Interventions to enhance maternal awareness of decreased fetal movement and its effect on perinatal morbidity and mortality: a systematic review

Background
Fetal movement is an important factor in pregnancy health. As an undisputed sign of life, its presence is reassuring and its reduction or absence causes concern. The pregnancies of women who consistently report fetal activity have shown very low morbidity and mortality rates\(^1\). On the other hand, decreased fetal movement (DFM) is associated with a range of intrapartum and postpartum pathologies, including fetal growth restriction\(^2-5\) and stillbirth\(^6-9\). Fetal growth restriction has often been reported to be associated with maternal perception of DFM. DFM has also been reported in the days preceding unexplained stillbirth. Thus, timely reporting of DFM may provide an opportunity to initiate necessary preventive management,\(^7,10\) and thereby reduce the risk of stillbirth, particularly that deemed avoidable\(^1,11\).

Several interventions on improving maternal awareness of DFM for reducing fetal morbidity and mortality have been reported, including information and quality improvement campaigns and fetal movement counting. Fetal movement counting is a daily systematic record of the mother’s perception of her baby’s movement. Explorative studies on kick counting patterns have concluded that the information in the temporal fetal movement counts is limited and that any effects of fetal movement counting most likely reflect improved awareness following the routine of counting\(^12-15\). Thus in this review interventions to increase maternal awareness of fetal movement is included, irrespective of whether fetal movement counting was part of the intervention or not.

Critiques have argued that interventions to raise maternal awareness of fetal movement may cause maternal anxiety, overuse of restricted health care resources, and iatrogenic adverse effects.

There are numerous reviews and expert comments on the usefulness of interventions to raise maternal awareness of fetal movement. However, only one review meets the formal requirements for being a systematic review\(^16\). This review was limited to fetal movement counting as intervention compared no counting or different methods of fetal movement counting on outcomes of pregnancies. In the planned systematic review we will include all aspects related to interventions to increase maternal awareness of fetal movements.

Objective:
Determine the effect of interventions to raise maternal awareness of fetal movement in reducing perinatal morbidity and mortality, and its effect on maternal psychological health, utilization, coverage and access, safety, use of resources and equitability.

Population:
Women with third trimester singleton pregnancies
**Intervention:**
Interventions to raise maternal awareness of fetal movement through (i) standardized information to women and care providers versus standard care with no standardized information, or (ii) fetal movement counting versus standard care including: no counting +/- advice about monitoring or awareness of movements or instructions to count movements.

**Outcome measures**

**Primary outcomes**
- **Fetal health** including: perinatal death (antepartum/intrapartum/early neonatal/late neonatal), preterm birth, small for gestational age (centile definition), low birth weight (<2500 grams), birth asphyxia, transfer to neonatal care unit, induced deliveries, emergency cesarean section.

**Secondary outcomes**
- **Maternal psychological health** including: maternal concern (Cambridge worry scale or other) and fetal-maternal attachment (Prenatal Attachment Inventory or other)
- **Utilization, coverage and access** including: target population, proportion of population consenting to participate, and compliance with recommendations.
- **Safety** including: delay in reporting DFM (>48 h for DFM and > 24 h for absence of DFM), OR proportion of women; (i) presenting with predefined alarm; (ii) presenting without predefined alarm; OR the proportion of women with alarm not presenting to health care.
- **Resource use** including: number of DFM pregnancies evaluated in antenatal care OR resources used in evaluation of DFM pregnancies (CTG, Ultrasound for fetal growth, amniotic fluid and fetal activity, Doppler) OR resources used in follow-up of DFM pregnancies (scheduled for repeat consultations, admitted to delivery unit for observation, induction or delivery).
- **Costs** including: relative costs of intervention in relation to outcomes.

**Method:**
We will do a systematic literature search in MEDLINE, EMBASE and the Cochrane Library for publications including the relevant search terms. Search terms include *fetal/fetus activity, fetal movement(s), fetal movement count(s), fetal movement chart(s), kick count(s) and kick chart(s)* (in both US and English spelling), restricted to human studies. In addition we hand search reference lists of included studies for additional studies that may not be indexed in the databases included. We made no restrictions to publication year or publication language.

Extracted articles/abstracts will be screened by their relevance to interventions to raise maternal awareness of decreased fetal movement, including formal fetal movement counting. Study screening will be carried out by two independent reviewers and disagreements will be solved by a third reviewer and consensus. Data will be extracted according to predefined data extraction information presented below.
Inclusion criteria
Inclusion criteria are any intervention studies on maternal awareness of fetal movements including cluster RCT’s, RCT’s and quasi RCT’s, before-and-after studies, and interrupted time-series designs measuring:

- effects on perinatal morbidity and mortality
- patient perspectives
- utilization, coverage and access
- safety
- use of resources and equitability
- cost-effectiveness

Exclusion criteria
- effect studies reporting other comparators than standard care
- other study designs than those listed
- studies reporting maternally perceived FM in comparisons with objective measures (ultrasound etc.) aiming to validate maternally perceived FM

Where comparable studies and outcomes are identified, meta-analyses will be undertaken in Revman using random effects model. Reasons for statistical heterogeneity ($I^2 >30\%$) will be explored through subgroup analysis and examining characteristic of the studies.

Subgroup analysis will be undertaken according to country setting (high versus low and middle) and risk profile of participants.

**Quality assessment:**
The quality of randomized controlled trials will be assessed by the The Cochrane Collaboration’s tool for assessing risk of bias $^{17}$, and quality assessment of non-randomized studies will be based on checklists from the Ottawa Non-Randomized Studies Workshop$^{18}$

**Review Team:**
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**Competing interests:**
None of the authors have any competing interests
STUDY SCREENING FORM

Study date:
Last name of first author:
Reviewer initials:

1. Is this a case study/case report/non-intervention-study? (if, so exclude)
2. Is this reporting multiple pregnancies (if, so exclude)
3. Are outcomes of key interest reported (standardized information interventions/focused fetal movement counting data AND birth outcome) (if, no – exclude)
4. Category of study
5. Decision: (exclude/include/needs consensus)
6. Comments:
STUDY INFORMATION

Study ID:
Review author initials:

STUDY INFORMATION
1. Study information
   a. Author
   b. Year of publication
   c. Source of publication
      i. Journal
      ii. Conference proceedings
      iii. Master/doctoral thesis
      iv. Unpublished
      v. Other

2. Study design
   a. RCT
   b. Cluster RCT
   c. Interrupted time series
   d. Non-randomised comparison
   e. Within-group comparison
   f. Other

POPULATION CHARACTERISTICS
3. Country (txt)

4. Risk profile
   a. Mixed high-low risk
   b. High risk
   c. Low-risk/healthy
   d. Total population
   e. Unknown

5. Setting
   a. Total population
   b. Total single-site hospital population
   c. Total multi-site hospital population

6. Total enrolled
7. Total for randomization

INTERVENTIONS
8. Comparator
   a. Standard care (-FMC/-advice)
   b. Awareness only (-FMC/+advice)
   c. Selective FM counting (+FMC/-advice)
   d. Other FMC method

9. Intervention (txt)
10. Details of counting method (txt)
11. Period of counting in pregnancy (txt)

DFM-DEFINITION

12. DFM-definition (txt)
13. Rationale for DFM definition (txt)
14. Definition of movements (txt)

CONSORT DETAILS INTERVENTION

15. Number randomised
16. Number analysed
17. Reasons for drop-out

CONSORT DETAILS CONTROL

18. Number randomised
19. Number analysed
20. Reasons for drop-out

OUTCOMES IN INTERVENTION AND CONTROL GROUP RESPECTIVELY AND FOR TOTAL SAMPLE AND DFM PREGNANCIES SEPARATELY

21. Primary outcomes
   a. Perinatal deaths (Numerator/Denominator)
   b. Stillbirth Antepartum (Numerator/Denominator)
   c. Intrapartum stillbirth (Numerator/Denominator)
   d. Early neonatal (Numerator/Denominator)
   e. Late neonatal (Numerator/Denominator)
   f. Avoidable deaths (Numerator/Denominator)
   g. Preterm (Numerator/Denominator)
   h. SGA<10p (Numerator/Denominator)
   i. SGA<2.5p (Numerator/Denominator)
   j. LBW<2500gr (Numerator/Denominator)
   k. Asphyxia (Numerator/Denominator) (measure of asphyxia txt)
   l. Apgar <7 1min (Numerator/Denominator)
   m. Apgar <4 1 min (Numerator/Denominator)
   n. Apgar <7 5 min (Numerator/Denominator)
   o. Apgar <4 5 min (Numerator/Denominator)
   p. NCU (Numerator/Denominator)
   q. Number of days in NCU (Numerator/Denominator)
   r. Induced delivery (Numerator/Denominator)
   s. ECS (Numerator/Denominator)

22. Secondary outcomes
   a. Resource use
      i. Number of DFM consultations (Numerator/Denominator)
      ii. Ultrasound scan (Numerator/Denominator)
      iii. Cardiotocogram (Numerator/Denominator)
      iv. Admission (Numerator/Denominator)
      v. Resources used in evaluation of DFM (txt)
   b. Safety
      i. Delayed > 48 hours (Numerator/Denominator)
      ii. Absence >24h (Numerator/Denominator)
      iii. Fetal deaths among fetuses alive at first presentation (Numerator/Denominator)
   c. Compliance
i. Response rate
ii. Compliance with daily counting
iii. Definition of compliance
iv. Mean counting time reported
v. Number of alarms
d. Maternal psychological health
   i. Maternal negative reactions to intervention (e.g., worried, nervous)
   ii. Maternal positive reactions to intervention (e.g. reassurance, enjoyment)
   iii. Locus of control
   iv. Prenatal attachment
   v. Trait anxiety
   vi. State anxiety
e. Cost-effectiveness

RISK OF BIAS ASSESSMENT

23. Risk of bias for RCT – recorded as low risk/high risk/unclear risk followed by comments for support of judgment
   a. Was the allocation sequence adequately generated?
   b. Was the allocation adequately concealed?
   c. Was the blinding of participants and personnel adequate to avoid performance bias?
   d. Was the blinding of outcome assessment adequate to avoid detection bias?
   e. Were incomplete data adequately addressed?
   f. Was the study free from selective outcome reporting?
   g. Was the study free from other bias?

24. Risk of bias for non-randomised study by individual - recorded as yes/no/can’t tell/NA
   a. Was there a relevant comparison between two or more groups of participants receiving different interventions?
   b. Was there a relevant comparison within the same group of participants over time?
   c. Were groups formed by:
      i. Randomisation
      ii. Quasi-randomised
      iii. Other action of researchers
      iv. Time differences
      v. Health care decision makers
      vi. Participant preferences
      vii. On the basis of outcome
      viii. Some other process
      ix. Specify process (txt)
   d. Were the following key steps of the study carried out after the study was designed
      i. Identification of participants
      ii. Assessment before intervention
      iii. Actions/choices leading to an individual becoming a member of a group
      iv. Assessment of outcomes
   e. On which variables was comparability between groups assessed
      i. Potential confounders
      ii. Assessment of outcome variables before intervention

25. Risk of bias for non-randomised studies by cluster – recorded as yes/no/can’t tell/NA
a. Was there a relevant comparison between two or more groups of clusters receiving different interventions?
b. Was there a relevant comparison within the same group of clusters over time?
c. Were groups formed by:
   i. Randomisation
   ii. Quasi-randomised
   iii. Other action of researchers
   iv. Time differences
   v. Location differences
   vi. Policy/public health decisions
   vii. Cluster preferences
   viii. Some other process
   ix. Specify process (txt)
d. Were the key steps of the study described below carried out after the study was designed:
   i. Identification of participating clusters
   ii. Assessment before intervention
   iii. Actions/choices leading to a cluster becoming a member of the group?
   iv. Assessments of outcomes?
e. On which variables was comparability between groups assessed
   i. Potential confounders
   ii. Assessment of outcome variables before intervention

26. Confounding (non-randomised studies only) – recorded as yes/no
   a. Did the researchers describe how they decided which potential confounding domains should be considered
      i. If yes to previous, describe method used (txt)
   b. Did the researchers consider some relevant confounding domains
      i. If yes to previous, list these (txt)
   c. Did the researchers control for confounding at the design stage
      i. If yes to previous, on which domains (variables) were subjects matched (txt)
         1. Confounding domain (e.g., 'socio-economic status')
         2. Confounding variable (e.g., 'annual income')
   d. Did the researchers adjust for confounding at the analysis stage?
      i. If yes to previous, which method(s) were used (txt)
         1. Stratification
         2. Multivariate regression
         3. Propensity scores (matching)
         4. Propensity scores (multivariate regression)
   e. Confounders described by researchers rank ordered (txt)
      i. Is there evidence that a confounding domain did not give rise to confounding (yes/probably yes/no/probably no)
      ii. Did the analysis control for the confounding domain with adequate care (yes/probably yes/no/probably no)
Reference List


(5) Saastad E, Winje BA, Stray Pedersen B, Frøen JF. Fetal Movement Counting Improved Identification of Fetal Growth Restriction and Perinatal Outcomes - a Multi-Centre, Randomized, Controlled Trial. PLoS ONE 2011; 6 (12):e28482.


(12) Winje BA. Fetal movement counts and fetal health. Faculty of Medicine, University of Oslo, 2013. Ref Type: Thesis/Dissertation


