Guideline

Maternity - Fetal Heart Rate Monitoring

Summary This Guideline provides guidance for antenatal and intrapartum fetal heart rate (FHR) monitoring as a fetal welfare assessment tool. The document provides background on electronic fetal heart rate monitoring (EFM), definitions of FHR features, criteria for intermittent auscultation, criteria for continuous EFM, algorithms for the interpretation of antenatal and intrapartum FHR patterns, and a guide for clinical management including consultation and escalation.

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NSW GOVERNMENT Health

GUIDELINE SUMMARY

MATERNITY- FETAL HEART RATE MONITORING

PURPOSE

This Guideline provides guidance for fetal heart rate (FHR) monitoring using intermittent auscultation (IA), antenatal and intrapartum electronic fetal heart rate monitoring (EFM), and fetal blood scalp sampling (FBS) to monitor fetal wellbeing.

KEY PRINCIPLES

This Guideline applies to all NSW Public Health Organisations (PHOs) providing maternity services where fetal welfare assessment is conducted. The Guideline:

- clarifies the indicators for FHR assessment, monitoring and FBS
- defines the terms used to describe FHR features used by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), and the International Federation of Gynaecologists and Obstetricians (FIGO)
- clarifies the features of the preterm FHR response compared to the term fetus
- introduces new assessment tools (algorithms and documentation labels) for the interpretation of antenatal and intrapartum FHR features
- facilitates standardisation of clinical management, consultation and escalation of abnormal FHR features in line with Policy Directive PD2013_049 Recognition and Management of Patients who are Clinically Deteriorating and the GL2016_018 NSW Maternity and Neonatal Service Capability Framework.

USE OF THE GUIDELINE

The Chief Executives are responsible for:

- the implementation of this Guideline in NSW PHO maternity services
- the development of local protocols, pathways and Clinical Emergency Response Systems (CERS) to facilitate consultation and escalation of concern where abnormal FHR features are identified
- monitoring patient safety and quality outcomes related to fetal monitoring, particularly for women with identified risks
- processes are in place to ensure that all relevant maternity services staff (this includes permanent, casual staff, agency and locum staff) receive appropriate education.

REVISION HISTORY

Version	Approved by	Amendment notes
December 2018 (GL2018_025)	Deputy Secretary, Strategy and Resources Division	Revised Guideline replaces GL2016_001 Standardisation of terms to describe FHR features Clarification of the preterm FHR features Revision of antenatal and intrapartum FHR algorithm Introduction of new preterm FHR algorithm and documentation

January 2016 (GL2016_001)	Deputy Secretary, Population and Public Health	Correction to gestational age listed on page 7 in table 3 under column 'Antenatal risk factors, requiring intrapartum EFM'.
March 2015 (GL2015_004)	Deputy Secretary, Population and Public Health	Revised guideline
June 2010 (PD2010_040	Director General	New policy

ATTACHMENTS

1. Maternity - Fetal Heart Rate Monitoring: Guideline

Maternity - Fetal Heart Rate Monitoring

NSW GOVERNMENT Health

GUIDELINE

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ABBREVIATIONS

bpm	beats per minute
BTF	Between the Flags
CEC	Clinical Excellence Commission
CERS	Clinical Emergency Response System
CTG	Cardiotocograph
EFM	Electronic Fetal heart rate Monitoring
FBS	Fetal Blood (scalp) Sampling
FHR	Fetal Heart Rate
FSE	Fetal Scalp Electrode
IA	Intermittent Auscultation
IUGR	Intra uterine growth restriction
PHO	Public Health Organisation
SAC	Severity Assessment Code
<	Less than
≤	Less than or equal to
>	Greater than
≥	Greater than or equal to

1 BACKGROUND

Fetal heart rate (FHR) monitoring is an important tool for fetal welfare assessment. The electronic recording of the FHR using a cardiotocograph (CTG) is a screening tool that should be considered for use in the antenatal period when there is a change in the maternal condition that has the potential to affect fetal wellbeing, or in the intrapartum period when there are identified antenatal and/ or intrapartum risk factors that may affect fetal wellbeing. Intermittent auscultation (IA) is the appropriate tool to monitor the FHR during labour for women with no identified risk factors [1, 2].

1.1 About this document

This document provides guidance on IA using either a Pinard stethoscope or Doppler ultrasound, electronic fetal heart rate monitoring (EFM) via CTG, and fetal blood scalp sampling (FBS) as the diagnostic test during the intrapartum period for fetal hypoxia.

This revised Guideline refers to criteria for FHR monitoring and FHR features as defined by the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), and the International Federation of Gynaecologists and Obstetricians (FIGO) [2, 3]. RANZCOG terminology and definitions for FHR features are recommended to communicate the status of fetal wellbeing [2]. Other recommended terminology for communicating fetal welfare, derived from FIGO, describes the occurrence of different fetal behavioural states as important markers of fetal neurological responsiveness [3].

The preterm fetus will have altered FHR features due to immature cardiovascular and neurological systems, and a relatively decreased physiological reserve to combat hypoxia, when compared to a term fetus [4]. This information informs the development of a new algorithm and documentation label for antenatal EFM <32 weeks gestation (Appendix 3 and 4).

Clinical response and escalation in regard to the deteriorating fetus should occur in line with the appropriate EFM algorithm (Appendices 3, 5 and 7), the Between The Flags (BTF) calling criteria, and local Clinical Emergency Response System (CERS). Consultation and referral may be appropriate within the Tiered Maternity Network.

1.2 Scope

This Guideline applies to all NSW Health Public Health Organisations (PHO) and/ or maternity services where FHR monitoring occurs. Local operating procedure/ protocols may be required to supplement this guideline.

1.3 This Guideline should be read in conjunction with:

- Policy Directive PD2012_069 Health Care Records- Documentation and Management
- Policy Directive PD2013_049 Recognition and Management of Patients who are Clinically Deteriorating

- Guideline GL2016_018 NSW Maternity and Neonatal Service Capability Framework.

2 COMMUNICATION

2.1 Information for women and maternal consent

All methods of fetal welfare assessment require informed verbal consent from the woman. Fetal welfare assessment during labour should be discussed during the antenatal period. This may include but is not limited to IA, EFM and FBS.

If a woman declines fetal welfare assessment at any time, inform her of the risks and benefits of her decision, respect her decision making and document her choice.

Women should be advised of the findings of fetal welfare assessment on *every* occasion where an assessment of fetal welfare is conducted.

2.2 Aboriginal and Torres Strait Islander women

It is recognised that Aboriginal and Torres Strait Islander women are more likely to have risk factors which are indicators for the use of antenatal and intrapartum EFM [5, 6]. Where these risks are identified it is important to discuss this (and all aspects of care) in a culturally sensitive, respectful and supportive manner. It is also important to engage and work in partnership with Aboriginal women and where appropriate involve their family and Aboriginal and Torres Strait Islander health professionals [5].

2.3 Interpretation and communication of CTG features

During any form of FHR assessment, the maternal radial pulse must be palpated to differentiate between the maternal and FHR to reduce error in FHR interpretation.

The use of RANZCOG and FIGO definitions to describe features of the CTG are recommended (Appendix 1). The interpretation of all CTG features should occur in line with the appropriate EFM algorithm (Appendix 3, 5 and 7). The terminology to be used when communicating CTG features should be consistent with the algorithm in use.

2.3.1 Altered calling criteria

The FHR parameters in the fetal monitoring algorithms (Appendix 3, 5, 7) have been selected to mobilise clinicians to assess fetal welfare, and escalate as appropriate, according to BTF principles. However, it is acknowledged that a fetus may demonstrate particular FHR features in response to clinical circumstances, and alterations to the standard calling criteria may be required. Examples include:

- postdates pregnancy
- fetal heart block or maternal thyroid antibodies

- use of maternal medication e.g. magnesium sulphate (particularly during the loading dose), beta blockers.

Altered calling criteria should be communicated to all care providers and documented in the management plan.

2.3.2 Management plans

Clinicians should not make any decision/ management plan based on the FHR in isolation. Where concerns are identified during IA, EFM should be initiated. EFM is a screening tool for hypoxia but does not replace the need for additional accurate, comprehensive, clinical assessments.

Following interpretation of the CTG, care providers should collaborate to develop a management plan that is documented in the clinical record. Management plans should take into account the complete clinical picture which may include but are not limited to:

- the presence of ongoing antenatal and/ or intrapartum risk factors which should be noted on the EFM documentation tool (Appendix 4, 6 or 8)
- the woman's individual clinical circumstances and progress in labour
- the interpretation of the CTG
- results of other relevant tests (e.g. ultrasound)
- the recommended clinical response and escalation
- the woman's preferences.

2.3.3 Escalation of care

The antenatal and intrapartum EFM algorithms (Appendices 3, 5 and 7) are designed in line with the CEC *Between the Flags* CERS.

- A CTG feature which falls within the Yellow Zone is abnormal and requires a clinical review within 30 minutes.
- A CTG feature which falls within a Red Zone is also abnormal and requires a Rapid Response.
- If two or more Yellow Zone features are present this should be interpreted as Red Zone requiring a Rapid Response.

All clinical responses should occur in accordance with local CERS protocols.

If there is ongoing concern regarding fetal wellbeing, clinical consultation and appropriate fetal welfare diagnostic testing should be performed (e.g. ultrasound assessment, FBS). In facilities without the service capability to perform diagnostic testing, referral should be made to a tiered maternity network facility with a diagnostic service, or birth expedited as appropriate.

2.4 Documentation

When undertaking intermittent IA, the FHR and the maternal pulse should be recorded in the woman's notes and on the partogram.

At the commencement of every episode of EFM, the following information should be recorded directly on to the CTG:

- the woman's identifiers including, name, date of birth and medical record number
- estimated gestation
- maternal pulse rate
- clinical indications for performing the EFM
- identification of individual FHR for each fetus in multiple pregnancies
- the time and date of commencement of the CTG. Check the date and time on the CTG machine is set correctly on each occasion prior to commencing monitoring (reset if necessary).

The appropriate EFM Documentation Tool (Appendices 4, 6 or 8) is to be completed in the clinical record (electronic or adhesive) by clinicians on every occasion interpretation of EFM is conducted.

All CTGs (hard copy or electronic) should be securely stored in the woman's clinical record or CTG archive system in line with local guidelines.

3 ANTENATAL FETAL HEART RATE ASSESSMENT

3.1 Antenatal auscultation

A Doppler may be used from 12 weeks to auscultate the FHR [5]. Women should be advised a further screening and/ or diagnostic fetal welfare assessment test may be indicated or offered if unexpected FHR features are identified on auscultation.

3.2 Indications for antenatal EFM

There is no evidence to support the use of antenatal EFM in women who are assessed as having no risk factors, or any other conditions likely to lead to fetal compromise [5, 7].

At the earliest opportunity and throughout pregnancy, all women should be assessed for risk factors and/ or complications of pregnancy which may increase the risk of fetal compromise. The decision of whom to consult if risk factors are identified should be based on the National Midwifery Guidelines for Consultation and Referral [8]).

Antenatal factors for which EFM should be considered are listed in Appendix 2. This list, and the recommendations are not exhaustive and should not replace clinical judgement.

Additional factors not listed in Appendix 2 that require EFM include:

- preterm uterine activity
- detection of fetal bradycardia or tachycardia
- maternal perception of reduced fetal activity in the third trimester
- directly after trauma to the abdomen with significant injury e.g. resulting from motor vehicle accident or domestic violence
- pre and post external cephalic version
- pre and post administration of mechanical and chemical cervical ripening agents
- any other obstetric condition that increases the risk of fetal compromise.

3.3 Frequency of monitoring

The frequency of antenatal EFM is dependent on both the maternal and fetal condition. There are very few instances where regular routine EFM must be implemented in the antenatal period. Daily assessment of fetal condition using a CTG should only be performed when there is a risk of fetal compromise. For example, when there is:

- rupture of the membranes, and liquor continues to drain
- abnormal Doppler waveform studies
- maternal hypertension.

Note: EFM should be repeated on the same day if there is a change in the maternal condition. If concerns exist regarding fetal wellbeing, ultrasound assessment should be undertaken.

3.4 Discontinuing antenatal electronic fetal monitoring

Before discontinuing antenatal fetal monitoring, two clinicians should interpret every feature of the CTG using the NSW Health Antenatal EFM Algorithm (Appendix 3 or 5). Both clinicians should have experience in interpretation of FHR features and one of these clinicians should be a senior midwife, or medical officer, or their delegate. The appropriate process for obtaining a second person and signature should be clearly described in local guidelines. Episodes of antenatal EFM should only be ceased after the following criteria are met:

- all features of the CTG are normal for gestational age
- the maternal condition stabilises and there are no acute ongoing risk factors (for example, no active bleeding or regular uterine activity).

4 INTRAPARTUM FETAL HEART RATE ASSESSMENT

4.1 Intrapartum admission CTGs in women without risk factors

Upon admission, and throughout established labour, all women should be assessed for the presence or development of risk factors/ complications for fetal compromise (Appendix 2). There is no evidence to support EFM on admission or during established labour in women who do not have any risk factor for fetal compromise [1, 9].

4.2 Intermittent auscultation

IA of the FHR is the preferred fetal welfare assessment during labour and should be routinely offered to all women in established labour who do not have risk factors for fetal compromise [1, 2, 10]. IA requires careful listening and interpretation of the fetal heart rate according to evidence based guidelines [1, 9-12].

4.2.1 Procedure for IA

- Perform an abdominal palpation to identify the optimal location for auscultation.
- Use either a Doppler on audible mode or Pinard stethoscope to measure the FHR.
- Palpate the maternal pulse simultaneously to differentiate between the maternal and fetal heartbeats, hourly, or more often if there are any concerns.
- Determine the FHR baseline when there is no uterine activity or fetal movements present.
- Document the counted rate (not as a range), the rhythm (regular or irregular), and the presence or absence of accelerations or decelerations.
- During labour, auscultation should commence immediately following a contraction and be continued for a minimum of 60 seconds.
- If in early labour, auscultate during fetal movements. An acceleration should be noted, and the presence of chronic hypoxia can be excluded.

4.2.2 Frequency of IA during labour

IA is performed:

- every 15 minutes in established first stage of labour
- every 15 minutes during passive second stage (i.e. the woman is confirmed to be fully dilated and is not spontaneously and/ or actively pushing)
- after each contraction in active second stage, or at least every five minutes.

4.2.3 If concern is identified during IA

If the FHR is auscultated at <110 or >160 beats per minute (bpm) OR there is a gradually falling/ rising baseline rate OR decelerations are suspected whilst using IA:

- perform a full assessment of the woman
- advise the woman of the need for EFM
- commence EFM
- escalate (as appropriate).

Cease the EFM if there are no risk factors for fetal compromise; and the CTG has all normal zone features.

4.3 Promoting mobility in labour

Women benefit from ambulation during established labour. Encouraging women to move around and adopt positions of choice and the use of water for pain relief in labour is supported by NSW Health policy. All birth units should offer women intrapartum EFM via waterproof wireless telemetry, where available.

4.4 Intrapartum electronic fetal monitoring

Intrapartum EFM is performed as a screening assessment to identify the fetus at risk of hypoxia. When intrapartum electronic fetal monitoring is in use:

- All events that may affect the FHR features (e.g. vaginal examinations, medications, change of position, FBS, or epidural insertion) should be noted on the CTG at the date/ time that they occur).
- All CTGs must be reviewed and the actual CTG must be annotated every 15 minutes by the midwife/ clinician providing the woman's care.
- A full interpretation of the CTG using the Intrapartum Algorithm (Appendix 7) must be recorded in the clinical notes at a minimum of every hour. It is essential that appropriate management is initiated to ensure fetal wellbeing (clinical action, review or rapid response) as per the Intrapartum Algorithm.
- The second clinician who is asked to provide an opinion of the CTG should countersign the documentation label to confirm agreement with the clinical response (Appendix 8).
- Following birth, the clinician providing care should annotate the CTG trace and note the date, time and type of birth (Section 2.4).

'Intermittent' EFM should not be routinely utilised. Where a woman's strong preference precludes the use of continuous EFM, intermittent EFM may be negotiated as part of an individualised risk management strategy and documented in the clinical record.

5 FETAL SCALP BLOOD SAMPLING

NSW maternity services with the service capability to provide planned care to women with risk factors requiring intrapartum EFM should also be able to perform FBS when indicated.

5.1 Fetal scalp blood sampling

FBS should occur when indicated in line with the NSW Health Intrapartum FHR Features Algorithm (Appendix 7). Prior to performing an FBS:

- It is essential to consider if the woman has any clinical risk factors or if there are contraindications to FBS (Section 5.1.1).
- The woman should be advised that the test will provide diagnostic information about the condition of her baby.
- The decision to use either pH or lactate FBS testing is a local decision based on availability of equipment and clinician experience.

5.1.1 Contraindications to fetal blood sampling

Contraindications to FBS include:

- maternal blood borne infection (e.g. HIV, sero-positive hepatitis and active genital herpes simplex viruses)
- confirmed or suspected fetal bleeding disorders (e.g. haemophilia)
- prematurity (less than 34+0 weeks)
- fetal malpresentation (including breech)
- any situation where a delay in expediting birth is contraindicated.

5.1.2 Response to fetal scalp stimulation

Any acceleration in the fetal heart rate in response to digital fetal scalp stimulation should be interpreted as reassuring. If FBS is unsuccessful or contraindicated, use the FHR response after fetal scalp stimulation during a vaginal examination to elicit information about fetal well-being [1]. The FHR response should be documented on the CTG and in the medical record.

5.1.3 Management plans following the results of FBS

Management plans/ actions following FBS results should consider:

- the maternal and fetal risk factors
- any previous pH/ lactate results
- the woman's rate of progress in labour
- the woman's preferences.

6 SPECIAL CONSIDERATIONS

6.1 Internal FHR monitoring with fetal scalp electrode

Recording of the maternal pulse may occur inadvertently when using fetal scalp electrodes (FSE). Therefore, after a FSE is applied, the maternal pulse must be palpated hourly to ensure differentiation from the FHR.

6.2 Electronic FHR monitoring less than 25 weeks gestation

There is a paucity of evidence and guidelines on the use of CTG for the preterm fetus less than 25 weeks gestation. Accurate interpretation of FHR features in early gestations is problematic due to the immaturity of the fetal autonomic nervous system. The use of EFM and interpretation of FHR features at very early gestations should be made in consultation within the tiered maternity network and due consideration of the woman's decision in this matter.

6.3 Electronic FHR monitoring at 25-32 weeks gestation

Immaturity of the central and peripheral nervous systems, reduced placental reserve, immature adrenal gland and myocardium may result in altered heart rate parameters in the fetus less than 32 weeks gestation. The antenatal EFM algorithm (Appendix 3) and documentation label (Appendix 4) for less than 32 weeks gestation should be used prior to labour. If in labour, the standard intrapartum algorithm and documentation tool (Appendix 8) should be used.

The most senior lead clinician available should undertake a comprehensive clinical assessment, review the CTG and document an ongoing management plan. If there are concerns regarding fetal welfare or the CTG, ensure escalation of care as per local CERS. This may include transfer of care where appropriate, in consultation with specialist obstetric and neonatal service providers in the tiered maternity network.

6.4 Multiple pregnancy

Multiple pregnancies are associated with a higher incidence of morbidity and mortality than singleton pregnancies. To ensure the accurate recording and interpretation of the distinct FHR features in a multiple pregnancy when continuous EFM is required, clinicians should:

- monitor each fetus simultaneously using the same machine
- use the functions of the CTG machine to 'separate' each FHR features on the trace to enable more accurate interpretation of each fetal heart rate feature
- clearly differentiate and document each fetal heart rate
- ensure that a distinct and interpretable CTG is obtained for each fetus before monitoring is ceased

- ensure that the most senior clinician completes a comprehensive clinical assessment, reviews the CTG and documents an ongoing management plan
- escalate any concerns regarding fetal welfare or the FHR features to a senior medical officer.

Plans for fetal welfare assessment in higher order multiple pregnancies (i.e. triplets) with or without EFM should always be developed by and/ or in consultation with a maternal fetal medicine specialist (MFM) through the tiered maternity network.

7 CLINICAL REVIEW AND AUDIT

Each NSW PHO maternity service should have processes in place to:

- ensure regular review of cases where EFM has been used
- audit the number and timeframes of escalations (yellow and red zone) in all Severity Assessment Code (SAC) 1 and SAC 2 case reviews related to FHR monitoring, to monitor compliance with escalation processes
- perform audit of FBS practices, results and outcomes.

Regular reviews should be multidisciplinary and attended and supported by senior maternity clinicians. Reviews should include both antenatal and intrapartum FHR features (normal and abnormal), where monitoring/ intervention may have occurred inappropriately, or monitoring/ intervention did not occur when warranted.

8 EDUCATION OF CLINICAL STAFF

All relevant maternity staff employed by NSW Health must undertake the current essential (mandatory) education and training in relation to FHR monitoring.

Local health districts should strengthen processes to ensure that all maternity clinicians, particularly locum and agency staff employed in obstetrics/ midwifery, have the required skills and education to confidently and competently assess fetal welfare prior to undertaking clinical care.

9 APPENDICES

Appendix 1. Definitions

- **Intermittent auscultation (IA):** The auscultation of the FHR using a hand-held Doppler or a Pinard stethoscope.
- **Cardiotocograph (CTG):** A graphic recording of the FHR features, uterine activity (contractions) and maternally perceived fetal activity.

The following RANZCOG definitions are used when describing uterine activity:

- **Tachysystole:** The presence of more than five active labour contractions in ten minutes without fetal heart rate abnormalities.
- **Uterine hypertonus:** Contractions lasting more than two minutes in duration or contractions occurring within 60 seconds of each other, without fetal heart rate abnormalities.
- **Uterine hyperstimulation:** Tachysystole or uterine hypertonus in the **presence** of fetal heart rate abnormalities.

The following definitions are to be used when describing FHR features:

- **Acceleration:** A transient increase in FHR of 15 bpm or more above the baseline and lasting more than 15 seconds. The significance of no accelerations in an otherwise normal trace is unclear. Accelerations in the preterm fetus may be of a lesser amplitude and shorter duration.
- **Reactivity:** A component of antenatal FHR features that is considered to be present when there are two accelerations in any given 20 minute period.
- **Cycling of the FHR:** Cycling refers to the alternating periods of fetal active sleep and fetal quiet sleep that are characterised by normal baseline FHR variability and reduced baseline FHR variability. Fetal sleep states were identified in the 1980s and evidence of ‘cycling’ between states provides 100% assurance of neurological integrity and the absence of significant acidaemia or acidosis. The presence of accelerations signifies a healthy somatic nervous system. Although the absence of accelerations is of uncertain significance during labour, the evidence of cycling should always be sought while interpreting CTG traces. The absence of cycling may occur in hypoxia and fetal infections including encephalitis and intrauterine fetal stroke [13].
- **Baseline FHR:** Recorded as a single rate, this is the mean level of the fetal heart rate when it is stable, excluding accelerations and decelerations and contractions. It is determined over a period of time of 5-10 minutes. Preterm fetuses tend to have values towards the upper end of this range. A progressive rise in the baseline is important as well as the absolute value.
- **Normal baseline:** 110-160 bpm
- **Baseline tachycardia:** more than 160 bpm

- **Baseline bradycardia:** less than 110 bpm
- **Rising baseline rate:** A gradual rise over time, an ongoing increase in the fetal heart baseline rate. In this Guideline, a 10% rise from baseline is considered significant.
- **Baseline variability:** The minor fluctuations in baseline FHR. Assessed by estimating the difference in beats per minute between the highest peak and lowest trough of fluctuation in one minute of the trace between contractions. Normal is 6-25 bpm.
- **Increased baseline variability:** more than 25 bpm
- **Reduced variability:** less than 6 bpm
- **Absent variability:** less than 3 bpm
- **Deceleration:** Transient episodes of decrease of FHR below the baseline of more than 15 bpm lasting at least 15 seconds and conforming to one of the following features:

  ***Intrapartum* decelerations may be either:**

  - ***Early:*** Uniform, repetitive, periodic slowing of the FHR with slow onset early in the contraction and slow return to baseline by the end of the contraction.
  - ***Variable:*** Repetitive or intermittent decelerations with rapid onset and recovery. Time relationships with the contraction cycle may be variable but most commonly occur simultaneously with contractions.
  - ***Complicated:*** Variable decelerations (as per above) that occur with any of the following additional features:
    - rising baseline or fetal tachycardia
    - reducing baseline variability
    - slow return to baseline FHR after the end of the contraction
    - large amplitude (fall by 60 bpm or to 60 bpm) and/ or long duration (60 seconds)
    - presence of smooth post deceleration overshoots (temporary increase in FHR above baseline).
  - ***Prolonged*:** Decrease of the FHR below the baseline for longer than 90 seconds but less than five minutes.
  - ***Late:*** Uniform, repetitive*, decreasing of the FHR with slow onset mid to end of the contractions and nadir (deepest point) more than 20 seconds after the peak of the contraction and ending after the contraction. In the presence of a non-accelerative trace with baseline variability less than 5 bpm, the definition of late decelerations would include those less than 15 bpm.

  *In this Guideline, late decelerations may be considered 'repetitive' when associated with more than 50% of contractions.

  Decelerations in an antenatal trace (> 15 bpm fall for > 15 seconds)

Decelerations may be seen in an antenatal trace in the presence of uterine activity (e.g. Braxton Hicks), or without uterine activity. Decelerations may be classified in relationship to uterine activity as either:

- *Single isolated*
- *Recurrent (occurring more than one per hour)*
- *Prolonged (lasting more than 90 seconds and less than three minutes OR lasting more than 3 minutes).*

Sinusoidal FHR Features: A regular oscillation of the baseline long-term variability resembling a sine wave. This smooth, undulating features, lasting at least 10 minutes, has a relatively fixed period of 2-5 cycles per minute and an amplitude of 5-15 bpm above and below the baseline. Baseline variability is absent and there are no accelerations.

Pseudosinusoidal: A features resembling the sinusoidal features, but with a more jagged 'saw-tooth' appearance, rather than a sine-form wave. Its duration seldom exceeds 30 minutes and is characterised by normal features, before and after. The pseudosinusoidal features has been described after analgesia administration to the mother, and during periods of fetal sucking and other mouth movements. It is sometimes difficult to distinguish the pseudosinusoidal features from the true sinusoidal features, leaving the short duration of the pseudosinusoidal features as the most important variable to discriminate between the two.

Appendix 2. Risk factors for electronic FHR monitoring

Antenatal and intrapartum risk factors that increase fetal compromise in labour. Cardiotocography is recommended [2].

Antenatal risk factors	Intrapartum risk factors
• abnormal antenatal CTG • abnormal Doppler umbilical artery velocimetry • suspected or confirmed intrauterine growth restriction • oligohydramnios or polyhydramnios • prolonged pregnancy ≥42 weeks • multiple pregnancy • breech presentation • antepartum haemorrhage • prolonged rupture of membranes (≥24 hours) • known fetal abnormality which requires monitoring • uterine scar (e.g. previous caesarean section) • essential hypertension or pre-eclampsia • diabetes where medication is indicated or poorly controlled, or with fetal macrosomia • other current or previous obstetric or medical conditions which constitute a significant risk of fetal compromise (e.g. cholestasis, isoimmunisation, substance abuse) • fetal movements reduced (within the week preceding labour) • morbid obesity (BMI ≥40) • maternal age ≥42 • abnormalities of maternal serum screening associated with an increased risk of poor perinatal outcomes (e.g. low PAPP-A <0.4MoM) Additional indicators for antenatal EFM (Section 3.2)	• induction of labour with prostaglandin or oxytocin • oxytocin augmentation • regional anaesthesia* (e.g. epidural, or spinal) and paracervical block • abnormal vaginal bleeding in labour • maternal pyrexia ≥38°C • meconium or blood stained liquor • absent liquor following amniotomy • prolonged first stage as defined by referral guidelines+ • prolonged second stage as defined by referral guidelines+ • pre-term labour less than 37 completed weeks • tachysystole (more than five active labour contractions in ten minutes without fetal heart rate abnormalities) • uterine hypertonus (contractions lasting more than two minutes in duration or contractions occurring within 60 seconds of each other, without fetal heart rate abnormalities) • uterine hyperstimulation (either tachysystole or uterine hypertonus with fetal heart rate abnormalities)
*Following a decision to insert an epidural block, a CTG should be commenced to establish baseline features prior to the block's insertion.	

Conditions where an intrapartum CTG is not indicated when the condition occurs in isolation, but if multiple conditions are present, intrapartum cardiotocography should be considered	
Antenatal risk factors • pregnancy gestation 41.0 – 41.6 weeks' gestation • gestational hypertension • gestational diabetes mellitus without complicating factors • obesity (BMI: 30-40) • maternal age: ≥40 and <42 years	**Intrapartum risk factors** • maternal pyrexia ≥37.8 and <38 degrees

Table adapted from The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) Intrapartum Fetal Surveillance Clinical Guidelines, 2014.

+Prolonged first and second stage of labour as per RANZCOG referral guidelines or as per local health district/ institutional operating protocols.

Appendix 3. Antenatal electronic fetal heart rate monitoring algorithm: <32 weeks gestation

Determine Risk/s and Indication/s for EFM Refer to Maternity Fetal Heart Rate Monitoring Guideline	Maternal	Any obstetric risk factors or change/s in maternal condition which may compromise fetal welfare. E.g. Pre-eclampsia or preterm uterine activity
	Fetal	Any condition/s that suggest or increase the risk of fetal compromise E.g. IUGR, absent or decreased fetal movements
	Are there fetal conditions that require altered calling criteria? If identified, a collaborative care plan should be documented. E.g. maternal magnesium infusion affecting fetal baseline variability	

Uterine Activity	**Baseline Rate (bpm)**	**Variability (bpm)**	**Reactivity / Cycling** Accelerations >15bpm for >15secs (2:20mins)	**Decelerations** >15bpm fall for >15secs Recurrent (more than one per hour)
Nil	≥125-160	6-25	Presence of accelerations Or Rise in baseline of >10 bpm associated with multiple fetal movements	Nil Decelerations with amplitude <40 bpm for <30 seconds with reactivity
Present <3:10 mild	115-124 >160-180	Reduced ≤5 or absent for more than 45 mins	Absent >45 mins	Single isolated <3 mins
Present ≥3:10 or regular strong contractions	<115 >180	Reduced ≤5 or absent for >90 mins Sinusoidal / sawtooth >15 mins	Absent >75 mins	Recurrent >30 secs or Prolonged >3 mins

Escalation and Management Plan – Clinical Response

NORMAL	Providing there is no continued risk to the mother and/or fetus requiring ongoing monitoring, then the CTG can be ceased when it meets all the normal criteria (White Zones) after consultation with a 2nd clinician. An appropriate ongoing care and assessment plan must be formulated
ABNORMAL	Inform midwife in charge and determine need for **Clinical Review.** Continue to monitor with ongoing assessment. Clinical Review by a medical officer **within 30 mins,** as per local CERS. An appropriate ongoing care and assessment plan must be formulated **If there are two or more Yellow Zone features, escalate as a Rapid Response**
ABNORMAL	Escalate to a **Rapid Response** as per local CERS; this should involve notifying a medical officer for urgent review. Consider further fetal welfare assessment and/or expediting birth. NOTE: *Do not give food or oral fluids*

Note: A clinician, woman, her partner or family member may call for a clinical review at any time if they are concerned or unsure.

Appendix 4. Antenatal electronic fetal heart rate monitoring label: <32 weeks gestation

ANTENATAL < 32 WEEKS	Name	MRN	Date	Time	Gest Age
Determine Risk / Indication for CTG			Fetal movements	Maternal Pulse	

Altered Calling Criteria	☐ NO	☐ YES	Collaborative care plan in place	☐ YES	☐ NO

Uterine Activity	Baseline	Rate	Variability	bpm	Reactivity	Decelerations
Nil	≥125-160		6-25		Present	Nil Decelerations with amplitude <40bpm for <30 seconds with reactivity
Present < 3:10 mild	115-124 >160-180		Reduced ≤5 or absent for more than 45 minutes		Absent >45 mins	Single isolated <3 mins
Present ≥ 3:10, or regular strong contractions	<115 >180		Reduced ≤5 or absent for >90mins Sinusoidal / sawtooth >15 mins		Absent >75 mins	Recurrent >30 secs or Prolonged >3 mins

Clinical Escalation Response

Normal	Abnormal Yellow feature-Clinical Review within 30 mins 2 or more Yellow Zone features - Call a Rapid Response Time of call	Abnormal Red Zone feature/s - Call a Rapid Response Time of call

Name (s) Signature(s)	Date	Time	
Name (s) Signature(s)	Date	Time	Agree with Clinical Response ☐ Yes ☐ No

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Appendix 5. Antenatal electronic fetal heart rate monitoring algorithm: ≥32 weeks gestation

Determine Risk/s and Indication/s for EFM **Refer to Maternity Fetal Heart Rate Monitoring Guideline**	**Maternal**	Any obstetric risk factor/s or change in maternal condition which may compromise fetal welfare. For example, **administration of mechanical or chemical cervical ripening agents**
	Fetal	Any condition/s that suggest or increase the risk of fetal compromise. E.g. IUGR, absent or decreased fetal movements
	Are there fetal conditions that require altered calling criteria? If identified, a collaborative care plan should be documented. E.g. Maternal magnesium infusion affecting fetal baseline variability.	

Uterine Activity	**Baseline Rate** (bpm)	**Variability** (bpm)	**Reactivity / Cycling** Accelerations >15 bpm rise for >15 secs (2:20 mins)	**Decelerations** >15 bpm fall for > 15 secs Recurrent (more than one per hour)
Nil or gestation ≥37/40	≥110-160	6-25	Present	Nil Single <90 secs on a trace with reactivity
Present <37/40	100-109 >160-180	Reduced ≤5 or absent for >45 mins; or >25 for >15 mins	Absent >45 mins	Single prolonged >90 sec and <3 min Recurrent on a trace with reactivity
Present and occurring >5:10 Lasting ≥2 mins and/ or <60 secs between contractions	<100 >180	≤5 for >90 mins Sinusoidal/ sawtooth >15 mins	Absent >90 mins	Prolonged >3 mins Recurrent on a trace without reactivity

Escalation and Management Plan – Clinical Response

NORMAL	Providing there is no continued risk to the mother and/ or fetus requiring ongoing monitoring, then the CTG can be ceased when it meets all the normal criteria (White Zones) after consultation with a 2nd clinician. An appropriate ongoing care and assessment plan must be formulated.
ABNORMAL	Inform midwife in charge and determine need for **Clinical Review.** Continue to monitor with ongoing assessment. Clinical Review by a medical officer **within 30 mins,** as per local CERS. An appropriate ongoing collaborative care and assessment plan must be formulated. **If there are two or more Yellow Zone features, escalate as a Rapid Response.**
ABNORMAL	Escalate to a **Rapid Response** as per local CERS; this should involve notifying a medical officer for immediate review. Consider further fetal welfare assessment and / or expediting birth NOTE: *Do not give food or oral fluids.*

Note: A clinician, woman, her partner or family member may call for a clinical review at any time if they are concerned or unsure.

Appendix 6. Antenatal electronic fetal heart rate monitoring label: ≥32 weeks gestation

ANTENATAL ≥ 32 WEEKS	Name		MRN		Date	Time	Gest Age
Determine Risk / Indication for CTG				Fetal movements		Maternal Pulse	
Altered Calling Criteria	☐ NO	☐ YES	Collaborative care plan in place	☐ YES	☐ NO		
Uterine Activity	**Baseline**	**Rate**	**Variability**	**bpm**	**Reactivity**	**Decelerations**	
Nil or gestation ≥37 weeks gestation	≥110-160		6-25		Present	Nil Single <90 secs on a trace with reactivity	
Present < 37 /40	100-109 >160-180		Reduced ≤5 or absent for >45 mins; or >25 for >15 mins		Absent >45 mins	Prolonged >90 sec and <3 min Recurrent on a trace with reactivity	
Present and occurring > 5:10, Lasting ≥ 2 mins and/or <60 secs between contractions	<100 >180		Reduced <5 or absent >90 mins Sinusoidal /sawtooth >15 mins		Absent >90 mins	Prolonged >3 mins Recurrent on a trace without reactivity	
Clinical Escalation Response							
Normal	**Abnormal Yellow feature - Clinical Review within 30 mins 2 or more Yellow features=Red Zone=Call a Rapid Response Time of call**				**Abnormal Red Zone feature/s - Call a Rapid Response Time of call**		
Name (s) Signature(s)			Date	Time			
Name (s) Signature(s)			Date	Time	**Agree with Clinical Response** ☐ **Yes** ☐ **No**		

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Appendix 7. Intrapartum electronic fetal heart rate monitoring algorithm

DR: Determine Risk. Is continuous electronic fetal monitoring required?								
Antenatal risk factors	Refer to antenatal records/management plans and review risk factors							
Intrapartum risk factors	Oxytocin	Uterine scar	Second stage	Epidural	Abnormal labour progress	Persistent pain	Vaginal bleeding	Other
Fetal reserve risk factors	IUGR	Hypertension/ Pre-eclampsia	Temperature/Infection	Meconium	Prematurity	Diabetes		

	Contractions	Baseline Rate (bpm)	Baseline Variability (bpm)	Accelerations	Decelerations *Decelerations are repetitive when associated with >50% contractions
EFM Features	Normal uterine activity ≤5 in 10 mins	110-160	6-25 Presence of cycling	Present	Nil
	Abnormal uterine activity ≥6 in 10 minutes Lasting ≥2 minutes <60 seconds between contractions	100-109 >160 Rising baseline rate >10%	Absence of cycling in last 60 minutes	Absent **The absence of accelerations is unlikely to be associated with fetal compromise**	Early or occasional variable Repetitive variable Single prolonged >90 seconds and <3 minutes
		<100 for >10 mins	Reduced ≤5 or absent for >50 minutes Increased >25 for >30 mins Sinusoidal pattern >30 mins		Repetitive complicated variable Repetitive late Prolonged >3 mins and no sign of recovery

Variable decelerations should be classified as <u>complicated</u> if they occur with one or more of the following

- Rising baseline rate
- Large amplitude (falls by 60bpm or to 60bpm) and/or long duration (>60 secs)
- Reducing baseline variability
- Presence of smooth post-deceleration overshoots (temporary smooth increase in FHR above baseline)
- Fetal tachycardia
- Slow return to baseline FHR after the end of the contraction

Clinical Response For all identified risk factors-ensure a collaborative plan is documented and in place.		**Risk of Hypoxia**	**Fetal Blood Sampling**	
			pH	**Lactate**
Normal	• Continue monitoring as required	Low risk	≥7.25	<4.2
Blue Zone Alert	• Escalate to midwife in charge – initiate appropriate clinical action and document e.g. change maternal position		7.21-7.24	4.2-4.8
Yellow Zone Abnormal	• Escalate to midwife in charge and determine need for **Clinical Review.** Continue to monitor with ongoing assessment. Clinical Review by a medical officer **within 30 mins,** as per local CERS. • Identify any reversible causes – change maternal position, give IV fluids if appropriate • Abnormal uterine activity – cease or reduce Syntocinon, consider use of terbutaline • **2 or more Yellow Zone features = Red Zone. Call a Rapid Response** (as per local CERS)			
Red Zone Abnormal	• **Rapid Response** is required (as per local CERS). Notify midwife in charge and a medical officer • Identify any reversible causes – cease Syntocinon, change maternal position • Consider further assessment of fetal wellbeing including FBS, or expediting birth by most appropriate means if a significant abnormality persists	High risk	≤7.20	≥4.9

Note: A clinician, woman, her partner or family member may call for a Clinical Review or Rapid Response at any time if they are concerned or unsure.

Appendix 8. Intrapartum electronic fetal heart rate monitoring label

INTRAPARTUM	Name				MRN	Date	Time	Gest Age	Mat Pulse
Antenatal risk factors									
Intrapartum Risk Factors	Uterine scar	Second stage	Epidural	Oxytocin	Abnormal labour progress	Persistent pain		Vaginal bleeding	Other
Risk Factors Affecting Fetal Reserve	IUGR	Hypertension / Pre-eclampsia	Temperature / Infection		Meconium	Prematurity		Diabetes	
Altered calling criteria	☐ No	☐ Yes	**Collaborative care plan in place**		☐ Yes	☐ No			

Contractions	Baseline	Rate	Variability	bpm	Accelerations	Decelerations
Normal uterine activity ≤5 in 10 minutes	110-160		Normal 6-25 Cycling present		Present	Nil
Abnormal uterine activity ≥6 in 10 minutes or lasting ≥2 minutes <60 seconds between contractions	100 to 109 >160 Rising baseline >10%		Absence of cycling in last 60 minutes		Absent *The absence of accelerations are unlikely to be associated with fetal compromise*	Early Occasional variable
						Repetitive variable Single prolonged >90 seconds and <3 minutes
	<100 for >10 minutes		Reduced ≤5 or absent for >50 minutes Increased >25 for >30 minutes Sinusoidal pattern >30minutes			Repetitive complicated variables Repetitive late Single prolonged (>3 minutes and no signs recovery)

Clinical Escalation Response			
Normal	**Blue Zone Alert**	**Abnormal Yellow feature - Clinical Review within 30 mins** **2 or more Yellow features=Red Zone=Call a Rapid Response** **Time of call**	**Abnormal Red Zone feature/s - Call a Rapid Response** **Time of call**
Name Signature	Date Time	Name Signature	Date Time Agree with Clinical Response ☐ Yes ☐ No

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