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ORIGINAL ARTICLE

A national survey of obstetric early warning systems in the United Kingdom: five years on.

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Short title: UK survey of obstetric early warning systems

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Summary

The Confidential Enquiries into Maternal Deaths in the UK have recommended obstetric early warning systems for early identification of clinical deterioration to reduce maternal morbidity and mortality. This survey explored early warning systems currently used by maternity units in the United Kingdom. An electronic questionnaire was sent to all 205 lead obstetric anaesthetists under the auspices of the Obstetric Anaesthetists' Association, generating 130 responses (63%). All respondents reported use of an obstetric early warning system, compared with 19% in a similar survey in 2007. Respondents agreed that the six most important physiological parameters to record were respiratory rate, heart rate, temperature, systolic and diastolic BP and oxygen saturation. One hundred and eighteen leads (91%) agreed that early warning systems helped prevent obstetric morbidity. Staffing pressures were perceived as the greatest barrier to their use, and improved audit, education and training for healthcare professionals were identified as priority areas.

Maternal mortality has reached a plateau in high-income countries, which in the UK is currently 11.4 per 100 000 live births per year [1]. One approach to achieving a possible reduction in mortality is by targeting severe maternal morbidity through the use of early warning systems (EWS) to monitor women during pregnancy and the peripartum period. These are predominantly objective 'calling criteria' used to indicate the need to call for clinical assessment and intervention. Also known as 'track and trigger' systems, EWS can be single-parameter, multiple-parameter, aggregate-weighted scoring systems or a combination [2]. They use physiological (e.g. heart rate, BP, respiratory rate) and other parameters to 'track' a patient's condition, detect deterioration early and 'trigger' appropriate clinical intervention. The National Institute for Health and Care Excellence (NICE) recommends that such systems be used for all hospitalised patients [3] as delayed interventions for acutely ill patients leads to poor outcomes [4, 5]. National guidance recommends the use of EWS in maternity [1, 6]. MEOWS, an acronym for 'modified early obstetric warning system' is more colloquially used to describe the observation chart recommended by the Confidential Enquiry into Maternal and Child Health [7] and is thought to be a useful tool for predicting maternal morbidity [8]. In this article, EWS refers to all its forms as used in current UK obstetric practice. Although the UK Confidential Enquiries into Maternal Deaths (CEMD) recommended the use of EWS [1, 7], no standard EWS has been adopted leading to many different EWS being used nationally [9]. In 2007, only 30 of 222 (19%) consultant-led obstetric units regularly used an EWS in obstetrics, with nine (6%) using a system modified for parturients [10].

The Modified Obstetric Early Warning Systems (MObs) Research Group based at Bournemouth University consists of members representing a number of academic and clinical institutions in the UK. Our national survey aimed to identify which EWS are currently used in obstetric practice, which physiological parameters are included and to describe problems associated with EWS.

Methods

The survey content was based on a 2007 Obstetric Anaesthetists' Association (OAA)-approved survey (OAA survey number 76) [11] and adapted by the MObs Research Group to assess the uptake of EWS in obstetrics. Our questionnaire was submitted to the OAA Audit Sub-Committee for review. The survey encouraged free-text comments and requested that copies of existing obstetric EWS used in local practice should be forwarded for subsequent comparison and analysis. After approval, an electronic questionnaire was sent to all 205 lead

obstetric anaesthetists in November 2012 (OAA survey number 135) [11]. Two reminder e-mails were sent to non-responders in December 2012 and January 2013. All responses were anonymised and results were collated and discussed within the team.

Results

Of the 205 invited participants, 130 completed surveys (overall response rate 63%) were returned. Of these, 33 (25%) were from tertiary referral units and 97 (75%) were district general hospitals. All respondents reported use of an obstetric EWS, with 117 (90%) having a written policy in place. The CEMACH-recommended chart was used by 58 (45%), a modified version by 65 (50%) with seven (5%) using another system. Usage was highest for women after surgery and lowest for women in the community (Table 1). Adherence to CEMD recommendation was the main reason for chart introduction selected by 107 (82%) of respondents, with 66 (51%) stating that it was a Clinical Negligence Scheme for Trusts requirement. Forty-six (35%) agreed that the occurrence of critical incidents and/or risk management prompted change. Free-text comments highlighted a general desire amongst maternity staff (anaesthetists, obstetricians and midwives) for its use and a need to conform to other clinical areas within the Trust. There was strong agreement regarding the physiological parameters that should be included on any obstetric EWS (Table 2). In addition to the triggers listed, free-text suggestions also included blood sugar level, oxygen supplementation and pain scores. One hundred and twenty-four leads (95%) considered the limits used on their charts to be appropriate for obstetrics. The main reported barriers to full implementation of EWS were staffing pressures, lack of support from midwives and lack of education, training and audit (Table 3). Eighty-one leads (62%) reported having a training programme in place and less than half reported that an audit of compliance had been undertaken in their unit. The final question simply asked whether the EWS tool was useful (with no further clarification given); 118 (91%) respondents answered 'yes' and 12 (9%) were unsure.

Discussion

In 2007, only 19% of maternity units used an obstetric EWS [10]. Five years later, 130 (100%) responding units use an obstetric EWS. Although fewer than half the respondents currently use the CEMACH-recommended chart, several units use a modified version. Those with a high dependency area generally have the same obstetric EWS as on maternity wards or a critical care observation chart. There was widespread inter-hospital variation in the type of

EWS and thresholds for escalating care. There was good agreement regarding the choice of parameters to be included in any obstetric EWS.

In 2012, the Royal College of Physicians recommended a National Early Warning Score (NEWS) for UK hospitals [12]. However, they do not recommend its use in obstetrics, because maternal physiology is different to the non-pregnant state. The first attempt to internally validate an obstetric EWS was based on physiological parameters derived from obstetric admissions to intensive care [13]. However, this EWS has not been validated on an obstetric ward, or for any outcome other than ICU death [14]. The majority of the obstetric EWS currently used are single parameter based on the CEMACH-recommended chart [7] in contrast to the aggregate-weighted charts used by NEWS or the obstetric EWS proposed by Carle et al. [13]. The single parameter systems are based on the premise that the occurrence of just one abnormal physiological parameter can be used immediately to trigger a call for help. The advantage of this is its simplicity; the disadvantage is that it does not lend itself easily to risk stratification or a graded response.

In our survey, four physiological parameters (heart rate, respiratory rate, systolic BP and temperature) were deemed essential to the recognition of deterioration by all units. A further two parameters (S_pO_2 and diastolic BP) were also highly rated. This demonstrates consistency between national recommendations, current research work and individual opinion. Therefore, it seems sensible that these six should be considered in any national obstetric EWS and further research. The inclusion of 'inspired gas during S_pO_2 measurement' requires consideration, as S_pO_2 can only be interpreted correctly with its knowledge.

The importance of subjective views of acute illness should not be overlooked [15, 16]. Results from a recent UK survey highlighted that midwives were in favour of including triggers such as the concern of midwives, patients or their partners/relatives (D. E. Bick, unpublished observations, 2013). Such subjective criteria have already been incorporated in paediatric and non-obstetric adult settings [17, 18]. This echoes a key theme in the recently published *Francis Report* into the failings at Mid-Staffordshire NHS Foundation Trust where staff did not always listen to patients', carers' and families' concerns [19].

That obstetric EWS are less frequently used on midwife-led units or in the community is an interesting finding. CEMD recently highlighted the significance of genital tract sepsis in maternal death [20]. The Transforming Maternity Services mini-collaborative, part of the Welsh 1000 Lives Plus programme, developed a specific EWS for community midwives [21]. Known as the Community Early Warning Score, it is designed to be simple and quick to complete and aid decision-making, consistency and documentation.

Any obstetric EWS must overcome institutional barriers, especially where there has previously been poor compliance and staff disregard. The high workload pressures due to staff shortages, a rising birth rate and increased health complexities of pregnant women, may conflict with recording maternal EWS. Taking observations may also be perceived as inconvenient and unnecessary for 'well' women. If obstetric EWS are to be used successfully, the needs of staff and pregnant and postnatal women must be considered.

A lack of training was the second most important barrier to EWS, but is being addressed by emergency courses, such as PROMPT (Practical Obstetric Multi-Professional Training) [22], ALERT (Acute Life-Threatening Events: Recognition & Treatment) [23] or even specifically tailored ALERT courses [24]. Midwives and maternity support workers appeared to receive the majority of training, with varying obstetric and anaesthetic staff involvement. An obstetric EWS might be a valuable tool to support early detection of complications, although care is needed to ensure that it does not over-medicalise childbirth which is a concern of some midwives. Perhaps targeting specific subgroups of women, such as those with co-morbidities or specific interventions, may address this.

One hundred and seventeen (91%) lead anaesthetists believed that an obstetric EWS was a useful tool for the reduction of maternal morbidity. However, a parallel survey of 107 Heads of Midwifery revealed that only 71 (66%) thought this to be the case (D. E. Bick, unpublished observations, 2013). This disparity needs to be further investigated.

Our survey revealed that all respondents' units use some form of obstetric EWS and the majority considered it a useful tool in reducing maternal morbidity. However, staffing pressures and lack of teaching and training are the two most common barriers. There was general consensus regarding the most important physiological parameters to be used in any EWS and these agreed with Carle et al. and NEWS [12, 13]. Continuing education, training and audit is essential to improve uptake and utility of obstetric EWS, so that it may be a useful tool towards the reduction of maternal morbidity and mortality.

Competing interests

GBS was a co-developer of the VitalPAC clinical software system. VitalPAC is a collaborative development of The Learning Clinic Ltd (TLC) and Portsmouth Hospitals NHS Trust (PHT). GBS was an employee of PHT until 31/03/2011. PHT has a royalty agreement with TLC to pay for the use of PHT intellectual property within the VitalPAC product. GBS's wife is a minority shareholder in TLC. GBS is an unpaid research advisor to TLC. GBS was also a co-developer of the Acute Life-Threatening Events – Recognition and Treatment (ALERT) course, which is owned and run by PHT, which receives payment for sales of the courses and course materials. GBS is an Independent consultant to Laerdal Medical AS on the early recognition and response to patient deterioration. GBS was a member of the following groups: Royal College of Physicians of London's National Early Warning Score Development and Implementation Group; NICE Guideline Development Group on "*Acutely ill patients in hospital. Recognition of and response to acute illness in adults in hospital*"; NPSA Observatory group considering "*Deterioration not recognised or not acted on***;** DH Emergency Care Strategy Team's "*Competencies for Recognising and Responding to Acutely Ill Patients in Hospital*"; National Cardiac Arrest Audit steering committee; Executive Committee of the Resuscitation Council (UK); and the RC (UK)'s Immediate Life Support (ILS) course working group. GBS was also a paid Expert Adviser to South Eastern HSC Trust re the Report of the Northern Ireland Audit of Physiological Early Warning Scoring Systems. GBS is a co-Director of the annual International Rapid Response Systems conference and Board member of International Society for Rapid Response Systems.

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Appendix – Survey Questions

(1) What type of maternity unit do you work in?
Tertiary referral hospital
District general hospital

(2) What is the approximate number of births per year in your unit?
<2500 births
2500-3999 births
4000-5499 births
5500-6999 births
≥7000 births

(3) Does your unit use an Early Warning System in obstetrics?
Yes and there is a written policy
Yes but there is no written policy
No (Jumps to: "Any other comments regarding EWS?")

(4) Which subset of women are the charts used for?
antenatal/postnatal women in the community
women in the midwife-led unit
ALL women admitted to the consultant-led unit
ALL women after surgery
women in the High Dependency Unit
high-risk women ONLY (please specify)
other (please specify)

(5) Is your chart:
the CMACE recommended one
your own version of an EWS chart
other

(6) Are or have the following been barriers to full implementation?
lack of teaching/training
lack of support for EWS charts by midwives
lack of support for EWS charts by doctors
concurrent use of a standard TPR chart/partogram
too time-consuming
impact on the mother of frequent interruptions
staffing pressures to adequately complete EWS charts
poor correlation of charts with obstetric physiology
lack of evidence and validation of EWS in obstetrics
other (please specify)

(7) Do you think that the trigger thresholds of the chart you use are appropriate for obstetric patients?
Yes
No (please explain)

(8) Which of the following parameters in your opinion should be documented on an EWS chart?
    temperature
    heart rate
    systolic BP
    diastolic BP
    urine output
    respiratory rate
    oxygen saturations
    AVPU score
    capillary refill
    lochia
    'looks unwell' comment
    proteinuria
    any others?

(9) What prompted the introduction of the chart to the unit?
    critical incident(s) / risk management
    CMACE recommendation
    Clinical Negligence Scheme for Trusts requirement
    other (please specify)

(10) Is there specific teaching/training on your EWS chart for healthcare professionals?
    Written instructions
    Training course
    If YES, which groups receive the training (midwives, maternity support workers, anaesthetists, obstetricians)

(11) Has your unit audited compliance with the EWS chart?
    Yes (can you provide a brief summary of results and exactly what the audit analysed?)
    No
    Don't know

(12) Do you believe the EWS tool is useful?
    Yes
    No
    Unsure

Table 1 Responses of lead obstetric anaesthetists regarding when and where obstetric EWS charts are used, in descending order of frequency. Values are number (proportion).

Subset of women*	n
All women after surgery (n=122)	116 (95%)
Women in the High Dependency Unit (n=120)	105 (88%)
All women admitted to the consultant-led unit (n=130)	109 (84%)
Women in the midwife-led unit (n=105)	49 (47%)
High-risk women only (n=76)	26 (34%)
Antenatal/postnatal women in the community (n=91)	20 (22%)

*Denominator is given in brackets after each category as some categories were left blank by respondents

Table 2 Responses of lead obstetric anaesthetists regarding parameters that should be included on an EWS chart, in descending order of frequency. Values are number (proportion).

Parameter	n
temperature	130 (100%)
heart rate	130 (100%)
respiratory rate	130 (100%)
systolic BP	130 (100%)
oxygen saturations	127 (97.7%)
diastolic BP	124 (95.4%)
urine output	110 (84.6%)
AVPU score*	101 (77.7%)
'looks unwell'	72 (55.4%)
proteinuria	72 (55.4%)
lochia	69 (53.1%)
capillary refill	38 (29.2%)

*this acronym (**a**lert, responds to **v**oice, responds to **p**ain and **u**nconsciousness) denotes a system used as a rapid method of assessing a person's level of consciousness

Table 3 Responses of lead obstetric anaesthetists regarding perceived barriers to full and proper implementation of an obstetric early warning system (EWS) system, in descending order of frequency. Values are number (proportion).

Barrier	n
staffing pressures to adequately complete EWS charts	45 (34.6%)
lack of support for EWS charts by midwives	28 (21.5%)
lack of teaching/training	27 (20.8%)
concurrent use of a standard vital signs chart/partogram	26 (20.0%)
too time-consuming	18 (13.8%)
lack of support for EWS charts by doctors	12 (9.2%)
lack of evidence and validation of EWS in obstetrics	11 (8.5%)
impact on the mother of frequent interruptions	10 (7.7%)
poor correlation of charts with obstetric physiology	9 (6.9%)
other	5 (3.8%)