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EDITORIAL

Following NEWS trend: charting progress in obstetrics?

Track-and-trigger early warning systems were used in the general medical and surgical populations for almost a decade in the United Kingdom (UK) before being adapted for pregnant women.^{1,2} In 2012, the Royal College of Physicians standardized the scoring system used in non-pregnant adults, introducing a National Early Warning System (NEWS).³ Should a standardized scoring system be applied to the obstetric population?

Recently Smith et al. reviewed the vital sign charts used in UK consultant-led obstetric units.⁴ This review found a lack of consensus in design, and the physiological parameters and triggers used. This finding suggests that we do not have a clear understanding of what is optimum, and thus a multitude of different systems, e.g. MEOWS,^{5,6} MOEWS,⁷ IMEWS,⁸ MEWT⁹ and others,^{10–13} have been developed. An effective track-and-trigger maternal early obstetric warning system (collectively referred to here as an EOWS) aims to improve the management of critically ill pregnant women. An EOWS potentially encourages early recognition of pregnant women at risk, enhances multidisciplinary communication, clarifies expectations for escalation of care and involvement of senior clinicians, and establishes an auditable standard. These theoretical benefits may not translate into clinical practice. In particular, one of the stated barriers to implementation of EOWSs is concern about the unintended consequences of instituting a non-validated instrument.¹⁴

When considering if an EOWS improves maternal safety, what is the best measure of success? Several papers have attempted to validate EOWSs: Singh et al. found an EOWS was 89% sensitive and 79% specific to identify obstetric morbidities.⁶ The ability of an EOWS to recognize the presence of morbidity can be arbitrary; it depends on the level of agreement between an EOWS's triggers and diagnostic criteria. For example, if an EOWS's triggers and sepsis are both defined using the same quick sepsis-related organ failure assessment (qSOFA) criteria, then sensitivity will be high.¹⁵ Edwards et al. found several EOWSs had poor specificity (3.6–29%) for identifying severe sepsis (severe sepsis is old nomenclature, now redundant¹⁵).⁷ This finding should be interpreted with caution; instead of identifying pregnant women with septic shock, ideally an EOWS would flag those at risk of developing septic shock, allowing clinicians to intervene to prevent deterioration to septic shock.¹⁶ It is not just the presence of a diagnosis that defines a woman's risk of deteriorating,

but the extent that the diagnosis impacts her physiology. An EOWS highlights this physiological frame of reference.

Ryan et al.¹⁷ found that an EOWS was 96% sensitive and 54% specific to predict intensive care unit (ICU) admission and Shields et al.¹⁸ showed a non-statistically significant increase of 5.5% in ICU admission rates following introduction of an EOWS. Intensive care unit admission is not a useful outcome measure when considered in isolation; an EOWS may either appropriately increase ICU admissions, or may lead to in situ “Enhanced Maternal Care”, averting ICU admission.^{13,19} The level of medical care provided is not necessarily defined by physical location of the patient. Carle et al.¹⁰ and Peternina-Cacedo et al.²⁰ have demonstrated that several EOWSs were sensitive and specific for predicting mortality after admission to ICU. An EOWS should ideally be focused towards identifying abnormal physiology, prior to need for admission to ICU.

The primary measure for an EOWS's utility should be prevention of mortality or reduction of severe morbidity, rather than its ability to identify obstetric morbidity or to predict mortality or ICU admission. It is challenging to measure a decreased maternal mortality rate, as it is unlikely any study would be adequately powered for this as a primary outcome. Therefore, pragmatically the best measure of an EOWS's utility is to report effect on severe maternal morbidity, a 70-times more frequent occurrence.¹³ An effective EOWS will not necessarily prevent morbidity, but identify it early and potentially prevent progression to severe morbidity. Retrospective reviews of ICU admissions suggest EOWSs could reduce morbidity severity in 7.6–62% of cases.^{9,21}

When prospectively studying EOWSs, in addition to selecting the most appropriate primary outcome, there are multiple confounders that need to be considered. The perfect EOWS does not guarantee improved outcomes: once an EOWS triggers, it needs to be recognized and effectively communicated to the clinicians providing the higher level of care. These clinicians must be available and trained to respond appropriately. Successful implementation depends on organizational culture and health professional engagement, and these may vary greatly between institutions. Shields et al. overcame these inherent challenges in studying EOWSs and present the best evidence so far supporting a morbidity

benefit from an EOWS.¹⁷ Their prospective multicenter study investigated the introduction of the “Maternal Early Warning Trigger (MEWT)” tool, comparing maternal morbidity to baseline and to other departments in the same hospital system where the MEWT was not used. They included over 180000 deliveries in the analysis and demonstrated a significant reduction in severe (18.4%, $P=0.01$) and composite (13.6%, $P=0.01$) maternal morbidity, as defined by the Center for Disease Control and Prevention.

There are many outstanding questions regarding EOWSs, such as “What parameters should be included in the optimum EOWS chart?” “What are the best triggers?” “How often should vital signs be taken?” “What are the most appropriate trigger-actions?” The Royal College of Anaesthetists’ draft document “Enhancing care for the sick mother” proposes some standards for EOWSs, the ObsEWS.¹³ It recommends using only six scoring parameters: respiratory rate, oxygen saturation, heart rate, systolic blood pressure (BP), diastolic BP, and temperature. In addition, it recommends that altered consciousness or clinical concern should automatically trigger maternal review by a clinician. These parameters are already the most common combination used across the UK, in 85% of charts.⁴ ObsEWS encourages “supplementary observations” to be recorded separately from the six “early warning observations”.¹³ Smith et al. reported that EOWSs frequently record maternal pain, lochia characteristics, or ‘looks unwell’.⁴ Capturing these additional measures is important to prevent EOWSs replacing clinical judgment, and to identify rare but serious diagnoses. For instance, pain has been highlighted as the only early symptom for cardiac disease or aortic dissection in a parturient.²² The ObsEWS does not suggest trigger levels; defining “normal” pregnancy physiology is an important step in their determination. Surprisingly we do not yet know what “normal” is.²³ “Normal” ranges differ in the antepartum, intrapartum and postpartum periods, and are dependent on mode of delivery. The 4P study will help define “normal”, providing a database of maternal physiology specific for stage of pregnancy.²⁴ An EOWS is not just about defining normality; it is about identifying pregnant women who are at risk of deteriorating early enough, in order to trigger intervention that prevents deterioration and potential harm. This is a subtle but important distinction.

The ideal EOWS would be 100% sensitive and specific. In practice EOWSs will be a trade-off between the two. Sensitivity is paramount to ensure all pregnant women at risk of deterioration are referred to a clinician. Specificity is also important; if low, it leads to false positives that may overload the healthcare system, or may cause alarm fatigue, or unnecessary intervention. If triggers for EOWSs are chosen to maximize sensitivity the risk of decreasing specificity can be

mitigated in several ways. Additional risk stratification can be built into the prescribed trigger actions; for example, if temperature is a trigger, the actions could include performing a serum lactate, a white blood cell-count and a sepsis score.^{7,25} If hypertension is a trigger, the action might be to perform a urine protein/creatinine ratio, uric acid concentration, liver function tests and a platelet count. Increasing the amount of time that an abnormal parameter needs to be sustained before triggering also improves specificity. Requiring abnormal parameters to be sustained for thirty minutes, rather than being a one-off reading, improved specificity (80–96%) and positive predictive value (78–95%) for one EOWS.⁹

To function consistently an EOWS should be easy to use and reliable. There are two main designs: either a two-tier triggering system (used in 66% of UK units),⁴ or assignment of an ordinal number to parameter ranges, depending on the extent of abnormality, then calculating an aggregate score. A two-tier system is possibly more reliable, with less inter- and intra-individual variability in scoring.²⁶ An aggregate score allows for a more graduated response. For identification of severe sepsis, two-tier^{5,6,12} systems were found to be more sensitive (100% vs 40–60%) and less specific (4–29% vs 84–97%) when compared to aggregate^{10,11} scores.⁷

Should we standardize the EOWS? It is likely that performance between different EOWSs varies significantly.^{7,10} The stated benefits of standardization include reducing variation in patient care, familiarity for staff moving between hospitals, improved multidisciplinary communication, and training and education of all staff.³ Given that the optimal EOWS is not currently known, standardization with central reporting would enable prospective analysis, and provide the volume of data required for further validation and ongoing improvement. Although there are obvious advantages to standardization of the EOWS, there are also arguments against standardization. Physiological changes, obstetric pathology and rates and indications for ICU admission differ in the different stages of pregnancy.¹⁹ Therefore, is it possible for one standardized EOWS to be effective across all obstetric risk settings and all stages of pregnancy? Should we instead be using technology to customize expected physiology and triggers to the individual patient and situation? A timely response is dependent on proximity to help. Should we be using more conservative triggers in the community setting, to identify women earlier, because of the time taken to transfer to a higher level of care?

It is ten years since Saving Mothers’ Lives recommended routine use of an EOWS.¹ My anecdotal experience is that, as with many changes in practice, there is initial resistance to introduction of an EOWS, but once established any perceived negative implications are overshadowed by the observed benefits. I think

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