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PROTOCOL FOR THE SYSTEMATIC REVIEW OF LITERATURE ON EARLY WARNING SYSTEMS FOR USE IN OBSTETRIC PATIENTS

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1.0. Background

Every day, about 830 women die worldwide from preventable causes related to pregnancy and childbirth: In 2015, maternal mortality was estimated at 303,000 around the world, majority (approximately 99%) of which occurred in the developing countries (Alkema L et al, 2016; WHO 2016). Analyses of these deaths have consistently revealed that delays in the recognition of pregnancy complications is a major contributing factor (Alkema L et al, 2016; Paternina-Caicedo et al, 2017). Thus, one of the proposed methods to reduce both maternal morbidity and mortality is by using clinical tools that would allow early recognition of patients who are likely to benefit from earlier lifesaving interventions or referral to a higher level of care (Edward SE et al, 2014; Austin DM et al, 2014; Shield LE, et al 2016). Such tools can constitute early warning systems.

Reports of the 2003-2005 triennial Confidential Enquiry into Maternal and Child Health (CEMACH) in the UK recommended the introduction of the modified early obstetric warning system (MEOWS) in all obstetric inpatients to track maternal physiological parameters, and to aid early recognition and treatment of the acutely unwell parturient (Lewis G, 2007). Following this recommendation, several versions of the chart were adopted for use in hospital maternities, most of which lack overall validity, with no single chart accepted as the national or international gold standard for maternity care (Isaacs RA, et al 2015; Singh et al, 2012).

A systematic review identified and summarized evidence on the effectiveness of early warning systems used in obstetric practice (Joel Betesh, et al 2013). According to this review, there is no direct evidence on the effect of obstetric early warning systems on patient outcomes. Hence, no sufficient evidence on which to draw any conclusions about the comparative effectiveness of different versions of MEOWS or related early warning systems for obstetric patients. However, several MEOWS validation studies were conducted after this review (Diana M. Austin et al 2014, Singh S et al, 2016, Paternina-Caicedo et al, 2017, Merriel et al, 2017), all of which strongly supported MEOWS as a valuable screening tool for obstetric morbidity.

Also, contrary to the conclusion of the previous systematic review (Joel Betesh, et al 2013) that no MEOWS studies measured the impact of the early warning system on patient outcomes, the use of obstetric early warning trigger tool has been shown to lower the prevalence of Centre for Disease Control (CDC)-defined severe maternal morbidity and composite morbidity, significantly in six pilot hospitals, compared to nineteen non-pilot controls in the USA (Shield LE, et al 2016). Moreover, the review included only studies on pregnant women in inpatient hospital units, excluding critical care, while the only statistically derived obstetric early warning system so far (Carle C et al, 2013), and its validation studies (Carle C et al, 2013; Paternina-Caicedo et al, 2017) were all conducted using pregnant and recently delivered women (in puerperium) admitted to critical care units.

A more holistic and up-to date review of literature is therefore necessary to ascertain evidence for the usefulness of MEOWS as a screening tool for morbidity, and its overall effectiveness in reducing adverse maternal outcomes. It was also deemed necessary to investigate evidence on feasibility of use of EWS in low resource settings which contribute over ninety nine percent of the global burden of maternal deaths (WHO 2016).

2.0. Aim

The aim of this systematic review is to contribute to better understanding of the overall usefulness of MEOWS and other related early warning systems for obstetric patients.

The specific objectives are as follows;

1) To identify, summarize describe and synthesize the existing evidence supporting MEOWS as a valuable bedside screening tool for obstetric morbidity in various settings.
2) To investigate the evidence on the overall effectiveness of obstetric early warning systems in reducing prevalence of measurable patient outcomes (Maternal deaths, near misses, ICU admission rates, among others) in various settings (high and low resourced)

3.0. Methods

3.1. Registration

We intend to register this systematic review on the international prospective register of systematic reviews (PROSPERO).

3.2. Criteria for inclusion of studies

Prospective and retrospective longitudinal, cross-sectional, case-control, cohort studies, step wedge and randomized controlled trials will all be included in the review so long as they possess the following characteristics based on PICO

a) Participants

Pregnant women in labour, sick pregnant and recently delivered women (within 6 weeks of delivery) admitted to all inpatient hospital units including intensive care and high dependency units.

b) Intervention

MEOWS and other related scoring systems for obstetric patients, to include both paper-based and electronic monitoring systems.

c) Comparisons

Non-obstetric early warning systems, usual care practice.

d) Outcome measures

Outcomes will be those commonly used in the MEOWS validation studies.

Primary: severe obstetric morbidity (maternal near misses), maternal deaths, severe maternal outcomes (deaths + near misses)

Other outcomes: ICU admission, Sepsis, length of ICU stay

3.3. Search methods for identifying the studies

Specific search strategies will be developed for each database by two reviewers, and will be checked by research fellows at the Cochrane Pregnancy and Childbirth group, Liverpool School of Tropical Medicine. The strategies will use Medical subheadings (MESH) and free text targeting articles published in English language.

3.4. Searching other sources

We will perform non-electronic searches of the reference lists of all included studies. The initial selection criteria will be as broad as possible to ensure that as many studies as possible are assessed as to their relevance to this review.

3.5. Selection of articles

The retrieved titles and abstracts will be reviewed by two reviewers to exclude studies that fall outside the inclusion criteria, such as studies of early warning systems on non-obstetric adult population, foetal studies, or studies of neonatal early warning systems.

The included and excluded studies, as well as those where there is uncertainty will be checked by a third independent reviewer, to agree on the included studies. Following this, the full texts of

potentially relevant articles will be retrieved for data extraction. Figure 1 below is a flow diagram that summarizes the study selection process

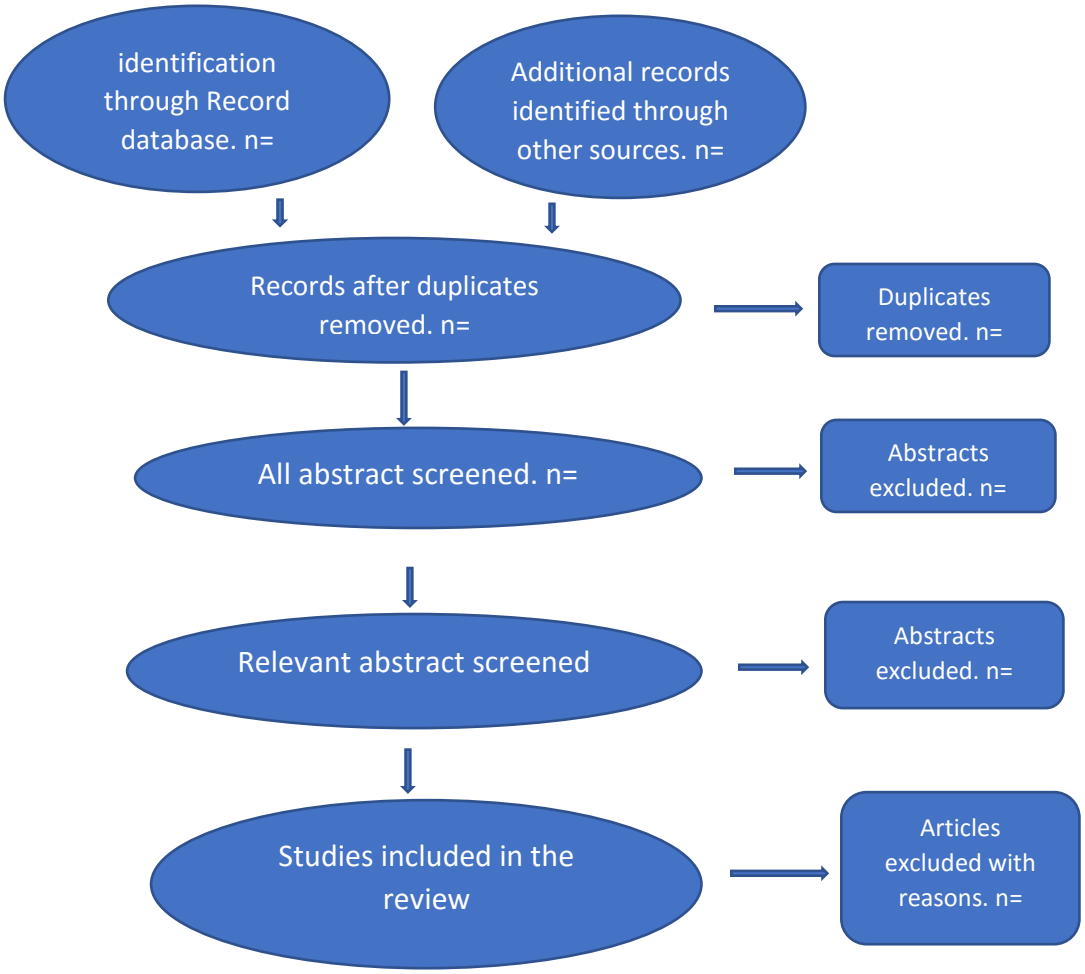


Figure 1: Articles selection process

3.6. Assessment of bias

A quality assessment of studies that meet our inclusion criteria will be undertaken by the primary and co-reviewer independently. Where the two disagrees, this will be resolved by referring to the original data. The quality assessment will be performed in accordance with the QUADAS-2 (Quality Assessment of Diagnostic Accuracy Studies) assessment, following the methodology of Ioannou et al (Whiting F.P. et al 2011; Ioannou C et al, 20012). The specific assessment criteria of the QUADAS-2 tool will be adapted for this review, checking the applicability of the signalling questions to its context. Results of the quality assessment will be presented in tabular form in the review.

3.7. Data extraction

Data will be extracted onto electronic spreadsheet (excel) by the primary reviewer, and the most important results from reviewed studies will be summarized. This will be cross-checked by two other reviewers (the co-reviewer and an independent third reviewer) and any difference of opinion will be resolved by consensus, and or consultation with the original study authors.

3.8. Dealing with missing data

In cases where relevant data have not been adequately reported, or presented in format that is not suitable for extraction, the original authors will be contacted, and the data requested. In the first

instance, contact details from the original paper will be used, but where these are no longer valid, contact details will be sought from recent publications, from institutional websites or through general online search engines.

3.9. Categorizing studies

Papers will be categorized according to study aims. Overall, we expect all retrieved articles to fall into either of four categories; studies on design of EWS, validation studies, studies assessing the effects of EWS on measurable patient outcomes, and others. When the studies themselves do not give us sufficient information to categorize, we will contact the authors, if this fails, such studies will be excluded from the review

3.10. Synthesis

A summary table of all included studies in this review will be produced, classifying them into low/middle income and high-income settings. We will analyse the studies on design and validation together identifying the predictive properties and overall diagnostic accuracy in each of the studies. These will be summarized and presented, comparing them to the modified Wilson and Jungner criteria for an ideal screening tool (Andermann A et al, 2008).

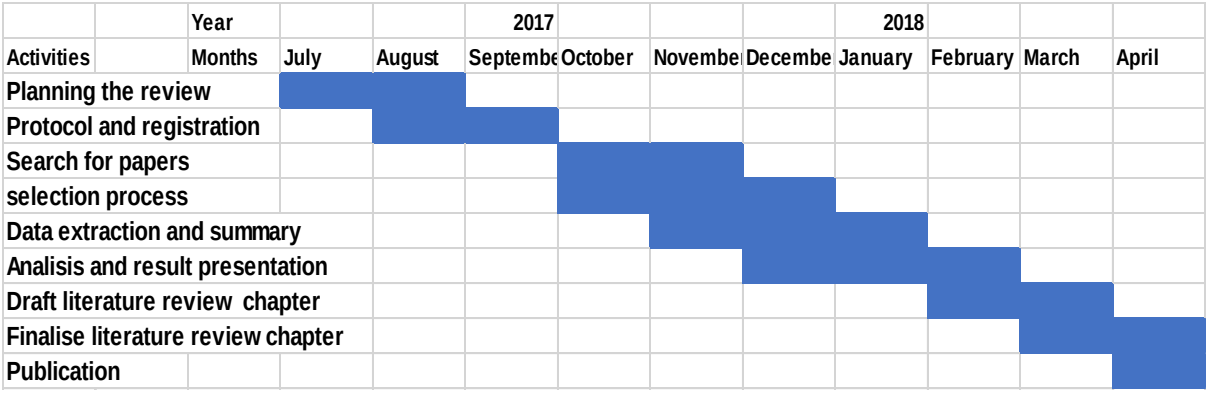
As we expect other studies to be of diverse designs, we will employ a narrative synthesis in their analyses. The results or frameworks will be discussed with appropriate emphasis given to publications that are more methodologically robust. The results will be appropriately tabulated. These tasks will be undertaken by the primary reviewer, and reviewed by two other reviewers.

3.11. Conflict of interest

The reviewers are unaware of any potential conflict of interest in this review.

3.12. Timeline

Below is the activity Gantt chart for the proposed systematic review. The review expected to take 9 months to complete.



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