirmek ve MEOWS'u Türkçeye kazandırarak ülkemizde kullanılabilirliğine katkıda bulunmaktır.

GEREÇ VE YÖNTEM: Yerel etik kurul izni alınan prospektif ve tanımlayıcı olan bu çalışmaya Samsun Eğitim ve Araştırma Hastanesi, Kadın Hastalıkları ve Çocuk Hastanesinde Nisan 2022-Ağustos 2022 tarihleri arasında, gebelik haftası 28 haftadan büyük ve postpartum 6. haftaya kadar olan ve yatarak tedavi edilen 350 doğum yapmış obstetrik hasta alındı.

BULGULAR: Hastaların yaş ortalaması 28.9±5.9 (18-40) yıl olup %34.6'sında (n=121) uyarıcı (tetikleyici) değerleri ve %30.9'unda (n=108) morbidite saptandı. Bireysel fizyolojik parametreler arasında en sık tetikleyici yüksek sistolik kan basıncı (SKB) (%28.3) idi. MEOWS'un performansına bakıldığında tetikleyici ile morbidite arasında istatistiksel olarak anlamlı düzeyde bir uyum olduğu görülmüştür (Kappa=0.605; p<0,001). MEOWS'un morbidite durumunu tahmin etmedeki duyarlılığı %77.78 (%95 GA 68.76-85.21%), özgüllüğü %84.71 (%95 GA 79.55-89.00%), PPV %69.42 (%95 GA 62.40-75.64%), NPV %89.52 (%95 GA 85.67-92.43%) ve doğruluk %82.57 (%95 GA 78.18-86.40%) olarak saptandı.

SONUÇ: Bu çalışma ile MEOWS'un morbiditeyi tahmin etmek için yararlı bir tarama aracı olduğu ve yeterli sensivite, spesifite ve doğruluk değerleri ile Türkçe dilinde kullanımında iyi bir performans gösterdiği saptanmıştır. Bununla birlikte, uzun vadeli sonuçların dahil edilmesi MEOWS'un etkinliğinin daha kapsamlı bir şekilde anlaşılmasını sağlayacaktır.

Anahtar sözcükler: Doğrulama; MEOWS, morbidite; obstetrik; şema.

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