EDITORIAL

Is the MEOWing of emergency department postpartum patients of diagnostic safety value?

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Severe maternal morbidity (SMM) and mortality are key population health indicators. In this issue of the Canadian Journal of Emergency Medicine (CJEM), Kaur and colleagues ask: Can the Modified Early Obstetrical Warning System (MEOWS) identify postpartum patients at risk of SMM and mortality within 30 days after emergency department (ED) presentation [1]? This is an important question to answer for the speciality of emergency medicine because SMM and mortality are often preventable. Obstetric early warning systems that alert care providers of impending critical illness may prevent SMM and mortality, improving maternal safety [2]. MEOWS is a major obstetric early warning system proposed by the United Kingdom (UK) Saving Mothers' Lives report as a direct outcome from their confidential enquiry into maternal deaths [3]. The goal of routine use of MEOWS is to help with more timely recognition, treatment and referral of women who have or are developing a critical illness. Other major obstetric early warning systems are: (1) the Maternal Early Warning Criteria (MERC) proposed by the National Partnership for Maternal Safety Collaborative in the United States (US), and (2) the Maternal Early Warning Trigger (MEWT) tool utilized in the Dignity Health System and at other hospitals in the US [2].

Kaur and colleagues used a retrospective chart review study design to answer their research question [1]. The authors report that in their study population with a postpartum complaint in a tertiary care hospital ED, the presence of a "trigger" (defined as one red or two yellow abnormal physiological parameters on the MEOWS tool) at ED triage or first nursing assessment, was associated with SMM. The authors found that the most common SMM in their ED study population was related to hypertension and preeclampsia. A key finding by the authors is the high negative predictive value [NPV; 98.2% (95% CI 95.1–99.4%)] of the MEOWS tool in their study population. The authors add that the high NPV suggests using the MEOWS tool in the ED setting may help reassure emergency medicine clinicians that they are not missing severe illness in patients presenting with a postpartum complaint. However, the high NPV of 98.2% may not be as impressive as it sounds. The probability of severe maternal morbidity (SMM) before using the MEOWS tool, the pre-test probability, was already only 7.9% (21/267), so the probability in this study population did not have SMM was already $100 - 7.9\% = 92.1\%$ before using the tool. NPV will always be high when the pre-test probability of disease is low.

The authors found that the MEOWS tool's specificity was modest [67.9% (95% CI 61.7–73.7%)], and its positive predictive value was low [PPV; 18.6% (95% CI 15.1–22.7%)]. In a study aimed to determine the ability of the MEOWS tool to predict maternal morbidity in women between 20 weeks' gestation and six weeks postpartum, admitted as inpatients to a maternity unit, Singh et al. reported slightly higher specificity with the MEOWS tool [79% (95% CI 76–82%)] but, due to the low positive PPV [39% (95% CI 32–46%)], argued for a refinement in the cut-off values, to reduce the false positive rate and the unnecessary escalation of care [4]. Similarly, Kaur and colleagues rightly point out that the

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modest specificity and low PPV in their study mean using the tool in the ED setting may increase resources and attention to patients who are not at risk of adverse outcomes. This finding by Kaur and colleagues highlights a critical problem of using early warning systems in routine clinical practice: early warning systems that result in many false positives may function as a "nuisance alarm," worsening clinical care and contributing to "alarm fatigue" [2]. "Alarm fatigue" occurs when clinical providers are overwhelmed and desensitized by alerts of minimal or no clinical usefulness ("nuisance alarms") and is a recognized source of medical errors [2].

Meanwhile, the MEOWS tool's modest specificity and low PPV reported by Kaur and colleagues support the concept that trigger thresholds for physiological "track and trigger" systems (such as the MEOWS tool) should be set locally, with the threshold reviewed regularly to optimize diagnostic performance. Therefore, future studies investigating the diagnostic accuracy of the MEOWS tool in the ED setting should consider using signal detection theory [receiver operating characteristic (ROC) curve analysis] to select possibly optimal diagnostic models and to discard suboptimal ones.

While the literature on test characteristics of maternal early warning systems (and their impact on patient outcomes) is evolving, it is crucial that researchers concomitantly validate them in the ED setting. Therefore, Kaur and colleagues should be commended for conducting the first study investigating the diagnostic performance of the MEOWS tool in the ED setting among patients presenting with a postpartum complaint. Kaur and colleagues have laid the groundwork for future studies investigating the diagnostic accuracy of the MEOWS tool and other major obstetric early warning systems in the ED setting. Although the authors highlight the limitations of their study, they did not highlight as a limitation the fact that they excluded the urine output element of the MEOWS tool because "this information is not consistently collected in the ED." Therefore, it can be validly argued that they used a "modified" version of the tool. Based on the study's limitations, it is intuitively logical to conclude that further work addressing them is required before the MEOWS tool is ready for prime time in the ED setting.

In the meantime, in response to a high number of sepsis deaths during pregnancy, the Society of Obstetricians and Gynaecologists of Canada recommended the national adoption of an obstetric early warning system to prevent morbidity and mortality [5]. As the provinces and territories work toward implementing their systems of maternal morbidity and mortality review, to review all cases out to 365 days post-pregnancy, the ED use of the MEOWS tool for patients of reproductive age is potentially a critical component to identifying maternal deaths—including those with early pregnancy—as well as into the postpartum period, where we know that risk is still very high but prevention is possible.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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