

Pregnant women and their partners' views and experiences of reduced fetal movements: a narrative literature review

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Abstract

Background/Aims Globally, 2 million stillbirths occur annually, 98% of which occur in low-income settings. In low-income settings, stillbirth may be associated with maternal perception of reduced fetal movements. However, little is known about maternal experiences of reduced fetal movements and subsequent engagement with health services in low-income settings. This narrative literature review initially aimed to improve understanding of views and experiences of reduced fetal movements in pregnant women in low-income settings using information synthesised from international studies. However, only a small number of articles from low-resource settings were found.

Methods The literature reviewed qualitative, quantitative and mixed-method studies guided by a systematic approach. The findings were discussed narratively.

Results A total of 40 studies were identified, only four of which were from low-income settings. The four main themes identified were: maternal perception of fetal movements, facilitators and barriers to seeking healthcare, reduced fetal movements as a predictor of fetal outcomes and knowledge of fetal movements and management strategies.

Conclusions A variety of factors may influence maternal perception of reduced fetal movements and experience of care. As most studies were conducted in high-income settings, it is imperative to describe women's experiences of reduced fetal movements in low-income settings.

Key words: Decreased fetal movements; Experiences; Partners; Pregnant women; Reduced fetal movements; Stillbirth; Views

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Introduction

Maternal perception of fetal activity is a normal occurrence in pregnancy associated with fetal wellbeing (Warrander and Heazell, 2011). As a fetus grows, it becomes more active and develops regular movements, usually discrete kicks that are first felt by primigravid women at around 18–20 weeks' gestation and earlier, at around 16–20 weeks' gestation, in multiparous women (Royal College of Obstetricians and Gynaecologists (RCOG), 2011). Abnormal fetal activity could describe either absent or reduced fetal movements or excessive fetal movements (Heazell et al, 2018). Studies have consistently observed an association between reduced fetal movements and placental pathology (Winje et al, 2012; Warrander et al, 2012; Levy et al, 2020). Reduced fetal movements is hypothesised to be a response to chronic oxygen and nutrient deprivation to the fetus in an attempt to conserve energy (Maulik, 2005). The terminal phase of fetal compromise is fetal movement loss, respiratory and metabolic acidosis and fetal death (Maulik, 2005). A significant reduction in fetal movement has been noted as a sign of impending fetal death (Stacey et al, 2011). Reduced fetal movements and abnormal behavioural patterns have also been observed in fetal abnormalities or fetal growth restriction (Andonotopo and Kurjak, 2006). However, reduced fetal movements have also been reported in advanced gestation with no fetal pathology (Linde et al, 2016; Bradford and Maude, 2018).

The vast majority of the 2 million stillbirths that take place each year occur in low and middle-income countries (United Nations Children's Fund, 2020). Encouraging awareness of reduced fetal movements does not require significant resources, and could

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therefore be considered a means of stillbirth prevention in low-income settings. However, there are insufficient data to recommend whether such an approach would be effective in these settings (Haws et al, 2009). Understanding women's experiences of reduced fetal movements, their response and subsequent care given is important to consider when evaluating whether reduced fetal movements could be used as part of screening for fetal compromise in high-burden settings.

This review aimed to gather in-depth knowledge on studies exploring the views and experiences of pregnant women and their partners regarding reduced fetal movements. The authors aimed to synthesise data from low-resource settings, and/or identify relevant data from studies conducted in a variety of settings. However, only a small number of articles found were conducted in low-income settings, and so this narrative review examines experiences of reduced fetal movements from a wide range of settings.

Methods

This narrative literature review was guided by a systematic approach (Grant and Booth, 2009). The approach was interpretative, which enabled a structured search question to be answered following a methodological sequence of critically appraising and synthesising literature to generate themes for narrative synthesis (Booth, 2006; Flemming et al, 2019).

Search strategy

The search strategy was developed and conducted using the key search terms: pregnant women, partners, views, experiences, reduced fetal movements and stillbirth. The inclusion criteria were qualitative, quantitative and mixed-method peer-reviewed studies on reduced fetal movements, written in English or with an available translation. No restrictions were placed on the publication period or geographical setting.

The electronic databases searched included: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), American Psychological Association (PsycINFO), Google Scholar and the African Journal Online (AJOL). The qualitative framework search question was based on the acronym, PICO: population, the phenomenon of interest and context (Aromataris and Munn, 2020). The quantitative framework search used PICO: population, intervention, comparison and outcomes (Richardson et al, 1995). The parameter 'intervention' did not apply to this search.

The specific research question was 'how do pregnant women and their partners view and/or experience reduced fetal movements in low-income settings?' The income status of the countries was defined as per World Bank (2019) ratings by gross national income per capita. For example, low-income countries had a gross national income per capita of <\$1035 in 2019 (World Bank, 2019). The authors anticipated that there may not be a large body of literature from low-income settings, and so studies were not limited to these countries.

PRISMA flow diagram

The search found a total of 5537 studies. These studies were further screened to remove duplicates and to ensure relevance by abstract, title, peer review and language, full text and design. The literature reviewed and included is shown in **Figure 1**. A total of 40 studies met the inclusion criteria and were appraised using the mixed method appraisal tool (Hong et al, 2018). This included 12 relevant qualitative studies and 28 quantitative studies. One of the qualitative findings was a systematic review framework that used qualitative content analysis (Daly et al, 2019).

Critical appraisal strategy

The 40 studies were appraised using the mixed method appraisal tool (Hong et al, 2018) because it allows appraisal of the methodological quality of five categories of studies: qualitative research, randomised controlled trials, non-randomised studies, quantitative descriptive studies and mixed methods studies. The tool has two screening questions to allow the study to be appraised. The first question aims to verify whether the questions asked address qualitative, quantitative or mixed-method design. The second question determines whether the data collected address the research question and objectives. The responses to

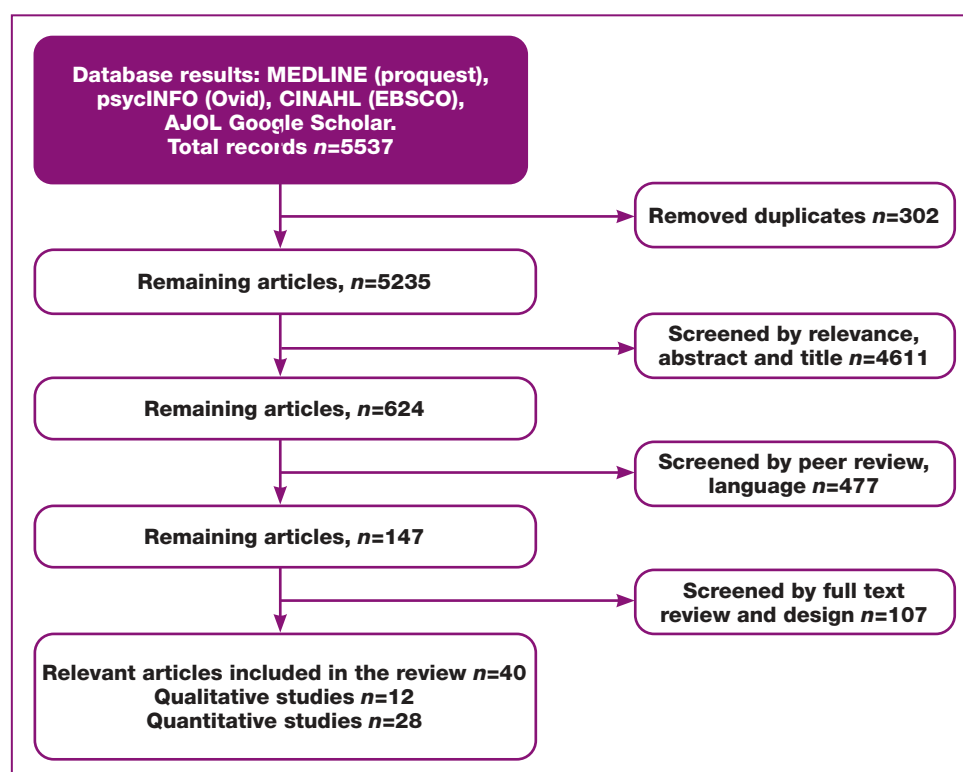


Figure 1. PRISMA flow diagram, adapted from Moher et al (2009).

the screening questions are ‘yes’, ‘no’ or ‘can’t tell’. The 40 studies all qualified for a ‘yes’ to the first two screening questions and were included in the critical appraisal.

The tool also advises the use of a more detailed presentation of quality and permits qualitative appraisal of included studies focusing on the study aims/objectives, sampling strategy, ethics and consent, data analysis and the limitations and strengths of the study. The critical appraisal of the 40 studies was carried out in detail by the first author using the tool and reviewed by the three coauthors for rigour and authenticity.

Evidence synthesis

A total of 12 qualitative studies were included in the synthesis, all from high-income settings: Sweden ($n=6$), the UK ($n=1$), New Zealand ($n=2$) and Australia ($n=3$). A total of 28 quantitative studies were included, 21 were from high-income settings: Australia ($n=2$), Norway ($n=3$), Iran ($n=2$), Japan ($n=2$), Canada ($n=1$), Iraq ($n=1$), New Zealand ($n=5$), the UK ($n=7$) and Ireland ($n=1$). Four studies were from low- to middle-income settings: Egypt ($n=1$), Malaysia ($n=1$), Nigeria ($n=1$) and Zimbabwe ($n=1$). Four themes and five subthemes emerged from the findings. The themes generated new knowledge to instill critical thinking for future research (de Souza et al, 2010). **Table 1** shows the source studies, study design/type and key findings. **Table 2** shows themes, subthemes and their sources. The themes were generated from analysis of the key findings.

Results

Theme 1: maternal perception of fetal movements

This theme was reported in five studies (Rådestad and Lindgren, 2012; Greenow et al, 2013; Linde et al, 2016; Smyth et al, 2016; Bradford and Maude, 2018). Primigravid women who lacked previous pregnancy experience described fetal movements as quickening around the second trimester (Bradford and Maude, 2018). These movements were described as little movements or ‘a worm swimming in the belly’ (Smyth et al, 2016). Women in Sweden shared similar sentiments and stated that movements resembled a film in slow motion or a small movement like a ‘floppy fish’ (Rådestad and Lindgren, 2012). During advanced gestation,

Table 1. Sources and key findings from the literature

Study details	Study type/design	Key findings
Linde et al (2015). Sweden	Qualitative content analysis of web-based questionnaire	Fetal movements weak or none at all. Normal movements became extremely vigorous followed by no movements at all
Linde et al (2016). Sweden	Qualitative content analysis of multiple choice open-ended questionnaire	Four categories: frequency (decreased, absence of kicks and movements), intensity (weaker and indistinct fetal movements), character (changed pattern of movements or slower movements), duration
Georgsson et al (2016). Sweden	Qualitative content analysis of open-ended multiple choice questionnaire	Women need to be taken seriously, inform one other to contact healthcare for check-up and pay attention to fetal movements. Need for rapid adequate care, improved information on fetal movements, reliable source of information and sound advice
Linde et al (2017). Sweden	Qualitative content analysis following the Malterud's method of analysing data in several steps	Five categories: reaching a deadline, receiving advice from healthcare professionals, undergoing worry, contributing external factors and not wanting to put baby's life at risk
Bradford and Maude (2018). New Zealand	Qualitative content analysis from grounded theory of constant comparison, no intention for theory generation	Fetal movements increased in strength, frequency and variation. Movements followed patterns, increased during day related to woman's activity and rest. At term, movements increased strength, noted as kicking, jolting and decreased while pushing and rolling movements increased
Smyth et al (2016). United Kingdom	Qualitative framework analysis principles with five logical steps	Themes: influences of social network, facilitators and barriers to presentation and desire for normal pregnancy
Rådestad and Lindgren (2012). Sweden	Qualitative content analysis of data obtained from face-to-face and telephone in-depth interviews using interview guide	Categories: strong and powerful, large, slow, stretching, from side to side, light and startled. Women perceived fetal kicks at beginning of pregnancy which became fetal movements at end of pregnancy
Bradford and Maude (2014). New Zealand	Qualitative content analysis of semi-structured open-ended questionnaire	Increased fetal activity reported during and before mealtimes or when hungry. Women who described fetal activity resulting from hunger delivered small babies compared to those with no fetal response to hunger
Warland and Glover (2017). Australia	Qualitative summative content analysis of survey questionnaire	Common words: '10, normal, kick charts', when to contact care providers. Suggest fluids, monitor at home and call back, or come in for an assessment
Akselsson et al (2017). Sweden	Qualitative manifest contest analysis of open-ended questionnaire	Categories: decreased worry, creating relationship, increased knowledge about unborn baby, awareness of baby and relaxing. Lack of time to observe movements
Greenow et al (2013). Australia	Qualitative thematic analysis of open-ended questions	Movements gentle, with strong limb movements and whole-body movements. Movements changed with gestation period
Daly et al (2019). Australia	Systematic review framework and qualitative content analysis	All 24 apps mentioned reduced fetal movements, few explicitly linked the movements to stillbirth or other specific linked adverse outcomes
Olagbuji et al (2014). Nigeria	Cross-sectional quantitative survey of 255 women above 26 weeks gestation	87.6 % of women did not know fetal movement. 47% and 31.1% had correct knowledge of excessive and reduced fetal movements. 31.1% and 21.8% expressed concern over excessive and reduced fetal movements. Maternal education significantly associated with correct knowledge of reduced fetal movements ($P=0.026$)
Berndl et al (2013). Canada	Quantitative descriptive survey of 304 women above 26 weeks gestation	55 (18%) women knew fetal movement, 164 (54.7%) would seek care for reduced fetal movements. 90 (30%) did not identify daily fetal movements as normal, 114 (3, 5%) reported it may be normal for fetal movements to stop around due date
Belal and Abo Elghite (2017). Egypt	Quantitative descriptive design of 300 women at 28 weeks gestation	29% perceived more movements in morning. 5.7 % of women displayed limited knowledge of movements. Quarter of women said it was normal to experience less than three movements in 8 hours

Table 1. Sources and key findings from the literature (continued)

Study details	Study type/design	Key findings
Sheikh et al (2014). Iran	Cohort of 729 normotensive women at 28–40 weeks gestation	Perception of decreased fetal movements independently associated with maternal employment, not having daily exercise and maternal supine position. 8.1% of women reported perceived reduced fetal movements had good pregnancy outcomes
Hantoushzadeh et al (2015). Iran	Prospective observation of 729 normotensive women at 28–40 weeks gestation	90 (8%) women reported general body movements independently associated with maternal employment, 72.2% trunk movements associated with multiparity, 86.3% isolated limb movements associated with maternal unemployment, lower gestational age, perception of fetal movements at night and multiparity. 36.6% experienced high frequency associated with higher gestational age
McArdle et al (2015). Australia	Prospective descriptive study of 426 women at 34 weeks gestation. Content analysis used for comments from women	67% of women received information about fetal movements, from midwives (80%), family (57%), own mother and friends (48%), internet (52%), 11% opted for internet advice
Stacey et al (2011). New Zealand	Case-control study of 155 women with stillbirth. Control group: 310 women at same gestational period stillbirth occurred	Single episode of vigorous fetal activity associated with almost sevenfold increase in late stillbirth risk
Bradford et al (2018). New Zealand	Systematic review. Data extracted from 23 publications from 19 observational studies. Statistical analysis (Revman (version 5.3) and descriptive summary	Increased maternal body size not associated with altered perception of fetal movement but associated with reduced fetal movements. Increased maternal body size associated with increased risk of stillbirth and fetal growth restriction
Farrant and Heazell (2016). United Kingdom	Online survey from 15 websites. Websites assessed for readability, accountability and content. Chat forums assessed using thematic content analysis	15 (21.4%) websites met accountability criteria; 43 (70%) contained information not following evidence-based recommendations
Nor Azlin et al (2015). Malaysia	Retrospective analysis of 230 case notes of women who presented with reduced fetal movements	48.7% of women had spontaneous labour, 45.7% had induction and 5.6% had elective caesarean section. No maternal complications in 97.4%. About 0.9% and 1.7% had primary postpartum haemorrhage and extended perineal tear
Bradford et al (2019a). New Zealand	Cross-sectional study of 274 women at 28 weeks and above gestation with normal singleton pregnancy	59.3% of women felt increased strength of fetal movements in 2 weeks. 72.8% perceived strong fetal movements in evening and 74.5% at night. 78.8% reported fetal hiccup
Pollock et al (2020). South Australia	Online survey of 428 women who had live birth and attended antenatal clinic. Descriptive statistics and content analysis	84.6% informed of importance of fetal movements by healthcare professionals. Awareness that stillbirth occurs was high (95.2%, although 65% were unable to identify current incidence of stillbirth
Bradford et al (2019b). New Zealand	Multicentre case-control study of 164 women with late stillbirth at 28 weeks gestational period. 569 control women with ongoing pregnancy at same gestational period. Multivariable logistic regression analysis used	Maternal perception of fetal movement associated with decreased risk of late stillbirth; multiple instances of 'more vigorous than usual' fetal movement, daily perception of fetal hiccups, and perception of increased length of fetal movement clusters or 'busy times'
Hammed (2013). Iran	Correlational study of 200 women presenting with sluggish fetal movements at 32–41 gestational period	Majority of patients with normal biophysical profile score of 8–10/10 had good APGAR score. Caesarean section rate was 34%. 70% of cases with good outcome
Bradford et al (2020). New Zealand	Multicentre case-control study of 233 women from Healthy Mums and Babies. Control group from Multicentre Stillbirth Study, 164 women with singleton pregnancies	88.7% vs 99.3% reported movements at night (92.1% vs 93.1%). Women with obesity more likely to report strong fetal movements when hungry (29.1% vs 17.7%, $P=0.001$) and quiet fetal movements after eating (47.4% vs 32.0%, $P=0.001$)

Table 1. Sources and key findings from the literature (continued)

Study details	Study type/design	Key findings
Tveit et al (2010). Norway	Prospective observational of 2374 women at 28 weeks and above gestation	Subgroups of cases at increased risk of fetal growth restriction and stillbirth identified in women with uncomplicated pregnancy, maternal weight, advanced age and smoking
Saastad et al (2010). Norway	Pre- and post-intervention cohort included 19 407 and 46 143 births with 1215 and 3038 women with decreased fetal movements. Brochure used for data collection	Delayed reporting among primiparous women with reduced fetal movements reported (≥ 48 hrs) and stillbirths shown in post-intervention period
Smith et al (2014). Ireland	Descriptive survey of midwives and obstetricians from 19 maternity units	Majority of respondents reported absence of local guidelines for detecting and managing reduced fetal movements in pregnancy
Koshida et al (2019). Japan	Quantitative prospective study of 2337 women at 37 weeks gestation until delivery	Maternal perception of fetal movement time showed gradually increasing trend within 30 minutes for 10 fetal movements by modified 'count to 10' method
Koshida et al (2017). Japan	Quantitative population-based survey of 245 stillbirths at 22 weeks gestational period	66 cases (35%) had decreased fetal movements among 188 stillbirths in Shiga during study period. Only seven (11%) among 64 stillbirths were diagnosed in outpatient department
Heazell et al (2008). United Kingdom	Online survey of 223 midwives and obstetricians. Descriptive statistics used	Majority of respondents inquired about presence of fetal movements after 28 weeks of gestation. There was little agreement on definition of reduced fetal movements
Dutton et al (2012). United Kingdom	Prospective cohort study of 305 women at 28 weeks gestation	22.1% of pregnancies have poor perinatal outcomes after reduced fetal movements. Most common complication: small for gestation infants
Norman et al (2018). United Kingdom and Ireland	Stepped-wedge cluster-randomised trial of 33 hospitals	Incidence of stillbirth during control period: 4.40 per 1000 births, during intervention period: 4.06 per 1000 births
Hayes et al (2019). United Kingdom	Scoping review of 19 studies with meta-analysis when possible	Five studies reported association between absent or reduced fetal movements and stillbirth in low- to middle-income countries: 1466 pregnancies including 266 stillbirths. Likelihood of stillbirth higher in absent or reduced fetal movements. Women's awareness of absent or reduced fetal movements as danger sign varied from 3.1 to 62.3%
Heazell et al (2017). United Kingdom	Case-control study. Cases were women 18 years old who delivered singleton fetus. Controls: women same age with ongoing pregnancy at 28 weeks gestational period	Women whose pregnancies ended in stillbirth less likely to check fetal movements. Pregnancies that resulted in stillbirths frequently found associated with abnormal fetal movements
Heazell et al (2018). United Kingdom	Case-control study. Cases were 291 women who had late stillbirth at 28 weeks gestational period. Controls: 733 women with ongoing pregnancies	Increased strength of fetal movements and fetal hiccups associated with decreased risk of stillbirth
Tveit et al (2009). Norway	Cohort study. The baseline versus intervention cohorts included: 19407 versus 46143 births and 1215 versus 3038 women with reduced fetal movements.	Stillbirth rate reduced by 50% among women with reduced fetal movements during intervention
de Muylder (1988). Zimbabwe	Cohort study. 200 women ongoing pregnancy	Good correlation between abnormal kick chart and increased risk of intrauterine death

the baby's movements were said to have changed in character, frequency and intensity to become slower, more jerky, pushing and stretching. Some women expressed that it was a sign of fetal communication, which was no longer a kick but a movement (Rådestad and Lindgren, 2012; Linde et al, 2016; Bradford and Maude, 2018). Some women explained

that their babies knew what they were doing, and went on to describe various fetal patterns, for instance, initial movements being very soft like a feather, flutters or butterflies. Later movements were described as stronger kicks, pushes or jerky movements, as pregnancy advanced (Greenow et al, 2013; Bradford and Maude, 2018).

Notably, the descriptions of fetal movements in normal pregnancy were regarded as a sign of fetal wellbeing (RCOG, 2011). Women reported that they felt at peace and knew that the movement of their baby signified that their baby was well, some felt enjoyment and a connection (Smyth et al, 2016; Bradford and Maude, 2018). However, some primigravid women expressed a sense of fear and insecurity from the baby's spasms and assumed that the baby was having a convulsion (Bradford and Maude, 2018).

The three subthemes under the maternal perception of fetal movements were descriptions of movements of an unwell fetus, subjective methods of observing fetal movements and relating patterns of fetal movements to internal and external factors.

Descriptions of movements of an unwell fetus

Five studies reported information from this theme (Greenow et al, 2013; Linde et al, 2015; 2016; Warland and Glover, 2017; Bradford et al, 2019a, b). The studies argued that maternal perceptions of reduced fetal movements could be a sign of impending fetal death (Warland and Glover, 2017; Greenow et al, 2013; Bradford et al, 2019a, b). Some women were reported to have felt a single episode of vigorous fetal movements followed by no movement at all (Linde et al, 2015; Bradford and Maude, 2018). Some misinterpreted the movements as contractions, describing them as a hard-moving mass that made them assume that the child was alive (Linde et al, 2016). However, mothers' descriptions of reduced fetal movements remain a grey area that need more research, and the limits that separate normal and abnormal activity remain undefined.

Subjective methods of observing fetal movements

Four studies reported this theme (Rådestad and Lindgren, 2012; Akselsson et al, 2017; 2020; Daly et al, 2019). Women's perception of fetal movements is a subjective way of monitoring

Table 2. Sources of four themes emerging from literature

Themes	Subthemes	Source
Maternal perception of fetal movements		Rådestad and Lindgren (2012); Greenow et al (2013); Linde et al (2016); Bradford and Maude (2018); Smyth et al (2016)
	Descriptions of movements of an unwell fetus	Greenow et al (2013); Linde et al (2015); Linde et al (2016); Warland and Glover (2017); Bradford et al (2019a, b)
	Subjective methods of observing fetal movements	Rådestad and Lindgren (2012); Akselsson et al (2017, 2020); Daly et al, 2019
	Relating patterns of fetal movements to internal and external factors	Rådestad and Lindgren (2012); Greenow et al (2013); Bradford and Maude (2014; 2018); Linde et al (2016); Smyth et al (2016)
Reduced fetal movements as a predictor of fetal outcomes		de Muylder (1988); Tveit et al (2009); Saastad et al (2010); Stacey et al (2011); Dutton et al (2012); Hammed (2013); Nor Azlin et al (2015); Heazell et al (2017; 2018); Koshida et al (2017); Norman et al (2018); Hayes et al (2019); Koshida et al (2019)
Facilitators and barriers to seeking healthcare for abnormal fetal movements		Tveit et al (2009); Georgsson et al (2016); Smyth et al (2016); Linde et al (2017); Daly et al (2019)
Knowledge of fetal movements and management strategies		Heazell et al (2008); Berndt et al (2013); Olagbuji et al (2014); Smith et al (2014); Belal and Elkazeh (2017)
	Factors associated with fetal movements	Tveit et al (2010); Sheikh et al (2014); Hantoushzadeh et al (2015); Bradford et al (2018, 2019a, b; 2020)
	Sources of information	McArdle et al (2015); Georgsson et al (2016); Smyth et al (2016); Daly et al (2019); Farrant and Heazell (2016); Pollock et al (2020)

fetal wellbeing (Rådestad and Lindgren, 2012). ‘Mindfetalness’ is a similar subjective method of fetal monitoring that provides systematic observation of fetal movements in late pregnancy (Akselsson et al, 2017). Using this approach, the woman focuses on the intensity, character and frequency of movements without counting them (Akselsson et al, 2017). Recent findings suggest that mindfetalness reduces the incidence of caesarean sections and babies born small for gestational age, although this study did not also show a reduction in stillbirth or perinatal asphyxia (Akselsson et al, 2020). Despite the positive findings, some women resented the method for being time-consuming (Akselsson et al, 2017). Recent research suggested the use of mobile applications to guide monitoring fetal movements (Daly et al, 2019). Mobile applications were suggested to be an antenatal package used by large numbers of women and had the potential to influence maternal perception of fetal movements (Daly et al, 2019).

Relating patterns of fetal movements to internal and external factors

The theme was reported in six studies (Rådestad and Lindgren, 2012; Greenow et al, 2013; Bradford and Maude, 2014; 2018; Linde et al, 2016; Smyth et al, 2016). Gestational age, time of day, hunger, external stimuli and maternal activity were recurring factors related to fetal movement patterns reported by women interviewed at different gestational ages (Rådestad and Lindgren, 2012; Greenow et al, 2013; Bradford and Maude, 2014). Increased perception of fetal movement was reported by a group of women occurring in the afternoon or evening (Bradford and Maude, 2018). A similar trend of movements had been reported to be associated with hunger or before dinner time (Bradford and Maude, 2014). Increased activity of the baby before, during and after mealtimes was perceived by women to be the baby’s way of communicating the need for food or an appreciation of satisfaction after eating (Bradford and Maude, 2014). Bradford and Maude (2014) concluded that fetal movements can be associated with maternal activity, supporting Greenow et al (2013), who stated that increased maternal perception was associated with maternal body positions, for instance sitting, lying down, resting or exercise. An external stimulus, such as music, a loud noise, abdominal palpation or compression seemed to sensitise the baby to move (Bradford and Maude, 2018).

Theme 2: facilitators and barriers to seeking healthcare

This theme was reported in five studies (Tveit et al, 2009; Georgsson et al, 2016; Smyth et al, 2016; Linde et al, 2017; Daly et al, 2019). Women’s social networks seemed to play a pivotal role and provided a rich source of information that could either hinder or prompt women to seek healthcare (Georgsson et al, 2016; Smyth et al, 2016). The social network included family members and peers who the woman would consult first for advice. A wide range of internet sources from various websites were trusted by women, even though their reliability had been questioned (Daly et al, 2019).

One reported barrier was women’s concern of not being taken seriously by healthcare providers (Georgsson et al, 2016; Smyth et al, 2016). To some, it was a new experience and they assumed reduced fetal movements were a consequence of the baby not being willing to move (Linde et al, 2017). Therefore, women delayed consulting healthcare until movements stopped or would delay consulting for 24 hours (Tveit et al, 2009). In some cases, women were scared to go to a health facility to be informed that something was wrong with their baby (Smyth et al, 2016). Common practices, for instance stimulation of the baby by rubbing the belly, taking a warm bath or eating something sweet, resulted in delays to seek healthcare (Georgsson et al, 2016; Smyth et al, 2016). The advice to stimulate the baby was reported to be from immediate family, the internet and healthcare providers themselves. However, most guidelines recommend that women with reduced fetal movements should immediately seek healthcare (RCOG, 2011; Daly et al, 2018).

Numerous factors that positively and negatively influenced women to seek healthcare for reduced fetal movements were reported, including the desire for a normal pregnancy, worry or anxiety, a reminder from healthcare professionals and physical symptoms (Georgsson et al, 2016; Smyth et al, 2016; Linde et al, 2016; 2017). Women predominantly sought confirmation that they made the right choice or decision to seek care and to be acknowledged for seeking care (Georgsson et al, 2016). Having investigations like fetal heart rate traces

allayed anxiety (Smyth et al, 2016). A physical symptom affecting the woman, for instance headache, nausea, backache, lack of sleep or dizziness, together with pregnancy-related symptoms such as bleeding, contractions, or ruptured membranes prompted most women to seek care for reduced fetal movements (Linde et al, 2017). Clinicians in some units were reported to have kept reminders of appointments for women who presented with reduced fetal movements (Smyth et al, 2016; Linde et al, 2017).

Theme 3: reduced fetal movements as a predictor of fetal outcomes

A total of 13 studies explored fetal movements as a predictor of fetal outcomes (de Muylder, 1988; Tveit et al, 2009; Saastad et al, 2010; Stacey et al, 2011; Dutton et al, 2012; Hamed, 2013; Nor Azlin et al, 2015; Heazell et al, 2017; 2018; Koshida et al, 2017; 2019; Norman et al, 2018; Hayes et al, 2019). Absent or reduced fetal movements were associated with adverse pregnancy outcomes, particularly stillbirth (Stacey et al, 2011; Heazell et al, 2017; 2018; Hayes et al, 2019). Women perceiving reduced fetal movements were reported in one study to report 2 days of irregular baby movements before actual cessation of movement (Stacey et al, 2011). Furthermore, of 305 women presenting with reduced fetal movements after 28 weeks gestation, 22.1% of pregnancies ended with the birth of a small for gestational age baby (Dutton et al, 2012).

Women who perceived increased strength and frequency of fetal movements, fetal hiccups and frequent vigorous activity had reduced stillbirth risk compared to those who had decreased strength and frequency of movements (Stacey et al, 2011; Heazell et al, 2017; Heazell et al, 2018; Hayes et al, 2019). Knowing the character and frequency of fetal movement was found to be an important determinant of fetal wellbeing, although this varied among women (Hayes et al, 2019).

In a scoping review, five quantitative studies were reported from low- to middle-income settings that discussed maternal perception of fetal movements in association with stillbirth. One study was from Zimbabwe, two from Nigeria, one from Kenya and one from Nepal (Hayes et al, 2019). The five studies described 1446 pregnancies, which included 266 stillbirths (Hayes et al, 2019). The study from Zimbabwe monitored 200 pregnant women using a 'fetal kick chart' (a formal method to count fetal movements) in a high-risk pregnancy compared to those with abnormal counts (de Muylder, 1988). In this study, 145 pregnancies had a favourable outcome. Adverse outcomes reported included one antepartum death (abruptio placentae), two intrapartum deaths (one undiagnosed intrapartum asphyxia during a poorly monitored labour and one abruptio placentae) and one neonatal death (difficult breech extraction). Eight neonates were born with a low Apgar score, including one delivered by caesarean section for fetal distress (de Muylder, 1988).

In two of the studies, an information brochure and care package were used to increase awareness of reduced fetal movements among pregnant women during pre- and post-intervention cohort studies. The findings suggested a reduction in stillbirth rates and in the number of women who delayed reporting reduced fetal movements (Tveit et al, 2009; Saastad et al, 2010). However, Norman et al (2018) did not report a reduction in stillbirth rates after using a care package in the awareness of fetal movements to reduce fetal mortality study.

Theme 4: knowledge of fetal movements and management strategies

Five studies reported knowledge about normal fetal movements among women and management strategies (Heazell et al, 2008; Berndl et al, 2013; Olagbuji et al, 2014; Smith et al, 2014; Belal and abo Elghite, 2017). A variation in knowledge and practice in the management of pregnant women with reduced fetal movements among practitioners was reported (Heazell et al, 2008; Smith et al, 2014). These findings were consistent with reports from pregnant women, one of which was from Nigeria, who received varied information about reduced fetal movements from healthcare providers (Olagbuji et al, 2014; Warland and Glover, 2017). A study in Canada surveyed 304 pregnant women and reported that two-thirds of participants could not describe normal fetal movements, while 37.5% further stated that it may be normal for fetal movements to stop when women approach their due date (Berndl et al, 2013). Similar findings were reported in primigravid women who did not know the relevance of fetal movements (Olagbuji et al,

2014; Bradford and Maude, 2018). However, in Egypt, 5.7% of 300 studied pregnant women displayed limited knowledge on the number of movements to be perceived in an hour, and a quarter of them knew that it was not normal to experience fewer than three movements in 8 hours (Belal and Elkazeh, 2017).

Two subthemes emerged under knowledge of fetal movements and management strategies: factors associated with reduced fetal movements and sources of information on fetal movements.

Factors associated with reduced fetal movements

Seven studies reported on factors associated with reduced fetal movements (Tveit et al, 2010; Sheikh et al, 2014; Hantoushzadeh et al, 2015; Bradford et al, 2018; 2019a, b; 2020). Hantoushzadeh et al (2015) studied 729 normotensive singleton pregnant women, 90.8% of whom perceived general body movement, 86.3% perceived isolated limb movement and 74.2% of women perceived trunk movement. Factors influencing maternal perception were parity, lower gestational age and maternal employment. Hiccups were perceived by 36.6% of women and were associated with higher gestational age. In another study from this cohort, Sheikh et al (2014) reported the supine position on counting and lack of daily exercise was associated with reduced fetal movements. Additionally, time of day and gestational period seemed to influence the pattern of perceived fetal movements (Bradford et al 2019a, b). The findings suggest that during the third trimester, fetal movement character followed a general pattern associated with maternal factors.

In Norway, factors associated with reduced fetal movements included being overweight, advanced age and cigarette smoking; subgroups of cases were also isolated who were at risk of fetal growth restriction and stillbirth (Tveit et al, 2010). These results were consistent with qualitative evidence where women reported fetal movements to be associated with maternal activity and time of the day (Rådestad and Lindgren, 2012; Greenow et al, 2013; Bradford and Maude, 2014). Furthermore, obese women were said to report strong fetal movements when hungry, which became silent after a meal (Bradford et al, 2020).

Sources of information on fetal movements

Six studies explored sources of information on fetal movements, three of which were from qualitative synthesis (McArdle et al, 2015; Georgsson et al, 2016; Smyth et al, 2016; Daly et al, 2019; Farrant and Heazell, 2016; Pollock et al, 2020). Evidence synthesis revealed that women reported sources of trusted information as being midwives or the internet (McArdle et al, 2015; Georgsson et al, 2016; Smyth et al, 2016). The websites were assessed for readability, accountability and content, and 70% (43) of the websites' information was suggested to be evidence-based (Farrant and Heazell, 2016). However, some website sources of information had no references (Daly et al, 2019). A survey in Australia revealed that 84.6% (362) of women were informed of the importance of fetal movements during pregnancy by healthcare professionals (Pollock et al, 2020). The information received by women was found to be inconsistent and these findings aligned with various studies conducted in Australia, Egypt, Nigeria and Canada (McArdle et al, 2015; Belal and Abo Elghite, 2017; Olagbuji et al, 2014; Berndt et al, 2013).

Discussion

This review aimed to describe the views and experiences of pregnant women and their partners regarding reduced fetal movements, with a focus on low-resource settings. There was a paucity of data from this context, as all 12 qualitative studies eligible for inclusion in the narrative synthesis were from high-income settings and only four quantitative studies were found in low-income settings. Therefore, this review encompassed a general narrative synthesis of reduced fetal movements. Available data from low-income countries suggest that reduced fetal movements are associated with adverse outcomes and intervention studies suggest potentially beneficial effects.

Notwithstanding the paucity of data directly obtained from low-resource settings, themes from published literature were identified that are relevant to women's perceptions of fetal movements and reduced fetal movements, irrespective of setting. To date, studies of reduced

fetal movements have concentrated on attempting to define it, explore pregnant women's perceptions of it, specify management strategies and determine outcomes associated with it. However, the studies rarely mention partners' views and experiences of reduced fetal movements, although studies acknowledge that the behaviour of others influences women's reaction to reduced fetal movements (Rådestad and Lindgren, 2012; Greenow et al, 2013; Linde et al, 2016; Smyth et al, 2016; Bradford and Maude, 2018).

The 40 included studies were of high quality, assessed by the first two screening questions of the mixed method appraisal tool (Hong et al, 2018). The studies portrayed strength in relation to the methods and methodology applied. However, the studies used a wide variety of methodologies and frequently employed different approaches to define normal and abnormal fetal movements, potentially limiting the generalisability of findings.

There were insufficient studies conducted in low-income settings to be able to draw any conclusions, but the small amount of available evidence from low- to middle-income countries suggests that awareness of reduced fetal movements may reduce adverse outcomes in this context. However, sources of information about fetal movements and reduced fetal movements need to be standardised to avoid misleading pregnant women and their partners. Given the potential value and gap in evidence identified by this review, it is pertinent to continue to research reduced fetal movements in low-income countries to enhance practice, research and inform policies. The limited data on partners' views and experiences of reduced fetal movements suggest that these should also be investigated to understand barriers and facilitators to accessing care for reduced fetal movements.

Conclusions

There is a lack of information on the views and experiences of pregnant women and their partners of reduced fetal movements in all settings, with a particular paucity of literature in low-income settings. Research should be prioritised to determine women's understanding of normal fetal activity, reasons for presentation with reduced fetal movements in these environments and how their knowledge can be improved. This information can then be used to determine whether improving knowledge and care pathways for reduced fetal movements affects pregnancy outcomes in low-resource, high-burden settings.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

References

- Akselsson A, Georgsson S, Lindgren H, Pettersson K, Rådestad I Women's attitudes, experiences and compliance concerning the use of Mindfetalness- a method for systematic observation of fetal movements in late pregnancy. *BMC Pregnancy Childbirth*. 2017;17(1):359. <https://doi.org/10.1186/s12884-017-1548-5>
- Akselsson A, Lindgren H, Georgsson S et al. Mindfetalness to increase women's awareness of fetal movements and pregnancy outcomes: a cluster-randomised controlled trial including 39,865 women. *BJOG*. 2020. <https://doi.org/10.1111/1471-0528.16104>
- Andonotopo W, Kurjak A. The assessment of fetal behavior of growth restricted fetuses by 4D sonography. *J Perinat Med*. 2006;34(6):471–478
- Aromataris E, Munn Z (eds). *JBI manual for evidence synthesis*. Adelaide, South Australia: Joanna Briggs Institute: 2020
- Belal G, Abo Elghite E. Maternal perception and antenatal advice regarding fetal movements in Al-Gharbyia Governorate, Egypt. *IOSR JNHS*. 2017;6(2):107–119. <https://doi.org/10.9790/1959-060207107119>

- Berndl AM, O'Connell CM, McLeod NL. Fetal movement monitoring: how are we doing as educators? *J Obstet Gynaecol.* 2013;35(1):22–28. [https://doi.org/10.1016/S1701-2163\(15\)31044-6](https://doi.org/10.1016/S1701-2163(15)31044-6)
- Booth A. Brimful of STARLITE: toward standards for reporting literature searches. *J Med Library Assoc.* 2006;94(4):421–429
- Bradford B, Cronin R, McKinlay C et al. A diurnal fetal movement pattern: findings from a cross-sectional study of maternally perceived fetal movements in the third trimester of pregnancy. *Pubmed.* 2019a;14(6). <https://doi.org/10.1371/journal.pone.0217583>
- Bradford BF, Cronin RS, McCowan LME et al. Association between maternally perceived quality and pattern of fetal movements and late stillbirth. *Sci Rep.* 2019b;9:9815
- Bradford BF, Cronin R, McKinlay C, Thompson J, McCowan L. Maternally perceived fetal movement patterns: the influence of body mass index. *Early Hum Dev.* 2020;140:104922. <https://doi.org/10.1016/j.earlhumdev.2019.104922>
- Bradford BF, Maude R. Fetal response to maternal hunger and satiation—novel finding from a qualitative study of maternal perception of fetal movements. *BMC Pregnancy Childbirth.* 2014;14(1):288. <https://doi.org/10.1186/1471-2393-14-288>
- Bradford B, Maude R. Maternal perception of fetal movements in the third trimester: a qualitative description. *Women Birth.* 2018;31(5) <https://doi.org/10.1016/j.wombi.2017.12.007>
- Bradford BF, Thompson JMD, Heazell AEP, McCowan LME, McKinlay CJD. Understanding the associations and significance of fetal movements in overweight or obese pregnant women: a systematic review. *Acta Obstet Gynecol Scand.* 2018;97(1):13–24. <https://doi.org/10.1111/aogs.13250>
- Daly LM, Boyle FM, Gibbons K et al. Mobile applications providing guidance about decreased fetal movement: review and content analysis. *Women Birth, Australian Coll Midwives.* 2019;32(3):e289–e296. <https://doi.org/10.1016/j.wombi.2018.07.020>
- Daly LM, Gardener G, Bowring V et al. Care of pregnant women with decreased fetal movements : Update of a clinical practice guideline for Australia and New Zealand. *Aust N Z J Obstet Gynaecol* 2018;58(4):463–468. <https://doi.org/10.1111/ajo.12762>
- de Muylder X. The kick chart in high risk pregnancies: a two year experience in Zimbabwe. *Int J Gynecol Obstetrics.* 1988;27(3):353–357. [https://doi.org/10.1016/0020-7292\(88\)90112-9](https://doi.org/10.1016/0020-7292(88)90112-9)
- de Souza M, da Silva MD, de Carvalho R. Integrative review: what is it? How to do it. *Einstein.* 2010;8(1):102–106. <https://doi.org/10.1590/s1679-45082010rw1134>
- Dutton PJ, Warrander LK, Roberts SA et al. Predictors of poor perinatal outcome following maternal perception of reduced fetal movements – a prospective cohort study. *PLoS One.* 2012;7(7). <https://doi.org/10.1371/journal.pone.0039784>
- Farrant K, Heazell AEP. Online information for women and their families regarding reduced fetal movements is of variable quality, readability and accountability. *Midwifery.* 2016;34:72–78. <https://doi.org/10.1016/j.midw.2015.12.013>
- Flemming K, Booth A, Garside R, Tuncalp O, Noyes J. Qualitative evidence synthesis for complex interventions and guideline development: clarification of the purpose, designs and relevant methods. *BMJ Global Health.* 2019;4:e000882. <https://doi.org/10.1136/bmjgh-2018-000882>
- Georgsson S, Linde A, Pettersson K, Nilsson R, Rådestad I. To be taken seriously and receive rapid and adequate care – womens' requests when they consult health care for reduced fetal movements. *Midwifery.* 2016;40:102–108. <https://doi.org/10.1016/j.midw.2016.06.006>
- Grant MJ, Booth A. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Inf Libraries J.* 2009;26(2):91–108. <https://doi.org/10.1111/j.1471-1842.2009.00848.x>
- Greenow CHR, Gordon A, Li Q, Hyett JA. A cross-sectional study of maternal perception of fetal movements and antenatal advice in a general pregnant population, using a qualitative framework. *BMC Pregnancy Childbirth.* 2013;13(32). <http://www.biomedcentral.com/1471-2393/13/3>
- Hammed BH. Reduced fetal movement as a predictor of perinatal outcome. *Mustansiriyah Med J.* 2013;12(1):29–34
- Hantoushzadeh S, Sheikh M, Shariat M, Farahani Z. Maternal perception of fetal movement type: the effect of gestational age and maternal factors. *J Matern Fetal Neonatal Med.* 2015;28(6):713–717. <https://doi.org/10.3109/14767058.2014.929112>
- Haws RA, Yakoob MY, Soomro T et al. Reducing stillbirths: screening and monitoring during pregnancy and labour. *BMC Pregnancy Childbirth.* 2009;Suppl 1(S5). <https://doi.org/10.1186/1471-2393-9-S1-S5>
- Hayes DJL, Smyth RMD, Heazell AEP. Investigating the significance and current state of knowledge and practice of absent or reduced fetal movements in low and lower middle-income countries: a scoping review. *JOGHR.* 2019;3. <https://doi.org/10.29392/joghr.3.e2019023>

- Heazell AEP, Budd J, Li M et al. Alterations in maternally perceived fetal movement and their association with late stillbirth: findings from the Midland and North of England stillbirth case-control study. *BMJ Open*. 2018;8(7):e020031. <https://doi.org/10.1136/bmjopen-2017-020031>
- Heazell AEP, Green M, Wright C, Flenady V, Frøen JF. Midwives and Obstetricians knowledge and management of women presenting with decreased fetal movements. *Acta Obstet Gynecol Scand*. 2008;87(3):331–339. <https://doi.org/10.1080/00016340801902034>
- Heazell AEP, Stacey T, O'Brien LM, Mitchell EA, Warland J. Excessive fetal movements are a sign of fetal compromise which merits further examination. *Medical Hypotheses*. 2018;111:19–23. <https://doi.org/10.1016/j.mehy.2017.12.024>
- Heazell AEP, Warland J, Stacey T et al. Stillbirth is associated with perceived alterations in fetal activity – findings from an international case control study. *BMC Pregnancy Childbirth*. 2017;17(1):1–11. <https://doi.org/10.1186/s12884-017-1555-6>
- Hong QN, Pluye P, Fabregues S et al. Mixed Methods Appraisal Tool (MMAT) Version 2018. 2018. http://mixedmethodsappraisaltoolpublic.pbworks.com/w/file/attach/127916259/MMAT_2018_criteria-manual_2018-08-01_ENG.pdf (accessed 15 August 2019)
- Koshida S, Ono T, Tsuji S et al. Excessively delayed maternal reaction after their perception of decreased fetal movements in stillbirths: population-based study in Japan. *Women Birth*. 2017;30(6):468–471. <https://doi.org/10.1016/j.wombi.2017.04.005>
- Koshida S, Ono T, Tsuji S et al. Fetal movement frequency and the effect of associated perinatal factors: multicenter study. *Women Birth J Australian College Midwives*. 2019;32(2):127–130. <https://doi.org/10.1016/j.wombi.2018.06.010>
- Levy M, Kovo M, Izaik Y. Reduced fetal movements at term in singleton low risk pregnancies—is there an association with placental histopathological findings? *AOGS*. 2020;99(7):884–890. <https://doi.org/10.1111/aogs.13810>
- Linde A, Georgsson S, Pettersson K et al. Fetal movement in late pregnancy – a content analysis of women's experiences of how their unborn baby moved less or differently. *BMJ Pregnancy Childbirth*. 2016;16(127). <https://doi.org/10.1186/s12884-016-0922-z>
- Linde A, Pettersson K, Rådestad I. Women's experiences of fetal movements before the confirmation of fetal death—contractions misinterpreted as fetal movement. *Birth Issues Perinatal Care*. 2015;42(2):189–194. <https://doi.org/10.1111/birt.12151>
- Linde A, Rådestad I, Pettersson K, Hagelberg L, Georgsson S. Better safe than sorry'—reasons for consulting care due to decreased fetal movements. *Women Birth*. 2017;30(5):376–381. <https://doi.org/10.1016/j.wombi.2017.02.007>
- Maulik D. *Dopler Ultrasound Sound in Obstetrics and Gynecology*. New York: Springer Publishing Company; 2005
- McArdle A, Flenady V, Toohill J, Gamble J, Creedy D. How pregnant women learn about fetal movements: sources and preferences for information. *Women Birth*. 2015;28(1):54–59. <https://doi.org/10.1016/j.wombi.2014.10.002>
- Moher D, Liberati A, Tetzlaff J, Altman DG. PRISMA 2009 Flow Diagram. www.prism-statement.org (accessed 18 August 2019)
- Nor Azlin MI, Maisarah AS, Rahana AR et al. Pregnancy outcomes with a primary complaint of perception of reduced fetal movements. *J Obstet Gynaecol*. 2015;35(1):13–15. <https://doi.org/10.3109/01443615.2014.930108>
- Norman JE, Heazell AEP, Rodriguez A et al. Awareness of fetal movements and care package to reduce fetal mortality (AFFIRM): a stepped wedge, cluster-randomised trial. *Lancet*. 2018;392(10158):1629–1638. [https://doi.org/10.1016/S0140-6736\(18\)31543-5](https://doi.org/10.1016/S0140-6736(18)31543-5)
- Olagbuji BN, Igarumah S, Akintayo AA et al. Maternal understanding of fetal movement in third trimester: a means for fetal monitoring and reducing stillbirth. *Niger J Clin Pract*. 2014;17(4):489–494. <https://doi.org/10.4103/1119-3077.134049>
- Pollock D, Ziaian T, Pearson E, Cooper M, Warland J. Breaking through the silence in antenatal care: fetal movement and stillbirth education. *Women Birth*. 2020;33(1):77–85. <https://doi.org/10.1016/j.wombi.2019.02.004>
- Rådestad I, Lindgren H. Women's perceptions of fetal movements in full-term pregnancy. *Sexual Reproductive Healthcare*. 2012;3(3):113–116. <https://doi.org/10.1016/j.srhc.2012.06.001>
- Richardson WS, Wilson MC, Nishikawa J, Hayward RS. The well-built clinical question: a key to evidence-based decisions. *ACP J Club*. 1995;123(3):A12–A13
- Royal College of Obstetricians and Gynaecologists. Reduced fetal movements (Green-top 57). 2011. www.rcog.org.uk/globalassets/documents/guidelines/gtg_57.pdf (accessed 5 April 2022)

- Saastad E, Tveit JVH, Flenady V et al. Implementation of uniform information on fetal movement in a Norwegian population reduced delayed reporting of decreased fetal movement and stillbirths in primiparous women – a clinical quality improvement. *BMC Res Notes*. 2010;3(1):2. <https://doi.org/10.1186/1756-0500-3-2>
- Saastad E, Tveit J, Flenady V et al. Implementation of uniform information of fetal movements in a Norwegian population reduced delayed reporting of decreased fetal movement and stillbirth in primiparous women – a clinical quality improvement. *BMC Res Notes*. 2010;3(1):2. <https://doi.org/10.1186/1756-0500-3-2>
- Sheikh M, Hantoushzadeh S, Shariat M. Maternal perception of decreased fetal movements from maternal and fetal perspectives, a cohort study. *BMC Pregnancy Childbirth*. 2014;14(1):286. <https://doi.org/10.1186/1471-2393-14-286>
- Smith V, Begley C, Devane D. Detection and management of decreased fetal movements in Ireland: a national survey of midwives' and obstetricians' practices. *Sci Direct*. 2014;30(1):43–49. <https://doi.org/10.1016/j.midw.2013.02.006>
- Smyth RMD, Taylor W, Heazell AE et al. Women's and clinicians perspectives of presentation with reduced fetal movements: a qualitative study. *BMC Pregnancy Childbirth*. 2016;16(1):280. <https://doi.org/10.1186/s12884-016-1074-x>
- Stacey T, Thompson JM, Mitchell EA et al. Maternal perception of fetal activity and late stillbirth risk: findings from the Auckland stillbirth study. *Birth Issues Perinatal Care*. 2011;38(4):311–316. <https://doi.org/10.1111/j.1523-536X.2011.00490.x>
- Tveit JVH, Saastad E, Stray-Pedersen B, Børdahl PE, Frøen JF. Concerns of decreased fetal movements in uncomplicated pregnancies – increased risk of fetal growth restriction and stillbirth among women being over weight, advanced age or smoking. *J Mater Fetal Neonatal Med*. 2010;23(10):1129–1135
- Tveit JVM, Saastad E, Stray-Pedersen B et al. Reduction of late stillbirth with the introduction of fetal movement information and guidelines – a clinical quality improvement. *BMC Pregnancy Childbirth*. 2009;32:9. <https://doi.org/10.1186/1471-2393-9-32>
- United Nations Children's Fund. A neglected tragedy the global burden of stillbirths. New York: UNICEF; 2020
- Warland J, Glover P. Fetal movements: what are we telling women? *Women Birth*. 2017;30(1):23–28. <https://doi.org/10.1016/j.wombi.2016.06.001>
- Warrander LK, Batra G, Bernatavicius G et al. Maternal perception of reduced fetal movements is associated with altered placental structure and function. *Plos One*. 2012;7(4):e34851. <https://doi.org/10.1371/journal.pone.0034851>
- Warrander LK, Heazell AEP. Identifying placental dysfunction in women with reduced fetal movements can be used to predict patients at increased risk of pregnancy complications. *Med Hypothesis*. 2011;76(1): 17–20. <https://doi.org/10.1016/j.mehy.2010.08.020>
- Winje BA, Roald B, Kristensen NP, Frøen JF. Placental pathology in pregnancies with maternally perceived decreased fetal movement – a population based nested case-cohort study. *Plos ONE*. 2012;7(6):e39259. <https://doi.org/10.1371/journal.pone.0039259>
- World Bank. World Bank country and lending groups. 2019. <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (accessed 5 April 2022)