Clinical practice guideline for the care of women with decreased fetal movements for women with a singleton pregnancy from 28 weeks' gestation

Endorsed by:

Version 2.3
September 2019

Produced by:

This is the third version of the clinical guideline produced by a multidisciplinary working group led by the Centre of Research Excellence in Stillbirth, Mater Research Institute, The University of Queensland, Brisbane, Australia in partnership with the Stillbirth and Neonatal Death Alliance (SANDA) of the Perinatal Society of Australia and New Zealand (PSANZ).

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Endorsed by:

The clinical guideline has been endorsed by: Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG); Australian College of Midwives (ACM); Stillbirth Foundation Australia; Australian National Council for Stillbirth and Neonatal Death Support (SANDS); Red Nose; Women's Healthcare Australasia; and Still Aware.

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Acknowledgments:

We wish to acknowledge all working group members and research support staff for their contribution to the current and previous versions of this guideline (see Appendix E).

Disclaimer:

The main objective of this guideline is to provide advice to health care providers on the care of women with concerns of decreased fetal movements (DFM), and to enhance consistency in information and care provided to women. This guideline has been developed to help reduce the risk of adverse pregnancy outcomes, including perinatal death or disability and maternal anxiety.

This guideline is not intended to be prescriptive. It is designed to provide the best available information, enabling integration of the best evidence, clinicians' judgement and individual choice in arriving at decisions about care. Clinical practice guidelines are considered as generally-recommended practice. Due to the lack of high-quality evidence, recommendations in this guideline are mainly consensus-based, following consideration of the available evidence.

E-learning program

An eLearning program has been developed to familiarise clinicians with the guidelines as part of the Safer Baby Bundle initiative. Please contact the Centre of Research Excellence in Stillbirth to request access to this eLearning program.

Update history

The first version of the Guideline was developed and disseminated in July 2010, subsequently updated in August 2017. In this update we incorporate the results of the AFFIRM trial and modify the management algorithm to include more specific advice around timing of birth.

Further review and information:

This guideline will remain current until the next review on or before **October 2020**. The next update will include an update of the literature review, incorporation of the findings of the My Baby's Movements trial (ACTRN12614000291684). Requests for further information, comments or suggestions are encouraged and can be forwarded to:

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Contents

1. Glossary of terms

Term	Definition
Acidaemia	Increased acidity of the blood caused by an increased concentration of hydrogen ions and measured by pH.
Amniotic fluid	The fluid that surrounds the fetus within the amniotic sac.
Antenatal	The period of the pregnancy prior to the onset of labour.
Antepartum	Before the onset of labour.
Apgar score	A system to assess the status of the baby after birth. The Apgar score is recorded at 1 minute and 5 minutes after birth and is based on the following five variables: heart rate, respiratory effort, muscle tone, reflex irritability and colour, with a maximum score of 10.
Body mass index (BMI)	A person's weight in kilograms divided by the square of height in meters.
Cardiotocography (CTG)	The electronic monitoring of the fetal heart rate (cardio) and of uterine contractions (toco). The fetal heart rate is recorded by means of either an external ultrasonic abdominal transducer or a fetal scalp electrode. Uterine contractions are recorded by means of an abdominal pressure transducer. The recordings are graphically represented over time.
Congenital anomaly	Structural or functional anomalies (e.g. metabolic disorders) that occur during intrauterine life and can be identified prenatally, at birth or later in life.[1]
Customised birthweight	Using a weight reference for the baby that is individualised (customised), and not based on population averages. Factors shown to be predictive of birthweight are maternal height and weight, ethnicity, fetal gender and gestational age. The customised birthweight standard is an adjusted standard for each individual baby.
Doppler ultrasound	A diagnostic tool that uses high frequency ultrasound to detect the presence or absence of blood flow and to measure blood flow velocity.
Fetal death	See “Stillbirth”
Fetal growth restriction (FGR)	Also known as ‘intrauterine growth restriction’ (IUGR). This term is often used interchangeably with the term ‘small for gestational age’ (SGA). However, SGA is defined as a baby with an antenatal ultrasound biometry assessment less than the 10th percentile for gestational age, while FGR refers to babies who have not reached their growth potential during pregnancy (which can be assessed by serial ultrasound scans). FGR babies are frequently *but not always* SGA.

[1] World Health Organization, 2019. Congenital anomalies. World Health Organization, accessed 24 July 2019 (https://www.who.int/topics/congenital_anomalies/en/)

Term	Definition
Fetal to maternal haemorrhage (FMH)	The passage of blood across the placental interface from the fetus to mother. FMH may be diagnosed using flow cytometry or the Kleihauer Betke test which detects fetal haemoglobin within red blood cells separately to the maternal adult haemoglobin. FMH may be acute or chronic and is usuallyasymptomatic. Although the volume of significant FMH is not defined and is gestational age dependent, it is associated with fetal mortality and morbidity.
Fetal movements	Any movements made by the fetus either perceived by the mother or detected on ultrasound or CTG at any gestation.
Decreased fetal movements (DFM)	Maternal perception of decrease in strength and/or frequency of her baby's movements in utero after 23 weeks' gestation.
Flow cytometry	A test used to detect FMH by differentiating fetal and maternal blood cells.
Gestation	The time from conception to birth. The duration of gestation is measured from the first day of the last normal menstrual period.
Health care provider	A midwife, GP, obstetrician, or other health professional providing maternity care.
Human placental lactogen (hPL)	hPL is a hormone produced by the placenta that modifies the metabolic state of the mother during pregnancy to facilitate the energy supply of the fetus.
Hypertension (Maternal)	Elevated blood pressure exceeding 140/90 mmHg.
Hypoglycaemia (Neonatal)	Low level of blood glucose (<2.6 mmol/L).[2]
Kick-chart	A method of counting fetal movements and recording them within a defined time frame.
Live birth	The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which after such separation breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of the voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. The definition of a live birth is independent of gestational age.
Neonatal	Pertaining to the newborn period, which is the first 28 days after birth.
Neonatal mortality rate (NMR)	The number of neonatal deaths (those occurring within the first 28 days following birth) per 1000 births.
Oligohydramnios	Reduced amniotic fluid volume
Planned early birth	Induction of labour or elective caesarean section prior to spontaneous onset of labour.

[2] Queensland Clinical Guidelines, 2013. Newborn hypoglycaemia (MN13.8-V5-R18). Statewide Maternity and Neonatal Clinical Network (Queensland).

Term	Definition
Perinatal mortality rate (PMR)	The number of stillbirths and neonatal deaths per 1000 births.
Preterm birth	The birth of a baby at less than 37 weeks gestational age.
Randomised controlled trial	A comparative study in which participants are randomly allocated to intervention and control groups and are followed up to examine differences in outcomes between the two groups.
Recurrent presentation of DFM	Where a woman presents with or reports DFM more than once in the same pregnancy.
Small for gestational age (SGA)	A fetus or baby with an estimated birthweight or actual birthweight less than the 10th percentile for gestational age, according to National birthweight percentiles.
Singleton	A single baby.
Stillbirth (Fetal Death)	Death prior to the complete expulsion or extraction from its mother of a product of conception of 20 or more completed weeks of gestation; or if the gestational age is not known, a birthweight of 400g or more. The death is indicated by the fact that after such separation, the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.
Stillbirth rate	The number of stillbirths per 1000 births.

2. Purpose of this guideline

With over 2.6 million stillbirths occurring annually in late gestation worldwide [1,2] and with little or no attention given to this public health problem, a strong call to action was made in the Lancet's series of 2011 and 2016 [3,4]. In high-income country settings, a key priority area to prevent stillbirths was addressing care of women with decreased fetal movements [5]. Stillbirths are often preceded by maternal perception of decreased fetal movement (DFM) [6,7]. DFM is also strongly linked to adverse perinatal outcomes such as neurodevelopmental disability, infection, fetal to maternal haemorrhage (FMH), emergency delivery, umbilical cord complications, and small for gestational age (SGA) [8,9]. DFM for some women may be associated with placental dysfunction, fetal growth restriction (FGR), and/or stillbirth [10].

This guideline has been developed in recognition of the variation in clinical practice and information provided to women regarding decreased fetal movements (DFM) [11,12].

2.1 Aims and objectives

The aim of this guideline is to improve the quality of care for women who perceive DFM at or after 28 weeks' gestation, and has been developed with the following objectives:

- Provide an evidence-based approach to the management of women with DFM;
- Improve consistency in the management of women with DFM;
- Assist health care providers to counsel women with DFM;
- Reduce maternal concern about fetal activity and self-monitoring;
- Aid in the identification of women with higher-risk pregnancy; and
- Improve outcomes for women and their babies.

The management of women with specific pregnancy conditions identified during the course of care, in accordance with this guideline (e.g. fetal growth restriction, hypertension, diabetes), is beyond the scope of this guideline, as is the management of DFM in multiple pregnancy or before 28 weeks' gestation.

2.2 Target audience

This guideline is written for health care professionals providing antenatal care in Australia and New Zealand and encourages them to provide consistent, best-practice management for women with singleton pregnancies who report or who are concerned about DFM from 28 weeks' or more gestation. Pregnant women and their partners may also find this guideline helpful. An information brochure has also been prepared in multiple languages to inform and assist women and their health care providers to facilitate shared management decisions. This brochure is based on the key recommendations set out in this guideline. More information is available at www.stillbirthcre.org.au.

2.3 Methods

The original version of this guideline followed the existing National Health and Medical Research Council (NHMRC) development of clinical practice guidelines at that time [13,14]. In this update we have incorporated findings from the Awareness of fetal movements and care package to reduce fetal mortality (AFFIRM) trial and addressed feedback from clinicians to provide more guidance on timing of birth according to risk factors and gestation. In the next update (planned for 2020) we aim to follow new methods set out by NHMRC (under development). Please refer to Appendix B for methods employed for version 1 of this guideline, Appendix C for an overview of the literature review, and Appendix D for grading of recommendations.

3. Summary of clinical practice recommendations and care pathway

3.1 Recommendations for information-provision and advice about fetal movement monitoring

Recommendations	References	Recommendation grade*
Recommendation 1		
a. All pregnant women should be routinely provided with verbal and written information about fetal movements by 28 weeks. Women should be advised that it is normal to perceive increasingly strong movement, episodes of movements that are more vigorous than usual, occasional fetal hiccups, and a diurnal pattern involving strong fetal movement in the evening.	11,15-19	**C**
b. Clinicians should remind women at each scheduled and unscheduled antenatal visit after 28 weeks' gestation of the importance of maternal awareness of fetal movements and to report concerns of a decrease in strength and/or frequency or a non-diurnal pattern of movements.		**√**
Recommendation 2		
a. All women who contact their health care provider with a concern about fetal movements should be invited to the health service for immediate assessment.	6,8,15	**C**
b. Presentation should not be delayed through efforts to stimulate the baby with food or drink or by requesting women to phone back after a period of concentrating on fetal movements.	20,21	**√**
Recommendation 3		
a. Maternal concern of DFM overrides any definition of DFM based on numbers of fetal movements.	8,15,22	**√**
b. The use of kick-charts is not currently recommended as part of routine antenatal care.	23	**B**

3.2 Recommendations for the investigation of decreased fetal movements

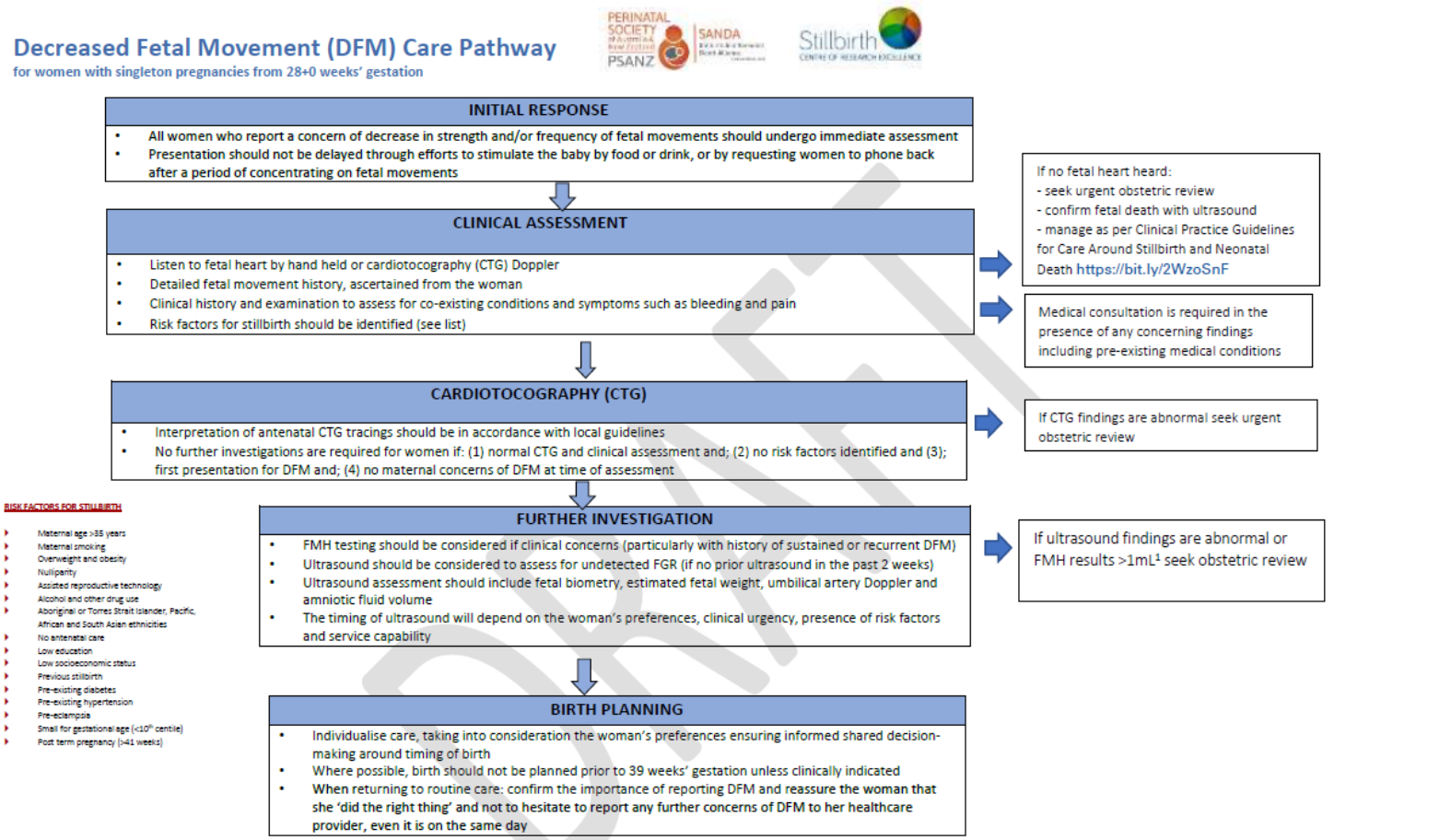
Recommendations	References	Recommendation grade*
Recommendation 4		
a. When a woman reports DFM, a medical history and clinical examination should be undertaken to assess for coexisting symptoms such as bleeding and pain and other conditions (e.g. hypertension, small for gestational age baby) and presence of risk factors for stillbirth and/or fetal growth restriction.	11,15,24,25	**B**

Recommendations	References	Recommendation grade*
b. This assessment should include a review with the woman of her history of fetal movements, including frequency, strength and any changes in the pattern of movements. c. Medical consultation is needed in the presence of any concerning findings.	15	√
Recommendation 5		
a. Listening to the fetal heart rate by handheld Doppler or electronic fetal heart rate monitoring (EFM) via cardiotocography (CTG) should be performed to exclude fetal death. b. CTG should be performed to exclude fetal compromise and an urgent medical review should be undertaken where findings are abnormal. c. No further investigations are required for women if: (1) CTG and clinical assessment is normal; (2) no risk factors for stillbirth are identified; (3) it is the woman's first presentation for DFM and; (4) there are no maternal concerns of DFM at time of assessment.	15,24,26	C √ √
Recommendation 6		
a. Ultrasound scan assessment including fetal biometry, estimated fetal weight, umbilical artery Doppler and amniotic fluid volume for undetected FGR should be considered for all women if not performed in the last two weeks. b. The timeframe to perform this investigation will depend on the woman's preferences, clinical urgency, presence of risk factors and service capability. c. Where ultrasound findings are abnormal, discuss with a senior obstetrician.	6,8,15,24,26,27	B
Recommendation 7		
Testing for fetal to maternal haemorrhage should be considered in the preliminary investigation of women with DFM where FMH is suspected, particularly if there is a history of sustained or recurrent DFM.	28,29	√
Recommendation 8		
a. Shared decision-making on the benefits and risks of planned birth should be facilitated through the provision of written and verbal information for each woman's individual situation, based on her preferences, gestational age, findings of clinical investigations, and the presence or absence of stillbirth risk factors. Where possible, birth should not be planned prior to 39 weeks unless clinically indicated. b. Women who report DFM should be reassured that they have done the right thing in presenting for assessment and that they are not	30,31 32	√ √

Recommendations	References	Recommendation grade*
a ‘nuisance’ or ‘burden’ to their care providers, even where no abnormal findings are found.		
Recommendation 9		
For women who represent with DFM on a second or subsequent occasion, manage as per initial presentation and individualise care.	[33]	**√**

* See Appendix D for a description of grading of recommendations used in this guideline.

3.3 Care pathway for women with decreased fetal movements from 28 weeks' gestation (singleton pregnancy)



*If women have a concern of DFM prior to 28 weeks' gestation, they should be advised to contact their healthcare provider. There is currently insufficient evidence to inform the management of women who report DFM prior to 28 weeks' gestation.

1. Wylie BJ, D'Alton ME. Fetomaternal hemorrhage. *Obstet Gynecol* 2010; 115(5): 1039-51.

4. Background

4.1 Maternal perception of fetal movement and adverse events

Maternal perception of fetal movement has long been used as an indicator of fetal wellbeing and vitality [34]. The quality and timing of fetal movements reflects neurobehavioural development and maturation of the fetus, and follows a general pattern with advancing gestation [35,36]. A discussion about how different types of movement may feel as pregnancy progresses, may help women learn the way a baby moves in pregnancy prior to the third trimester. Maternal perception of fetal movement tends to commence from 16 to 20 weeks gestation [37], with these first movements variably described as a "flutter", "butterflies" or "bubbles"[36]. As pregnancy progresses, description of movements changes to reflect increasing strength, more complex limb and body movements and greater frequency [36]. In a qualitative study of 40 women within 2 weeks of delivery of uncomplicated pregnancies, 39 of the women described their fetal movements at this stage as "strong and powerful", and half described the fetal movements as "large" [38,39].

Bradford and colleagues [16] prospectively evaluated maternal perception of fetal movement strength, frequency and pattern from 28 weeks' gestation in pregnancies with normal outcomes and reported a diurnal pattern with strong fetal movements felt by most women in the evening and at night-time. Diurnal pattern of strong or moderate movements in the evening was consistent in both early and late third trimester pregnancies. Around 17.2% of women who had a normal outcome reported decreased frequency of movements after 37 weeks, but only 2.8% who had a normal outcome reported that the baby was quiet in the evening. These data suggest a non-diurnal pattern of fetal movements may be a stronger predictor of adverse outcome than a decrease in the frequency of movements at term. Indeed, Bradford and colleagues [40] found that women who perceived their fetus to be quiet in the evening had an almost four-fold increased odds of late stillbirth. Consistent with this, the STARS case-control study reported a reduced risk of stillbirth where the baby was "active at bedtime" [17]. In any case, women should be encouraged to seek immediate review if concerned about DFM at any time, but especially where DFM occurs in the evening.

A number of factors have been purported to contribute to this variation including fetal size, specific movement patterns of the baby [37], gestational age, amniotic fluid volume, medications, fetal sleep state, anterior placentation, maternal BMI, smoking and parity. However, the evidence is conflicting with others showing no relationship between the proportion of movements perceived and placental site or parity [41], or BMI [42].

It is a misconception that fetal movements decrease in strength or frequency towards the end of pregnancy because the fetus has "less room to move". Healthy fetuses near term have longer periods of activity and rest. As pregnancy progresses, some women report feeling less kicks and more rolling, shuffling and pushing or stretching movements. Healthy fetuses continue to move every day towards the end of pregnancy and have bouts of strong movements right up to and including during labour [39,43].

We have limited understanding of patterns of fetal activity during "sleep" and active cycles, and the changes in the type of movements as pregnancy advances. However fetal movements are usually absent during fetal "sleep" cycles. Fetal "sleep" cycles occur regularly throughout the day and night and usually last 20 to 40 minutes [44,45], rarely exceeding 90 minutes in a healthy fetus [25,44,45].

Maternal perception of DFM can indicate pregnancies at increased risk of adverse outcomes. Studies have reported associations between DFM and low birth weight [24,46-53], oligohydramnios, preterm birth [46,54], threatened preterm labour [46], congenital malformations and chromosomal abnormalities

[55], fetal to maternal haemorrhage [56], perinatal brain injuries and disturbed neurodevelopment [57,58], intrauterine infections [59], low Apgar scores and acidaemia [47,49], hypoglycaemia [46], umbilical cord complications and placental insufficiency [10,24,52] and increased likelihood that the pregnancy will end in emergency delivery, induction of labour and Caesarean section, stillbirths and neonatal deaths [60-64].
Fetal growth restriction appears to be a major factor contributing to the increased risk of adverse outcomes in these pregnancies [24,61,65-69]. A case-control study of 18,000 births across 6 maternity hospitals in Queensland, Australia found that of pregnant women in the third trimester who reported decreased fetal movement, 16% of these women had a baby with FGR [70]. Another case-control study from the UK reported that FGR was present in 11% of women with DFM compared with 0% in the control group [27], but caution is required in interpreting these findings due to its small sample size.

DFM is a common cause for maternal concern, with 40 percent of pregnant women expressing concern about DFM one or more times during pregnancy [71], and 4-16% of women contacting their health care provider because of concern during the third trimester [15,72,73]. Even in pregnancies that are initially deemed as low risk, DFM is associated with an increased risk of adverse perinatal outcome, including fetal growth restriction, preterm birth and stillbirth [24,46,63,67,72,74,75]. A prospective, population-based study in Norway reported a fetal death rate in women who had a live fetus at time of presentation with DFM was 8.2 per 1000, compared to 2.9 per 1000 in the general population [60].

4.1.1 The evidence for interventions to improve outcomes for women with DFM

In 2016, a systematic review of interventions to raise awareness and improve outcomes for women with DFM showed no clear evidence of benefit or harm [76]. Fetal movement counting (where women record the number of movements using a kick chart) has been proposed as an intervention to reduce stillbirth rates through increasing maternal awareness of DFM. However, the Cochrane systematic review on fetal movement (FM) counting showed no statistically significant reduction in stillbirths [77].

In the largest trial of kick counting, while no reduction was shown in stillbirth rates, the overall late stillbirth (≥28 weeks' gestation) rate fell during the study period from 4 per 1,000 to 2.8 per 1,000 births. It was postulated that this reduction was due an increased awareness and vigilance of DFM [78]. In a non-randomised quality improvement study across 14 hospitals in Norway, a similar reduction was shown for a package of care to raise awareness of DFM (with optional kick counting) and a standardised protocol for clinical management. Importantly, in the Norwegian study women with DFM presented for care earlier during the intervention period [11,15]. A more recent individual participant randomised controlled trial showed that kick counting increased antenatal detection of FGR [79].

The recent AFFIRM trial in the UK was designed to evaluate a package of care that included raising awareness of the importance of DFM (in both women and health care providers); along with guidelines for assessing and managing fetal well-being, when women presented with DFM. The specific intervention was an e-learning package for clinical staff and a leaflet for pregnant women, alerting them to the importance of DFM in their pregnancy. The trial involved 33 maternity hospitals and over 400,000 births [80].

The primary outcome of AFFIRM was the stillbirth rate, which was 4.06 per 1,000 births in the intervention group and 4.40 per 1,000 births in the control group. This difference was not statistically significant. However, there was a decrease in the incidence of SGA babies being born after 40 weeks' gestation (1.5% vs 2.0%, aOR 0.86, p=0.0009) in the intervention compared with control group. This suggests that the AFFIRM intervention identified a population of high-risk babies with placental

insufficiency and SGA who had a timely delivery, thus potentially preventing stillbirths that otherwise may have occurred. The AFFIRM intervention also decreased the rate of spontaneous vaginal delivery (57.4% vs 59.8%), increased the rate of induction of labour (40.7% vs 35.8%), and of caesarean birth (28.3% vs 25.5%), and increased the rate of a prolonged admission to a neonatal unit (6.7% vs 6.2%) with all differences meeting statistical significance.

There is general consensus that practice change should await further studies [81,82] including the findings of ongoing trials in this area (My Baby's Movements trial in Australia and New Zealand (ACTRN12614000291684) and Mindfetalness in Sweden (NCT02865759) and planned Individual Participant Data Meta-analysis.

4.2 Stillbirths in Australia and New Zealand

Stillbirth affects over 2,500 families per year across Australia and New Zealand; equating to one baby is stillborn (≥20 weeks' of pregnancy) for every 142 births across Australia and New Zealand [83,84]. Global stillbirth rates have failed to show any significant reduction for more than a decade. In comparison, global neonatal mortality rates continue to steadily decline [2].

Both Australia and New Zealand report fetal deaths from 20 weeks (or weight of ≥ 400 grams if gestation unknown) and neonatal deaths up to 28 days after birth. In Australia, the combined rate is reported as a *perinatal mortality rate* (PMR) and in New Zealand it is reported as a *perinatal related mortality rate*.

Based on 2016 data from the National Perinatal Statistics Unit in Australia, there were 310,247 births and 2,849 perinatal deaths in Australia, giving a PMR of 9 per 1000 births [83]. Perinatal mortality comprised 2,107 stillbirths and 742 neonatal deaths, giving a stillbirth rate of 7 per 1000 births and a neonatal death rate of 2 per 1000 births [83]. The PMR of babies born to Aboriginal or Torres Strait Islander mothers was higher than that of babies born to non-Indigenous mothers (15 versus 9 per 1000 births) [83].

In New Zealand, based on data from the Perinatal and Maternal Mortality Review Committee in 2016, there were 60,600 births and 610 perinatal deaths, giving a perinatal-related mortality rate of 10 per 1000 births. Perinatal mortality comprised 310 stillbirths, 148 late terminations of pregnancy (from 20 weeks gestation), and 152 neonatal deaths. Stillbirth rate (excluding late termination of pregnancy) was 5.1 per 1000 births, fetal death rate (including stillbirths and late terminations) was 7.6, and neonatal death rate was 2.5 per 1000 births [84]. The overall New Zealand perinatal-related mortality rate per 1000 births for Māori (11.9), Pacific peoples (12.4) and Indian (14.8) mothers, is significantly higher than among Other Asian (7.5), Middle Eastern, Latin American or African (5.7), Other European (5.5), and New Zealand European (9.7) mothers [84].

The large proportion of unexplained antepartum stillbirths [85] is a major barrier to further reduction of stillbirth and perinatal mortality rates. Wide variation in the reported contribution of unexplained stillbirths relates to the different system used and levels of investigation [85]. The majority of these unexplained deaths occur in late gestation in apparently healthy pregnancies. In Australia (using the PSANZ classification system) [86], 22% of stillbirths are unexplained, with the proportion higher for term stillbirths (44%) [87]. Many of these babies are, however, found to be growth-restricted after birth [88,89], indicating potential for the prevention of some of these deaths if antenatal detection and appropriate intervention had been achieved.

Other factors which are associated with an increased risk of stillbirth in a high-income country setting include: maternal age older than 35 years; maternal overweight and obesity; maternal smoking; nulliparity; previous stillbirth; and pre-existing maternal diabetes or hypertension [5] (see Appendix A).

4.3 Clinical assessment of fetal movement concerns

Wide variation in clinical practice regarding the management of DFM was shown in a survey of members of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) [12], as well as in similar surveys for midwives in Australia and New Zealand [90-92]. Both surveys revealed that, although monitoring fetal activity through asking women about fetal movements was considered an important part of routine antenatal care, the definition of alarm limits, the level of clinical assessment and the follow-up of women presenting with DFM varied widely. These findings are consistent with other similar surveys from the UK and Norway [60,93].

Contributing factors relating to suboptimal care account for 30-50% of stillbirths and neonatal deaths [94-96]. A number of studies have identified that an inappropriate response to maternal perception of DFM was a common factor contributing to stillbirths [95-101]. Prolonged DFM (>24 hours) as well as sudden loss of fetal movements was reported in 47%-64% of all stillbirths [98,102].

4.4 Investigations for DFM prior to 28 weeks' gestation

There is currently insufficient evidence to inform the management of women who report DFM prior to 28 weeks' gestation. Between 20 and 28 weeks of gestation, conditions predisposing to DFM, e.g. fetal neuromuscular abnormalities, fetal anaemia, fetal hydrops, congenital infection and early onset fetal growth restriction, may be difficult to recognise clinically. Fetal ultrasound to assess fetal biometry and amniotic fluid volume should be considered. CTG prior to 28 weeks' can be difficult to interpret due to fetal immaturity and is not routinely recommended. Testing for FMH can also be undertaken by a Kleihauer Betke test or by flow cytometry. Where facilities and expertise are available, risk assessment for fetal anaemia can be undertaken by Doppler ultrasound of the fetal middle cerebral artery blood flow velocity.

5. Defining DFM and maternal perception of fetal activity

Recommendations	References	Recommendation grade
Recommendation 1		
a. All pregnant women should be routinely provided with verbal and written information about fetal movements by 28 weeks. Women should be advised that it is normal to perceive increasingly strong movement, episodes of movements that are more vigorous than usual, occasional fetal hiccups, and a diurnal pattern involving strong fetal movement in the evening.	11,15-19	**C**
b. Clinicians should remind women at each scheduled and unscheduled antenatal visit after 28 weeks' gestation of the importance of maternal awareness of fetal movements and to report concerns of a decrease in strength and/or frequency or a non-diurnal pattern of movements.		**√**
Recommendation 2		
a. All women who contact their health care provider with a concern about fetal movements should be invited to the health service for immediate assessment.	6,8,15	**C**
b. Presentation should not be delayed through efforts to stimulate the baby with food or drink or by requesting women to phone back after a period of concentrating on fetal movement.	20,21	**√**

Attempts have been made to define normal patterns of fetal movements, but there is no universally-agreed definition of DFM. Moore and Piacquadio proposed an alarm limit of less than 10 movements within 2 hours between the hours of 7pm and 11pm (when a fetus is likely to be active) [22]. However, this alarm limit was not found to be sufficiently sensitive to identify at-risk fetuses [103].

Antenatal education about fetal movement has been shown to reduce the time from maternal perception of DFM to health care-seeking behaviour [15]. A reduction in stillbirth rates has been associated with increased awareness of DFM in a quality improvement study in Norway [11,15]. The study used a prospective "before-and-after" study design to evaluate the combined impact of providing women with information on DFM, and clinicians with clinical practice guidelines on DFM. This combined intervention was associated with a reduction in stillbirth rates, giving an adjusted odds ratio (OR) of 0.67 (95% CI: 0.49-0.94) in the overall study population and an adjusted OR of 0.51 (95% CI: 0.32-0.81) in women with DFM.

However, despite this link between maternal awareness of fetal movement, clinical education and stillbirth prevention, many women do not receive adequate information from their care providers [104,105]. A recent prospective, descriptive study of 526 pregnant women at a large, metropolitan maternity facility found that more than one-third of women at 34 weeks gestation or later did not recall receiving information from their health care provider about fetal movement [92]. Most pregnant women preferred to be given as much information as possible, and cited health professionals as a trustworthy source [92]. However, a survey of 72 Australian Midwives showed that midwives may not always provide consistent, evidence-based information to women [91].

Women with DFM who ask for advice are often told that their baby may respond with movements within 20 minutes after having something sweet to eat, or after having a cold or fizzy drink. However, there is no evidence available to support this advice [16]. Fetal movements have been shown not to be altered by intravenous glucose administration, or by a recent meal [21,106-108].

6. The role of formal fetal movement counting

Recommendations	References	Recommendation grade
Recommendation 3		
a. Maternal concern of DFM overrides any definition of DFM based on numbers of fetal movements.	8,15,22	√
b. The use of kick-charts is not currently recommended as part of routine antenatal care.	23	B

A Cochrane review assessed the effect of formal fetal movement counting on perinatal death, major morbidity, maternal anxiety and satisfaction, pregnancy intervention and other adverse pregnancy outcomes, using five randomised trials, involving a total of 71,458 women [23]. Two of the included studies assessed a once-a-day fetal movement counting method with standard care as a control [79,109]. Two studies compared two different fetal movement counting methods [110,111].

The largest study included in this review was the cluster-randomised trial by Grant *et al* comparing formal fetal movement counting (using a modified Cardiff 'count to 10' method) in all pregnancies versus a control group fetal movement counting was used selectively [109]. When compared to women receiving standard antenatal care, this study found no significant reduction in the stillbirth rates in women undertaking daily fetal movement counting using a "kick-chart". There was, however, a trend towards more antenatal admissions in the fetal movement counting group than in the control group. Further, there was an increased use of other fetal testing methods, with more women having CTG in the fetal movement counting group than in the group where movement counting was selective [109]. The review authors concluded that there was not enough evidence to recommend or not recommend formal fetal movement counting for all women or for women at increased risk of adverse pregnancy outcomes, and recommended further research in this area.

Although the trial was subject to some methodological bias due to the use of "within hospital" clusters, the overall stillbirth rate of the intervention and the control groups combined fell during the study period from 4 per 1000 to 2.8 per 1000 births. It is postulated that this may be attributed to increased maternal awareness and vigilance toward DFM across both arms [72,109].

A meta-analysis of three trials, including 1893 women with at-risk pregnancies provided with "kick-charts", illustrated a strong association between fetal growth restriction and DFM (OR 6.34, 95% CI 4.19-9.58) [72]. A literature review of interventions to reduce stillbirth recommended routine fetal movement counting for high risk pregnancies only, especially where there is evidence of FGR [112]. However, this recommendation is limited due to the studies upon which it is based. Limitations of the two studies include the methodology used (non-randomised), the small numbers enrolled and changes in the population and in practice which may have occurred since these studies were undertaken; both of which were conducted in the late 1980s [113,114].

However, a more recent study in Norway demonstrated that a modified count-to-10 method of fetal movement counting may have contributed to a significant increase in antenatal detection of fetal growth restriction [79]. A subsequent multi-centre, randomized controlled trial of 1,076 pregnant

women, assigned to either perform fetal movement counting from gestational week 28, or to receive standard antenatal care (controls), found that 87% of growth-restricted fetuses were identified antenatally in the intervention group, compared to 60% identified antenatally in the control group, with no increase in consultations or obstetric interventions. This trial also corroborates previous findings that fetal movement counting has not proven to increase maternal concern or anxiety [11].

7. Which investigations should be undertaken for DFM?

7.1 Fetal heart rate monitoring

Recommendations	References	Recommendation grade
Recommendation 4		
a. When a woman reports DFM, a medical history and clinical examination should be undertaken to assess for coexisting symptoms such as bleeding and pain and other conditions (e.g. hypertension, small for gestational age baby) and presence of risk factors for stillbirth and/or fetal growth restriction.	11,15,24,25	**B**
b. This assessment should include a review with the woman of her history of fetal movements, including frequency, strength and any changes in the pattern of movements.	15	**√**
c. Medical consultation is needed in the presence of any concerning findings.		
Recommendation 5		
a. Listening to the fetal heart rate by handheld Doppler or electronic fetal heart rate monitoring (EFM) via cardiotocography (CTG) should be performed to exclude fetal death.	15,24,26	**C**
b. CTG should be performed to exclude fetal compromise and an urgent medical review should be undertaken where findings are abnormal.		**√**
c. No further investigations are required for women if: (1) CTG and clinical assessment is normal; (2) no risk factors for stillbirth are identified; (3) it is the woman's first presentation for DFM and; (4) there are no maternal concerns of DFM at time of assessment.		**√**

The first step in the management of DFM is to ensure the fetus is alive and not in imminent danger of death.

A handheld Doppler can immediately confirm the presence of a fetal heartbeat. A cardiotocography (CTG) may be performed to detect a fetal heart beat and to establish the fetal heart rate (FHR) pattern in women greater than 28+0 weeks' gestation. In both situations, a fetal heartbeat needs to be differentiated from the maternal heartbeat by assessing the maternal pulse rate and noting if this is the same or different from the FHR. If the presence of a fetal heart beat is not confirmed then an

immediate bedside ultrasound scan assessment of fetal cardiac activity should be undertaken. If fetal death is excluded, a CTG can assess for any signs of immediate fetal compromise.
The presence of a normal FHR pattern (i.e. showing baseline of 110-160 bpm, short term variability of 6-25 bpm, accelerations of 15 bpm for 15 seconds, and the absence of decelerations) is a positive indicator of fetal wellbeing and suggests a normally functioning autonomic nervous system [115]. The fetal heart rate (FHR) accelerates with 92-97% of all gross body movements felt by the mother [116,117]. Other FHR patterns may or may not be associated with fetal compromise. For example, a "flat" FHR pattern showing reduced short term variability (<5bpm) may be present during the sleep cycle of a healthy fetus, but it is more likely to be associated with fetal compromise if it lasts for >90 minutes [118-120]. If a woman presents with DFM and her CTG has abnormal features, this requires review by an experienced midwife or doctor. If the CTG remains abnormal after 90 minutes, this requires urgent medical review.

Although antenatal CTG has become part of clinical practice, a Cochrane review [121] comprising four trials and 1588 women did not confirm or refute any benefits for routine antepartum CTG monitoring of "at-risk" pregnancies. However, the authors acknowledge several limitations of this review, including the small numbers of women studied, methodological concerns, and also the fact that these trials were conducted in the early 1980s. However, a 2011 retrospective, population-based cohort study of women presenting with maternal perception of DFM during the third trimester found that the CTG was a reliable screening indicator of fetal wellbeing, and that abnormal pregnancy outcomes were more common when the initial CTG was abnormal or persistently non-reassuring [122].

Recent non-randomised studies have reported benefits of screening low- and at-risk pregnancies using CTG monitoring for the indication of DFM. For example, in a Norwegian study of 3014 women reporting DFM, a CTG was performed in 97.5% of cases and an abnormal result was detected in 3.2% [8]. In an observational study of women presenting with DFM who underwent CTG and an ultrasound scan, 21% had an abnormal result that required action and 4.4% required immediate delivery [24]. Another study showed that stillbirth rates (corrected for lethal congenital anomalies), after a normal and abnormal CTG, were 1.9 and 26 per 1000 births, respectively [123]. While the evidence on the effectiveness of CTG monitoring in the identification of "at-risk" babies remains inconclusive, the use of CTG as a screening tool can be justified, as an abnormal FHR pattern may be associated with poor outcomes [124].

7.2 Ultrasound scans and FMH testing

Recommendations	References	Recommendation grade
Recommendation 6		
a. Ultrasound scan assessment including fetal biometry, estimated fetal weight, umbilical artery Doppler and amniotic fluid volume for undetected FGR should be considered for all women if not performed in the last two weeks. b. The timeframe to perform this investigation will depend on the woman's preferences, clinical urgency, presence of risk factors and service capability. Where ultrasound findings are abnormal, discuss with a senior obstetrician. c. Where ultrasound findings are abnormal, discuss with a senior obstetrician.	6,8,15,24,26,27	**B**
Recommendation 7		
Testing for fetal to maternal haemorrhage should be considered in the preliminary investigation of women with DFM where FMH is suspected, particularly if there is a history of sustained or recurrent DFM.	28,29	**√**

Although evidence is currently lacking to recommend ultrasound assessment for all cases of women presenting with DFM, ultrasonography may be used for the detection of conditions that contribute to DFM. A prospective cohort study of 305 women reporting DFM found that of the 67 pregnancies with poor perinatal outcomes, 4 were identified by CTG, 20 by ultrasound assessment of fetal growth, amniotic fluid volume and umbilical artery Doppler, and a further 24 were identified by low hPL level in the absence of any other abnormality [53].

In a prospective cohort study of 3014 women with DFM, detection of an abnormality using ultrasound (FGR, reduced amniotic fluid volume or fetal abnormality) was reported in 11.6% [8]. The CTG in this study was abnormal in only 3.2% of cases and an abnormal umbilical artery Doppler was noted in 1.9% [8].

A Cochrane Review comprising 18 studies and over 10,000 women concluded that the use of Doppler ultrasound of the umbilical artery in high-risk pregnancies reduced the risk of perinatal deaths and resulted in fewer obstetric interventions [125]. However, the review cautioned that current evidence was not of high quality and further studies were required.

In a Norwegian study, an investigation protocol of CTG and ultrasound scan was used in the management of women reporting DFM [15]. The study recommended that both investigations should be performed within 2 hours if women reported *no fetal movements* and within 12 hours if they reported *decreased fetal movements*. In this study, the ultrasound scan was conducted to assess fetal biometry, amniotic fluid volume, and fetal anatomy. The addition of umbilical artery Doppler studies in the investigation protocol did not show any further benefit [15]. Although the number of ultrasound scans more than doubled (OR 2.64, 95% CI 2.02-3.45), this appeared to be offset by a reduction in additional follow-up consultations and admissions for induction of labour. The study

reported no increase in the number of preterm births, infants requiring transfer to neonatal care, or infants with severe neonatal depression or fetal growth restriction. Importantly, a significant reduction in perinatal mortality was shown (OR 0.51, 95%CI 0.32-0.81) [15].

Insignificant haemorrhage of fetal blood into the maternal circulation is common and usually unrecognised [28]; but when significant (i.e. acute large volume FMH, recurrent small/moderate FMH or chronic small volume loss over time) it can lead to fetal compromise and/or perinatal death. Massive fetal-to-maternal haemorrhage (FMH) (varying from >50mls to >150mls) has been demonstrated in approximately 4% of stillbirths and in 0.04% of neonatal deaths [126,127]. Moderate to severe FMH occurs in around 0.3% of all live births [28]. However, there is ambiguity over the definition of a clinically relevant volume of haemorrhage, as the rate of blood loss, chronicity of the bleed and gestational age of the fetus may also influence the risk of adverse perinatal outcome [128].

Clinical risk factors do not reliably predict the likelihood of massive fetal to maternal haemorrhage and DFM may be the only history suggesting this possibility [28,29,126,129,130]. A retrospective analysis of clinical data from a multihospital health care system in the US found that decreased or absent fetal movement was reported by pregnant women in 54% of FMH cases and was the most common presenting sign [131]. An earlier review had found decreased or absent fetal movement reported as the presenting symptom of 27% of all FMH cases published in the medical literature to 1997 [56].

A sinusoidal FHR pattern is the classically described CTG sign indicating severe fetal anaemia , however, this is not present in all cases [126]. One study demonstrated that among a population associated with severe fetal anaemia, only 12.5% of cases demonstrated a sinusoidal pattern [131]. A normal CTG therefore cannot exclude significant fetal anaemia and the only “suspicious” CTG signs may be reduced or absent variability [132].

It is suspected that a higher number of FMH cases are unreported, as in miscarriages or undiagnosed intrauterine fetal death. A recent study also found that FMH diagnosis is highly dependent on physician awareness of the condition. The incidence of diagnosed FMH in a large urban hospital, prior to an educational intervention for neonatologists, was 22 per 1000 anaemic neonates, compared to 182 per 1000 afterwards [133].

Testing for FMH from a sample of the mother’s blood is widely available by flow cytometry or the Kleihauer Betke test. Where ultrasound facilities and appropriate expertise are available, assessment for fetal anaemia can be undertaken by Doppler measurement of the fetal middle cerebral artery (MCA) velocity. If FMH is suspected or proven on flow cytometry or Kleihauer Betke test, CTG or ultrasound, specialist medical review is recommended.

8. Subsequent presentations for DFM

Following exclusion of fetal compromise at an initial episode of DFM, maternal concern of DFM may persist or may result in subsequent consultations for DFM. To date, few studies guide the management of women who have ongoing concern about DFM. A small retrospective study, involving 203 women, showed that women with more than one presentation of DFM were at increased risk of poor pregnancy outcomes [33]. A larger retrospective cohort study in the UK, involving 1234 women reporting DFM beyond 36 weeks' gestation, found that 16.6% of these had more than one presentation for DFM. Of women with repeated DFM episodes, 44% birthed a SGA baby, and they were also more likely to have had high second-trimester uterine artery Doppler resistance indices [134]. This study concluded that women presenting with repeated DFM episodes should be considered at high risk for placental dysfunction irrespective of antenatal ultrasound or Doppler assessment results.

While research is limited, with the potential for increased risk, closer surveillance should be considered for women with ongoing concerns of DFM. Any management strategy for DFM needs to take into account the presence of other risk factors and the gestational age.

9. DFM and birth planning

Recommendations	References	Recommendation grade
Recommendation 8		
a. Shared decision-making on the benefits and risks of planned birth should be facilitated through the provision of written and verbal information for each woman's individual situation, based on her preferences, gestational age, findings of clinical investigations, and the presence or absence of stillbirth risk factors. Where possible, birth should not be planned prior to 39 weeks unless clinically indicated.	30,31	√
b. Women who report DFM should be reassured that they have done the right thing in presenting for assessment and that they are not a 'nuisance' or 'burden' to their care providers, even where no abnormal findings are found.	32	√
Recommendation 9		
For women who represent with DFM on a second or subsequent occasion, manage as per initial presentation and individualise care.	33	√

While the adverse outcomes of preterm birth are well understood, it is becoming increasingly apparent that early term birth (37-38 weeks' gestation) is also associated with increased short and longer term mortality and morbidity [31] and poorer developmental outcomes [30]. In a cohort study, Bentley et al demonstrated that the risk of being 'developmentally high risk' (scoring in the bottom 10% for 2 or more developmental domains) was significantly increased by birth < 39 weeks' gestation compared to birth at 40 weeks' gestation [30]. Moreover, a dose-response relationship was evident, with the risk of being developmentally high risk increasing as gestation at birth decreased; 34 to 36 weeks 1.26 (1.18–1.34), 37 weeks 1.17 (1.10–1.25), 38 weeks 1.06 (1.01–1.10), 39 weeks 0.98 (0.94–1.02), ≥41 weeks 0.99 (0.94–1.03). Early-term birth (37 and 38 weeks' gestation) has also been linked to

increased mortality in infancy, early childhood and young adulthood [31]. The timing of birth should be individualised based on the woman's clinical situation and preferences. Shared informed decision making between the woman and her health care professional is needed around planned early birth, carefully balancing the risk of late stillbirth with the risk of harm of obstetric intervention. For further information, please refer to the statement "Improving decision-making about the timing of birth for women with risk factors for stillbirth".

10. Discussion: Implementation and future research

Leading international authorities have recommended that women experiencing DFM should notify their health care providers as soon as reasonably possible [135-137]. However, beyond this recommendation, there is limited guidance for clinicians on how to manage this presentation, resulting in much variation amongst clinicians with regards to appropriate clinical management. Cochrane reviews related to fetal movement counting and management of reported decreased fetal movements recommend further research in this area [23,138]. This guideline was developed to promote clinical practice which is based on the best available international evidence, thereby improving information and counselling offered to women during the antenatal period and reducing variation in clinical practice across Australia and New Zealand.

The recommendations of this guideline cover two key areas: 1) information for pregnant women about what constitutes normal fetal movements and advice about reporting concerns of a reduction in fetal movements to a health care provider; and 2) information for clinicians with regards to the management and investigation of women reporting DFM. In the absence of robust research in this area, the nine key recommendations are largely based on consensus after careful consideration of the available evidence.

Improving the consistency and standard of information provided to pregnant women on fetal movements and on the significance of reporting DFM is likely to reduce concern associated with DFM and, more importantly, may lead to timely intervention and a reduction in stillbirths. The findings of a Norwegian study [15] are encouraging in their demonstration of a reduction in the stillbirth rate by one-third following the implementation of a guideline and the provision of information about fetal movements to pregnant women. However, this was not replicated by the large AFFIRM trial [80]. The Australia and New Zealand MBM trial (ACTRN12614000291684) aims to reduce stillbirth rates through a package of interventions to a) increase pregnant women's awareness of fetal movement and prompt timely reporting of a decrease in fetal movement; and b) strengthen clinical management plans for women presenting to hospital with decreased fetal movements. The Mindfetalness trial (NCT02865759) aims to reduce delays in hospital presentation across 63 antenatal clinics in Stockholm [139].

The MBM trial has recently been completed and results will be incorporated into this guideline in 2020. A planned Individual Participant Data meta-analysis combining the results of MBM, Mindfetalness and AFFIRM will help inform current practices around responding to maternal concern of DFM. We anticipate that these combined data will further our understanding of the benefits and risks of strategies to address DFM.

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Appendix A. Risk factors for stillbirth in high-income country settings

Factor	aOR (95% CI)	PAR* (%)
Demographic and fertility		
Maternal age[¥]		
35-39 years	1.5 (1.2-1.7)	-
40-44 years	1.8 (1.4-2.3)	-
≥45 years	2.9 (1.9-4.4)	-
>35 years	1.7 (1.6-1.7)	12
Aboriginal and Torres Strait Islander ethnicity	1.9 (1.5–2.3) [°]	-
African ethnicity	2.6 (2.0-3.5) [ˇ]	-
South Asian ethnicity	1.3 (1.0-1.5)	-
Indian ethnicity (specific to New Zealand)	1.85 (1.18-.91) [⊖]	-
Pacific ethnicity	1.9 (1.2-2.9) [^]	-
Low education	1.7 (1.4-2.0)	4.9
Low socioeconomic status	1.2 (1.0-1.4)	9.0
No antenatal care	3.3 (3.1-3.6)	0.7
Assisted reproductive technology, singleton pregnancy	2.7 (1.6-4.7)	3.1
Nulliparity	1.4 (1.3-1.5)	15
Previous stillbirth	3.4 (2.6-4.4) [π]	1 [π]
Non-communicable disease and obesity		
BMI (kg/m^2) [€]		
25-30	1.2 (1.1-1.4)	-
>30	1.6 (1.4-2.0)	
>25		8-18
Pre-existing diabetes	2.9 (2.1-4.1)	2-3
Pre-existing hypertension	2.6 (2.1-3.1)	5-10
Pre-eclampsia	1.6 (1.1-2.2)	3.1
Eclampsia	2.2 (1.5-3.2)	0.1
Fetal factors		
Small for gestational age (<10 centile)	3.9 (3.0-5.1)	23.3
Post-term pregnancy (≥42 weeks)	1.3 (1.1-1.7)	0.3
Rhesus disease	2.6 (2.0-3.2) [±]	0.6[±]
Lifestyle factors		
Smoking	1.4 (1.3-1.5)	4-7
Drug use	1.9 (1.2-3.0)	2.1

Notes: High-income countries for aOR and PAR calculations include Australia, Canada, USA, UK and the Netherlands. [Σ] aOR=adjusted odds ratio (95% confidence interval). *PAR=population attributable risk (the proportion of cases that would not occur *in a population* if the factor were eliminated). Calculated using a prevalence of 0.05%. [¥] Reference < 35 years of age. [€] Reference BMI < 25. Source: Unless otherwise stated: Flenady V, Koopmans L, Middleton P, et al. Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis. *Lancet* 2011; 377(9774): 1331-40. See https://www.sciencedirect.com/science/article/pii/S0140673610622337?via%3Dihub#sec1

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Appendix B. Methods for guideline development

In 2010, the Australian and New Zealand arm of the international Fetal Movement Intervention and Assessment (FEMINA) collaboration developed this clinical practice guideline with a working party of clinicians and health service researchers. The process was coordinated by the Mater Mothers' Research Centre (MMRC), Mater Health Services, South Brisbane.

A literature review was undertaken based on questions identified by members of the working party (see Appendix C). Relevant papers were identified and classified according to level of evidence (see Appendix D). Recommendations were prepared with strength of recommendation grading and were presented to the working party for consensus. Following comment and necessary amendments, a final consultation draft of the guideline was shared with stakeholders and a consumer advisory panel for endorsement and circulation (see Appendix G).

The working party adopted the procedures recommended by the NHMRC for developing this guideline. These procedures comprised:

- Review the scope of the guideline for clinical relevance, to identify questions, target groups and health outcomes relevant to the guideline;
- Assess existing guidelines;
- Conduct a systematic graded review of the literature, to identify and evaluate the evidence relating to the effectiveness and appropriateness of the recommended interventions;
- Subject the draft guideline to wider stakeholder consultation, including a consumer advisory panel;
- Refine the guideline and related materials to make them accessible to the target users.

The following steps have also been undertaken in collaboration with PSANZ:

- Disseminate and implement the guideline;
- Monitor, evaluate and maintain the guideline
- Identify gaps in current information for the ongoing refinement of the guideline.

In 2015-16, an update was undertaken to review the literature, evidence and recommendations. Additional clinical resources were highlighted, including 1) patient information brochures, 2) clinician eLearning opportunities, and 3) an updated care pathway to reflect updated evidence for investigation of decreased fetal movement and to add clinical practice points.

Appendix C. Literature search

Guiding research questions

The following questions were raised by the working party and formed the basis of the search strategy:

- What is the definition of DFM?
- Within what time frame should a woman report concerns of DFM?
- What is the role of formal fetal movement monitoring in reducing adverse pregnancy outcome?
- Which investigations should be conducted when a woman presents with DFM?
- What follow-up care should be provided to women who report DFM?

Search strategy

A literature search was undertaken of major guideline websites (see below) and electronic databases: Medline OVID, CINAHL, Cochrane Library databases and Maternity and Infant Care.

The search of electronic databases was limited to the English language, and searches were undertaken using the following terms:

Medline OVID

((“fetal Movement” OR “foetal movement”).sh,ab,ti. OR (“fetal motility” or “foetal motility”).sh,ab,ti. OR (“fetal activity” or “foetal activity”).sh,ab,ti. OR (“fetal hypomotility” or “foetal hypomotility”).sh,ab,ti. OR (“fetal hypoactivity” or “foetal hypoactivity”).ab,ti. OR (fetal adj2 movement).ab,ti. OR (foetal adj2 movement).ab,ti.))

Cochrane Library

(fetal OR foetal) near/3 (movement* OR activity OR motility OR hypomotility OR hypoactivity).ti,ab.

MeSH descriptor Fetal Movement explode all trees

CINAHL

“Fetal Movement” (CINAHL heading) OR (“fetal movement*” OR “foetal movement*” OR “fetal activity” OR “foetal activity” OR “fetal hypoactivity” OR “foetal hypoactivity” OR “fetal hypomotility” OR “foetal hypomotility” OR “fetal motility” OR “foetal motility”).ab,ti

Maternity and infant care

“fetal movement”.de OR (“fetal movement$” OR “foetal movement$” OR “fetal activity” OR “foetal activity” OR “fetal hypoactivity” OR “foetal hypoactivity” OR “fetal hypomotility” OR “foetal hypomotility” OR “fetal motility” OR “foetal motility”).ab,ti

Relevant references provided in bibliographies from various articles were searched manually, as were any references recommended in personal communications with experts in the field.

The relevant existing guidelines were searched at the National Guideline Clearinghouse (http://www.guideline.gov/).

The literature review was updated in 2016 to include evidence published between May 2010 and July 2016. As such, 42 articles have been added as key citations in this update.

Appendix D. Grading of recommendations

Evidence based recommendations were prepared and graded on the strength of the evidence. This classification of the evidence and grading of the recommendations was based, as stated below, on criteria advocated by the National Health and Medical Research Committee[13].

Grading of recommendations[140]

Grade of recommendation	Description
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	The body of evidence is weak and the recommendation(s) must be applied with caution.
√	Body of evidence is inadequate and recommendation is based on consensus for good clinical practice

Body of Evidence Matrix[140]

Component	A	B	C	D
	Excellent	**Good**	**Satisfactory**	**Poor**
Evidence base[1]	several level I or II studies with low risk of bias	one or two level II studies with low risk of bias or a SR/ multiple level III studies with low risk of bias	level III studies with low risk of bias, or level I or II studies with moderate risk of bias	level IV studies, or level I to III studies with high risk of bias
Consistency[2]	all studies consistent	most studies consistent and inconsistency may be explained	some inconsistency reflecting genuine uncertainty around clinical question	Evidence is inconsistent
Clinical impact	very large	substantial	moderate	slight or restricted
Generalisability	population/s studied in body of evidence are the same as the target population for the guideline	population/s studied in the body of evidence are similar to the target population for the guideline	population/s studied in body of evidence differ to target population for guideline but it is clinically sensible to apply this evidence to target population[3]	population/s studied in body of evidence differ to target population and hard to judge whether it is sensible to generalise to target population
Applicability	directly applicable to Australian healthcare context	applicable to Australian healthcare context with few caveats	probably applicable to Australian healthcare context with some caveats	not applicable to Australian healthcare context

[1] Level of evidence determined from the NHMRC evidence hierarchy;

[2] If there is only one study, rank this component as 'not applicable';

[3] For example, results in adults that are clinically sensible to apply to children OR psychosocial outcomes for one cancer that may be applicable to patients with another cancer.

Appendix E. Guideline working group

These updated clinical guidelines have been compiled by the following clinicians, health researchers and representatives from collaborating organisations:

Name	Role and/or affiliation
Prof Vicki Flenady*	Director, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Queensland
Dr Christine Andrews	Postdoctoral Research Officer, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Queensland
A/Prof Fran Boyle	Social scientist and health services researcher, Institute for Social Sciences Research, The University of Queensland
Ms Billie Bradford	Midwife and Teaching Fellow, School of Nursing, Midwifery, and Health Practice, University of Wellington
Ms Robin Cronin	Midwife educator and researcher, Department of Obstetrics and Gynaecology, University of Auckland
Prof David Ellwood*	Professor of Obstetrics & Gynaecology, Griffith University School of Medicine, and Director of Maternal-Fetal Medicine, Gold Coast University Hospital
Tracy Fifth	Senior Project Officer, Safer Care Victoria
Ms Claire Foord	CEO and Founder, Still Aware
Dr Glenn Gardener*	Director, Mater Centre for Maternal Fetal Medicine, Mater Health, South Brisbane, Qld Australia; Senior Research Fellow, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Qld; Brisbane, Australia, Senior Lecturer, Obstetrics and Gynaecology, University of Queensland
Dr Adrienne Gordon*	Neonatal Staff Specialist, Royal Prince Alfred Hospital and NHMRC Early Career Research Fellow, University of Sydney
Prof Alexander Heazell	Senior Clinical Lecturer in Obstetrics, Maternal and Fetal Health Research group, University of Manchester
Ms Annelise Kirkham	Registered Nurse and Midwife, Royal Brisbane and Women's Hospital
Ms Kate Lynch	CEO, Stillbirth Foundation Australia
A/Prof Kassam Mahomed*	Senior Staff Specialist, Ipswich Hospital, and The University of Queensland
Prof Susan McDonald*	Professor of Midwifery (Adjunct), La Trobe University and Mercy Hospital for Women, Melbourne
Prof Lesley McCowan	Maternal Fetal Medicine specialist and Head of the Department of Obstetrics and Gynaecology, The University of Auckland

Name	Role and/or affiliation
Ms Lucy McCudden	Clinical midwife specialist, Royal Prince Alfred Hospital
A/Prof Philippa Middleton*	Perinatal Epidemiologist, South Australian Health and Medical Research Institute
Dr Richard Poll	Maternal Feta; Medicine Specialist, Mater Mothers' Hospital
Ms Hilary Rorison	Midwifery Advisor, Australian College of Midwives
Dr Sean Seeho	Joint Head, Discipline of Obstetrics, Gynaecology and Neonatology, Senior Lecturer and Postgraduate Coordinator Sydney Medical School – Northern, The University of Sydney
Dr Antonia Shand	Obstetrician and Gynaecologist, RANZCOG-certified subspecialist in Maternal Fetal Medicine; Head of Maternal Fetal Medicine, Royal Hospital for Women, Randwick
Dr Alexis Shub	Obstetrician and Specialist in Maternal-Fetal Medicine, Mercy Hospital for Women, Melbourne
Ms Elisha Swift	Clinical Midwife, Royal Brisbane and Women's Hospital
Prof Sue Walker	Head of the Department of Obstetrics and Gynaecology and Director of Perinatal Medicine at Mercy Hospital for Women
A/Prof Jane Warland	Associate Professor, School of Nursing and Midwifery, The University of South Australia (UniSA)
Ms Megan Weller*	Research Midwife, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Queensland
Ms Aleena Wojcieszek*	Research Associate, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Queensland

** Affiliated with the NHMRC Centre of Research Excellence in Stillbirth*

Previous versions of the guideline included the following working party members:

Name	Role and/or affiliation
Ms Victoria Bowring*	General Manager, Stillbirth Foundation Australia
Dr Wendy Burton	Chair, Mater Mothers' Hospital Alignment; Maternity Lead, Brisbane South Primary Health Network; General Practitioner, Brisbane, Australia
Dr Yogesh Chadha	Senior Staff Specialist, Royal Brisbane and Women's Hospital; Brisbane, Australia
Ms Lisa Daly*	PhD Candidate, NHMRC Centre of Research Excellence in Stillbirth, Mater Research Institute – The University of Queensland; Brisbane, Australia

Name	Role and/or affiliation
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Dr Ruth Fretts	Senior staff specialist, Brigham and Women's Hospital and Harvard University Medical School; Boston, USA
Ms Julie MacPhail	Mater Medical Research Institute, Mater Health Services; Brisbane, Australia
Ms Liz Conway	Stillbirth and Neonatal Death Support (SANDS) Queensland; Brisbane, Australia.
Ms Laura Koopmans	Fetal movement study group coordinator, Mater Medical Research Institute, Mater Health Services; Brisbane Australia
Ms Tomasina Stacey	Senior lecturer, School of Midwifery, Auckland University of Technology; Auckland, New Zealand
Dr J Frederik Frøen	Head of Research and Perinatal Epidemiologist, Norwegian Institute of Public Health; Oslo, Norway
Dr Jane E Norman	Professor of Maternal-Fetal Health, University of Edinburgh, Scotland
Prof Jeremy Oats*	Chair, Victorian Consultative Council on Obstetric and Paediatric Mortality and Morbidity; Professorial Fellow, Melbourne School of Population and Global Health, University of Melbourne; Chair PSANZ/ SANDA

** Affiliated with the NHMRC Centre of Research Excellence in Stillbirth*

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Appendix F. Conflict of interest statement

The working party feels strongly that the identification and management of conflicts of interest are of central importance, to ensure that there is no influence by competing interests that could erode the integrity of recommendations. Under the *Procedures and requirements for meeting the 2011 NHMRC standard for clinical practice guidelines* (the 2011 NHMRC Standard [141]), this working group has been required to identify, document and manage potential competing interests through adherence to the following NHMRC principles:

- transparency in the disclosure of any interests
- managing interests in a manner consistent with the NHMRC policy
- balance and diversity of expertise and perspectives
- balancing the benefit of having persons with expertise against the risks of their interests biasing a process
- the focus on technical knowledge should not override or dominate all other considerations
- the committee or working group is chaired by someone who has no conflicts of interest that could, or could be perceived to, erode the integrity of the recommendations
- ensuring the integrity of the guidelines.

Each member of the group has agreed to comply with the principles about disclosure of interests and also follows their own internal institutional procedures in relation to declaration, identification and management of interests.

Appendix G. Stakeholder consultation

Once the working party had achieved consensus around recommendations, consultation was undertaken including the following organisations and individuals:

1. Perinatal Society of Australia and New Zealand (PSANZ), Policy Committee
2. PSANZ Consumer Advisory Panel
3. PSANZ SANDA membership
4. Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG)
5. Australian College of Midwives (ACM)
6. Royal Australian College of General Practitioners (RACGP)
7. New Zealand College of Midwives
8. National SIDS Council of Australia Ltd (Red Nose)
9. Stillbirth Foundation Australia
10. SANDS Australia
11. Still Aware
12. Women's Healthcare Australasia