National Women & Infants Health Programme

National Clinical Practice Guideline

Fetal Heart Rate Monitoring

INSTITUTE OF OBSTETRICIANS & GYNAECOLOGISTS

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

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Key Recommendations

Section 1: Methods and Limitations of Fetal Heart Rate Monitoring		
1.	All women attending routine antenatal care should be offered auscultation of the fetal heart (FH) using a Pinard or Doppler from 23+0 weeks' gestation. The FH should be auscultated for at least 60 seconds and documented as a single rate in the healthcare record. The baseline FHR of 110 to 160 bpm should be considered as normal. The maternal pulse should be palpated simultaneously to differentiate between the maternal and fetal heart rates.	Best practice
2.	Antenatal CTG is not recommended as part of routine antenatal care.	Best practice
3.	The use of the external transducer of a CTG to confirm the fetal heart rate (FHR) should not be used.	1B
4.	All women should be recommended to avail of a method of intrapartum FHR monitoring. The method of monitoring (intermittent auscultation/CTG) should depend on the individual assessment of risk factors.	2C
5.	There is insufficient evidence to recommend the use of central monitoring.	Best practice
6.	Due to the lack of evidence for its effectiveness in potentially preventable neonatal outcomes, computerised antenatal CTG should not be routinely recommended until further evidence is available.	Best practice
7.	For the intrapartum period, there is insufficient evidence to recommend the use of Expert Systems.	Best practice
8.	The use of ST waveform analysis (STAN) has made no significant difference to primary outcomes or babies with neonatal encephalopathy and therefore is not recommended.	1A
9.	Intrapartum FHR monitoring (both IA and CTG) should be used as a tool to provide information on the fetal condition and should be reviewed as part of the overall clinical picture.	Best practice
10.	All types of FHR monitoring are subject to limitations and clinicians should consider each individually when offering FHR monitoring.	Best practice

Section 2: Information Sharing and Decision-Making		
11.	Discussions on the options of FHR monitoring should occur in the antenatal period. A national standardised evidence-based information leaflet should be used to guide the discussion.	Best practice
12.	The discussion should include the methods of FHR monitoring, benefits, reliability, limitations and evidence to support the recommendation of a method of FHR monitoring.	Best practice
13.	Shared decision-making and maternal choice should inform the method used. It is not necessary to revisit the woman's decision unless there are changes in the maternal or fetal condition	Best practice
Section 3: FHR Monitoring in the Antenatal Period		
14.	Women with maternal or fetal risk factors should be offered antenatal CTG monitoring as part of their individualised pathway of care.	2C
15.	Women identified as requiring antenatal FHR monitoring should have an individualised plan of care regarding the frequency and type of monitoring (IA/CTG).	Best practice
16.	Women presenting between **23+0 and 25+6 weeks' gestation** with a pregnancy-related concern should be offered auscultation of the fetal heart to confirm fetal life.	Best practice
17.	Women presenting between **26+0 to 27+6 weeks' gestation** with a pregnancy-related concern should be offered auscultation of the fetal heart as the first line of FHR monitoring to confirm fetal life. CTG monitoring should only be considered when there are risks of fetal hypoxia present. The decision for CTG monitoring should be made on a case-by-case basis by a senior obstetrician following a discussion with the woman. CTG should be performed and interpreted with caution, taking the clinical picture into account. A decision to expedite birth should not be made solely on the findings of an antenatal CTG.	Best practice
18.	Women presenting from **28+0 weeks' gestation** with a pregnancy-related concern and who have risk factors that may affect fetal well-being should be offered CTG monitoring from 28+0 weeks' gestation as part of their individualised plan of care.	Best practice
19.	A systematic assessment of the antenatal CTG should be performed and documented whenever the CTG is reviewed. The use of a standardised antenatal CTG pro forma for classification can aid systematic analysis. The CTG should be classified and documented as either ***normal* or *abnormal***. A sample antenatal CTG proforma can be found in Appendix 7.	Best practice
20.	Where an antenatal CTG is assessed as abnormal following a systematic review, prompt escalation to the obstetric team and senior midwife is required. A plan of care should be documented in the woman's healthcare record.	Best practice

Section 4: Intrapartum Risk Assessment		
21.	An initial risk assessment should be undertaken when a pregnant woman presents in early or established labour to determine the most appropriate form of FHR monitoring (IA or CTG).	1C
22.	The decision to commence continuous intrapartum CTG monitoring in preterm labours less than 28+0 weeks' gestation should be made following a clinical assessment of the woman's condition, and a discussion between the woman, senior obstetrician and senior paediatrician/neonatologist. This discussion should include the likelihood of survival or severe morbidity of the preterm infant.	Best practice
23.	A systematic assessment of the maternal and fetal condition should be undertaken every hour or more frequently if there are FHR concerns and documented in the healthcare record. The presence of new intrapartum risk factors should warrant an obstetric and midwifery team review. Continuous CTG monitoring should be recommended if not already in progress.	Best practice
24.	The use of a buddy system/fresh eyes may be used as part of a regular systematic review which includes FHR monitoring (IA or CTG) and a review of antenatal and intrapartum risk factors.	Best practice
25.	In the absence of any maternal or fetal risk factors, an admission CTG is not recommended.	1B
Section 5: Intrapartum Fetal Heart Rate Monitoring		
26.	Confirming fetal health by IA should be undertaken using a structured approach. The assessment should include abdominal palpation and auscultation of the fetal heart using a Pinard or Doppler during a period of fetal movement to exclude fetal hypoxia. The maternal heart rate should be palpated on each occasion to differentiate between the two heart rates.	Best practice
27.	The baseline FHR should be determined by auscultating the fetal heart for at least one minute between contractions and count the rate. The baseline FHR should range between 110-160 bpm. A single figure should be documented in the healthcare record.	Best practice
28.	When performing IA, the maternal pulse should be palpated simultaneously to ensure differentiation between the maternal and fetal heartbeats.	Best practice
29.	When auscultating the fetal heart, the presence of accelerations and/or decelerations should be recorded in the healthcare record.	Best practice
30.	In the event of no fetal heartbeat being detected, urgent real-time ultrasound assessment should be offered to check fetal viability and an obstetric review should be sought.	Best practice
31.	In the first stage of labour, IA should be carried out immediately after a palpated contraction for at least one minute and repeated at least once every 15 minutes.	Best practice

32.	Once the woman shows signs of the second stage of labour or is confirmed to be in the second stage of labour, IA should be undertaken immediately after a palpated contraction for at least one minute and repeated every 5 minutes or after every contraction – whichever comes first.	Best practice
33.	If there are concerns about differentiating between the maternal heart rate and FHR, changing the method of FHR monitoring is recommended.	Best practice
34.	The fetal heart should be recorded as a single rate on the partogram and/or in the woman's healthcare record.	Best practice
35.	The presence of any new or developing intrapartum risk factors warrants a transition from IA to CTG monitoring.	Best practice
36.	If FHR concerns are suspected during intermittent auscultation, the FHR should be auscultated more frequently (i.e., after 3 consecutive contractions). If FHR concerns are confirmed, escalate care and recommend continuous CTG monitoring.	Best practice
37.	If, during IA, there is an increase in the FHR of 20 bpm or more from the beginning of labour or if a deceleration is heard, care should be escalated and continuous monitoring should be commenced.	Best practice
38.	Where a CTG has been commenced due to concerns arising from IA and is classified as normal after 20 minutes, and there are no intrapartum maternal or fetal risk factors present, IA can be recommenced.	Best practice
39.	If during IA, there is difficulty in auscultating the FHR for at least one minute following a palpated contraction, and the difficulty in auscultating persists despite taking remedial actions, continuous CTG monitoring is recommended.	Best practice
40.	Prior to commencing intrapartum CTG monitoring, the woman should be provided with a full explanation of the rationale for continuous CTG monitoring, which should be documented in her health care records.	Best practice
41.	Prior to commencing CTG monitoring, fetal life should be confirmed independently by auscultating the fetal heart using a Pinard or Doppler and simultaneously palpating the maternal pulse.	Best practice
42.	The maternal pulse rate should be continuously monitored and recorded on the CTG by either pulse oximetry (Sp02) or the Toco MP transducer plate. If there are any concerns that the CTG is not differentiating the FHR signal from the maternal HR, or when unable to determine the baseline FHR between consecutive contractions: The FHR should be confirmed by independent means, including verification of the FHR with a fetal stethoscope/Pinard, ultrasound imaging, application of a fetal scalp electrode (where appropriate) The maternal HR should be verified by using either pulse oximetry (Sp02), the Toco MP transducer plate, maternal ECG or manual determination of the maternal pulse	Best practice

43.	When monitoring multiple pregnancies, the offsetting function on the CTG should be used to enable a more accurate assessment of each FHR. This separates the baselines by an offset of 20 bpm by switching on trace separation. Unless contraindicated, an FSE to monitor twin one should be considered.	Best practice
44.	The CTG trace should be of sufficient quality to facilitate the interpretation of its features. If not, remedial action should be taken to improve the quality of the trace (for example, by repositioning the toco transducer plate or using a fetal scalp electrode where appropriate).	Best practice
45.	A standardised intrapartum CTG pro forma for classification should be used to aid a systematic analysis of the CTG. The classification provided by NICE Fetal Monitoring in Labour (2022) should be used to categorise the intrapartum CTG in conjunction with the assessment of antenatal and intrapartum maternal and fetal risk factors. Intrapartum CTGs should be categorised as ***normal, suspicious or pathological.*** These terms should be used to describe the CTG and when seeking an obstetric review.	Best practice
46.	In the first stage of labour, the CTG should be categorised and documented at least every hour or sooner if there are FHR concerns.	Best practice
47.	In the passive second stage of labour, the CTG should be categorised and documented at least every hour or sooner if there are FHR concerns.	Best practice
48.	In the active second stage of labour, the CTG should be categorised and documented at least every 30 minutes however if there are FHR concerns, an obstetric review should be obtained. At all times, the necessary escalation based on CTG features should not be delayed until the next CTG classification is due. CTG concerns should be relayed to the obstetrician and senior midwife in a timely fashion regardless of the timing of classification.	Best practice
49.	In the active second stage of labour, if there are concerns in the differentiation of the maternal and FHR, a fetal scalp electrode (FSE) should be considered. If a Fetal Scalp Electrode (FSE) cannot be applied, urgent obstetric review should be sought.	Best practice
50.	All relevant events which may affect the FHR (e.g. vaginal examinations, changes in maternal position, vomiting, toilet breaks, fetal movements) should be annotated on the CTG trace.	Best practice
51.	It is recommended that decisions regarding the management of labour should be made based on the overall clinical picture and include maternal observations, contraction frequency and labour progress.	Best practice
52.	In the event of a CTG remaining pathological after implementing conservative measures (addressed in CQ 2.17) further obstetric and midwifery review should be sought and expediting birth should be considered. If there are evolving intrapartum risk factors for fetal compromise such as slow progress, sepsis or meconium, there should be a lower threshold for expediting birth.	Best practice
53.	Conservative measures should be used to resolve any possible underlying causes, such as maternal hypotension, tachysystole, and maternal aortocaval compression.	1C

54.	The administration of IV fluids should not be used routinely as part of conservative measures to treat FHR abnormalities.	Best practice
55.	The administration of maternal facial oxygen as part of conservative measures to address FHR concerns is not recommended.	1C
56.	Urgent action should be taken to resolve any FHR concerns in the second stage of labour; however, if there is no improvement, an urgent obstetric review should be obtained, and birth expedited.	Best practice
57.	Fetal scalp stimulation and fetal blood sampling may be considered as second-line tests to CTG monitoring when there are FHR concerns. The following factors should be taken into consideration when making the decision to use FSS or FBS; the invasiveness of the procedure, availability of resources, the time the procedure takes and the woman's wishes.	Best practice
Section 6: Storage of CTGs		
58.	CTG traces should be considered as part of the maternal healthcare record and should be stored electronically if possible. CTGs and associated maternal healthcare records should be retained indefinitely – up to the lifetime of the woman and eight years after death.	Best practice

Figures

Figure 1: Antenatal CTG parameters

CTG features	Normal parameters	Description
Baseline rate	110-160 bpm	Determine baseline FHR by looking at the mean FHR, excluding accelerations and decelerations, over a period of 10 minutes when the FHR is stable
Baseline variability	5-25 bpm	Refers to the minor oscillations in the FHR, which usually occur at 3 to 5 cycles a minute. It can be calculated by estimating the difference in beats per minute between the highest heart rate and the lowest heart rate in a 1-minute segment of the trace between contractions, excluding decelerations and accelerations
Accelerations	Presence of accelerations	Transient increases in FHR of 15 bpm or more, lasting 15 seconds
Decelerations	No decelerations	Transient episodes when the FHR slows to below the baseline level by more than 15 bpm, with each episode lasting 15 seconds or more

Figure 2: Initial risk assessment to determine the appropriate intrapartum FHR monitoring

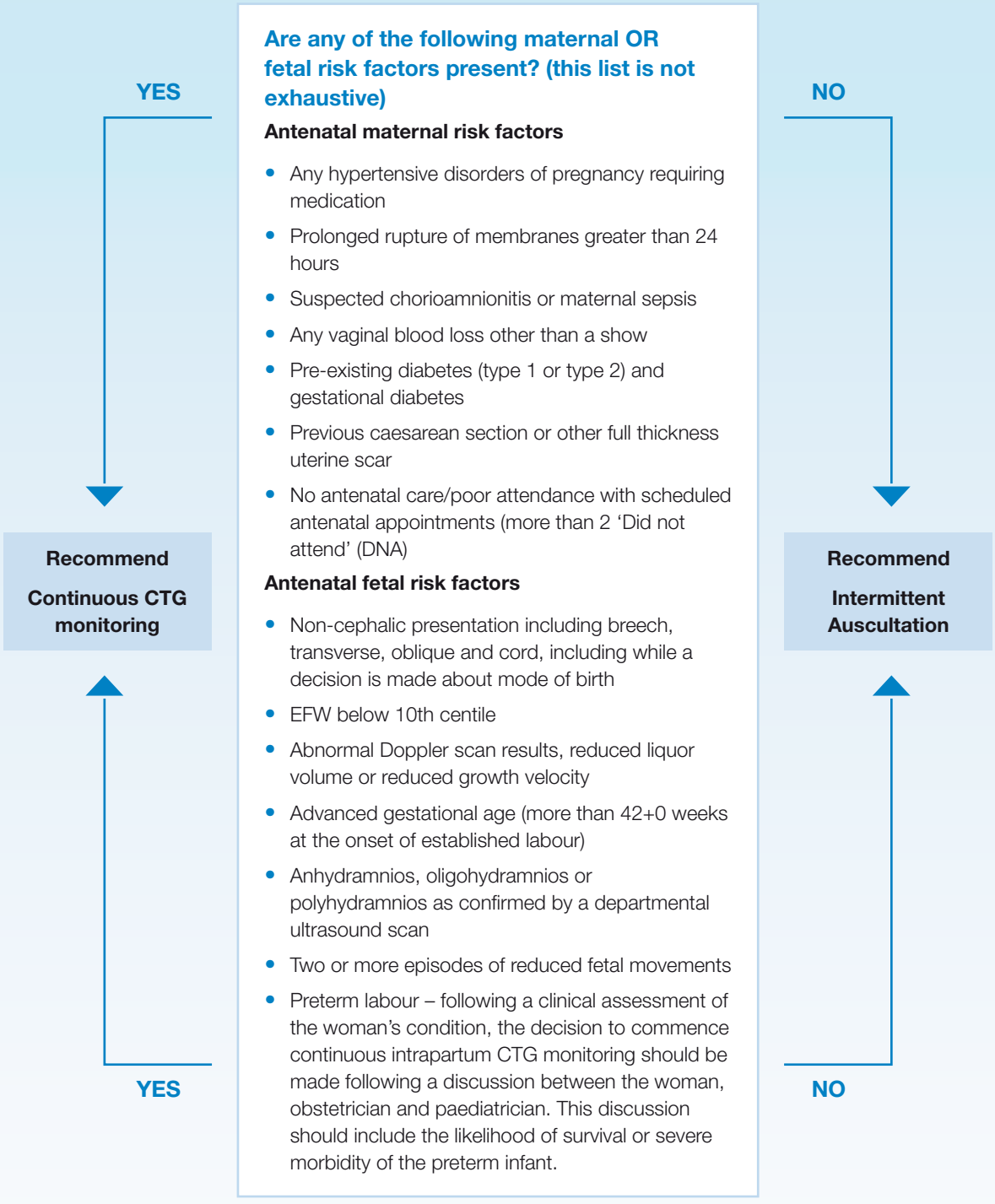

Figure 3: Ongoing risk assessment to determine the appropriate intrapartum FHR monitoring

Are any of the following risk factors present?

- Contraction lasting more than 2 minutes (hypertonus)
- 5 or more contractions in 10 minutes for at least 20 minutes
- Meconium stained liquor (any grade)
- Fresh vaginal bleeding that develops in labour
- Blood-stained liquor not associated with VE
- Use of oxytocin
- Maternal pyrexia (≥38°C on a single reading or 37.5°C or above on 2 consecutive occasions 1 hour apart)
- Suspected chorioamnionitis or sepsis
- Pain reported by the woman that appears to differ from the pain normally associated with contractions
- Maternal pulse over 120 bpm on 2 occasions 30 minutes apart
- Severe hypertension (a single reading of either systolic of ≥160 mmHg or diastolic of ≥110 mmHg Hypertension (either systolic ≥140 mmHg or diastolic ≥90 mmHg on 2 consecutive readings taken 30 minutes apart)
- A reading of 2+ of protein on urinalysis and a single reading of either raised systolic blood pressure (≥140 mmHg) or raised diastolic blood pressure (≥90 mmHg)
- Confirmed delay in the first or second stage of labour
- Regional analgesia: In cases where antenatal or intrapartum maternal or fetal risk factors are present, continuous CTG monitoring is recommended during epidural placement and for the duration of labour. In the absence of antenatal or intrapartum maternal or fetal risk factors, CTG monitoring should be commenced once the epidural is sited.
- Consider continuous CTG monitoring if, based on clinical assessment and obstetric and midwifery review, there are concerns about other intrapartum factors not listed above that may lead to fetal compromise.

YES ↓

If using IA, convert to continuous CTG monitoring

If already using continuous CTG monitoring, consider existing and evolving maternal/fetal risk factors in conjunction with CTG findings

Ongoing risk assessment should be performed hourly

NO ↓

Continue using IA if there are no antenatal/ intrapartum risk factors

Ongoing risk assessment should be performed hourly

Figure 4: Intrapartum CTG parameters (NICE 2022)

Contractions defined as bell-shaped gradual increases in the uterine activity signal followed by roughly symmetric decreases, with 45-120 seconds in total duration [1].

Tachysystole: a frequency of 5 or more contractions in 10 minutes [2]

Hypertonus: a contraction lasting 2 minutes or longer [2]

Normal	Up to 4 contractions in 10 minutes [2]
Suspicious	5 or more contractions in 10 minutes, leading to reduced resting time between contractions **or** hypertonus
Pathological	
Actions	If 5 or more contractions per 10 minutes are present, perform a full risk assessment and take action to reduce contraction frequency [2]

Baseline fetal heart rate (FHR)

Determine baseline FHR by looking at the mean FHR, excluding accelerations and decelerations, over a period of 10 minutes when the FHR is stable. When deciding if there is any change in baseline FHR, compare it with earlier CTG traces or recordings of FHR [2]

Stable baseline: usually 110 to 160 beats per minute (bpm). Lower FHR's are expected with post-term pregnancies, with higher baseline rates in preterm pregnancies [2]. When deciding if there is any change in baseline FHR, compare it with earlier CTG traces or recordings of FHR.

Rising baseline:

A rise in baseline FHR defined as an increase of 20 bpm or more from the previous stable baseline rate may represent either developing infection or hypoxia [2].

Normal	Stable baseline of 110 to 160 bpm
Suspicious	Increase in baseline FHR of 20 bpm or more from the start of labour or since the last review an hour ago, **or** 100 to 109 bpm **or** unable to determine baseline
Pathological	Below 100 bpm, **or** above 160 bpm **or** an increase in the baseline FHR of 20 bpm or more in active second stage labour [2]

Variability refers to the minor oscillations in the FHR, which usually occur at 3 to 5 cycles a minute. It can be calculated by estimating the difference in beats per minute between the highest heart rate and the lowest heart rate in a 1-minute segment of the trace between contractions, excluding decelerations and accelerations. The absence of variability is considered a very concerning feature [2]

Normal	5 to 25 bpm
Suspicious	Fewer than 5 bpm for between 30 and 50 minutes, **or** more than 25 bpm for **up to** 10 minutes
Pathological	Fewer than 5 bpm for **more than** 50 minutes, **or** more than 25 bpm for more than 10 minutes, **or** sinusoidal

Actions	**Obtain an urgent review by an obstetrician or senior midwife and consider expediting birth if:** there is an isolated reduction in variability to fewer than 5 bpm for more than 30 minutes when combined with antenatal or intrapartum risk factors, as this is associated with an increased risk of adverse neonatal outcomes, **or** there is a reduction in variability to fewer than 5 bpm combined with other CTG changes, particularly a rise in the baseline FHR, as this is a strong indicator for fetal compromise [2]

Decelerations: Transient episodes when the FHR slows to below the baseline level by more than 15 bpm, with each episode lasting 15 seconds or more. An exception to this is that in a trace with reduced variability, decelerations may be 'shallow'. Decelerations in the intrapartum period should be described as **'early'**, **'variable'** or **'late'** [2]

Early decelerations: Repetitive and periodic slowing of the FHR with onset early in the contraction and return to baseline at the end of the contraction. These are uncommon, benign and usually associated with head compression. They are not accompanied by any other changes, such as reduced variability or a rise in the baseline FHR [2]

Variable decelerations: Intermittent and periodic slowing of the FHR with a variable time in relation to the contraction [2]. The following characteristics of variable decelerations should be considered as **concerning***:

- Lasting more than 60 seconds
- Reduced variability within the deceleration
- Failure or slow return to baseline FHR
- Loss of previously present shouldering.

Shouldering: is defined as a slight increase in heart rate preceding and/or following decelerations [3]

Late decelerations: Repetitive and periodic slowing of the FHR with onset mid to end of the contraction and the lowest point more than 20 seconds after the peak of the contraction, and ending after the contraction [2]

Prolonged deceleration: single prolonged deceleration lasting 3 minutes or more [2]

Repetitive decelerations: decelerations that occur with over 50% of contractions

Normal	No decelerations, **or** early decelerations, **or** variable decelerations that are not evolving to have **concerning characteristics***
Suspicious	Repetitive variable decelerations with any concerning characteristics for less than 30 minutes, **or** variable decelerations with any concerning characteristics for more than 30 minutes, **or** repetitive late decelerations for less than 30 minutes
Pathological	Repetitive variable decelerations with any concerning characteristics for more than 30 minutes, **or** repetitive late decelerations for more than 30 minutes, **or** acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more

Accelerations: Transient increases in FHR of 15 bpm or more, lasting 15 seconds or more[2]. In the intrapartum period, the presence of FHR accelerations, even with reduced variability, is generally an indication that the baby is healthy. The absence of accelerations on an otherwise normal CTG trace does not indicate fetal acidosis[2].	
Overall classification of intrapartum CTG (contractions, baseline, variability, decelerations) (NICE, 2022)	
Normal	All 4 features are normal
Suspicious	Any 1 feature is suspicious
Pathological	Any 1 feature is pathological **or** 2 or more features are suspicious

Figure 5: Decision making on how to manage labour should be based on the overall clinical picture, including maternal observations, contraction frequency and labour progress

Classification	Recommended Actions
Normal:	• Continue standard care • In the event that the CTG was commenced due to FHR concerns arising from IA, and there are no antenatal or intrapartum risks factors present, fetal monitoring can revert to IA, if the women wishes
Suspicious and there are no other concerning factors:	• If the CTG was previously normal, consider possible underlying causes for the change in the FHR and take conservative measures (addressed in CQ 2.17)
Suspicious and there are additional intrapartum risk factors such as slow progress, sepsis or meconium:	• Possible underlying causes should be considered and if present, conservative measures should be undertaken • An urgent review by an obstetrician and senior midwife should be obtained and documented in the HCR
Pathological:	• An urgent review by an obstetrician and senior midwife should be obtained • Acute events such as cord prolapse, suspected placenta abruption or suspected uterine rupture should be considered • Other possible underlying causes should be considered and if present, conservative measures should be undertaken
If the CTG remains pathological after implementing conservative measures:	• Obtain a further urgent review by an obstetrician and senior midwife • Evaluate the whole clinical picture and consider expediting birth. If there are evolving intrapartum risk factors for fetal compromise, there should be a low threshold for expediting birth
Acute bradycardia or a single prolonged deceleration for 3 minutes or more:	• Obtain an urgent review by an obstetrician and senior midwife • If there has been an acute event such as cord prolapse, suspected placenta abruption or suspected uterine rupture, expedite birth • Possible underlying causes should be considered and if present, conservative measures should be undertaken • Preparations should be made for an urgent birth and include a request for paediatric or neonatal support in line with local obstetric emergencies activation protocols • If the acute bradycardia persists for 9 minutes, or less if there are significant antenatal or intrapartum risk factors for fetal compromise, expedite birth • If the FHR recovers at any time up to 9 minutes, reassess any decision to expedite the birth, but consider other antenatal and intrapartum risk factors • If a decision is made to expedite birth, the timings should be documented in the healthcare record and include the time of seeking an urgent review and the time of the decision was made

Chapter 1: **Initiation**

The National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) define clinical guidelines as systematically developed statements, based on a thorough evaluation of the evidence, to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances, across the entire clinical spectrum[1].

1.1 Purpose

The purpose of this guideline is to provide comprehensive, evidence-based guidance for antenatal and intrapartum fetal heart rate (FHR) monitoring. This document provides advice for healthcare professionals (HCPs) around the provision of safe, evidence-based care to pregnant women. A comprehensive literature review was undertaken, which included a review of international guidelines. Where there is a lack of strong evidence, consensus and expert opinion informs clinical practice recommendations. This guideline is designed to guide clinical judgment but not to replace it. This Guideline replaces the HSE National Clinical Guideline for Intrapartum Fetal Heart Rate Monitoring: Ireland (2021).

1.2 Scope

Target Users

This Guideline is a resource for healthcare professionals who provide care to women during the antenatal and intrapartum periods. This includes Doctors, Midwives, Advanced Midwifery Practitioners[2], and Students under supervision (midwifery and medical).

Target Population

This Guideline is intended for pregnant women attending maternity services and the healthcare professionals providing care.

1.3 Objective

To provide evidence-based recommendations for the care of pregnant women in the antenatal and intrapartum period and promote a standardised approach across all maternity services in the Republic of Ireland.

1 National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) (2015) National quality assurance criteria for clinical guidelines. Version 2. Dublin: NCEC and HIQA. https://www.hiqa.ie/sites/default/files/2017-01/National-Quality-Assurance-Criteria.pdf

2 Nursing and Midwifery Board of Ireland (NMBI) (2018) Advanced Practice (Midwifery) Standards and Requirements. Dublin. www.nmbi.ie/NMBI/media/NMBI/Advanced-Practice-(Midwifery)-Standards-and-Requirements-2018-final.pdf

1.4 Guideline Development Process

The Guideline Developers agreed to undertake this work under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group (EAG) was commissioned by the GPT. Their role was to critically review the Guideline prior to submission to the National Women and Infants Health Programme (NWIHP) for final approval.

See Appendix 1 for EAG membership and Appendix 2 for Guideline Programme Process.

The Guideline Development Group (GDG) comprised Obstetricians, Midwives and Academics with a special interest in fetal heart rate monitoring.

The GDG comprised is as follows:

- Ms Mary Rowland, Assistant Director of Midwifery, National Women and Infants Health Programme
- Ms Joanne Taylor, Lead Midwife for Fetal Monitoring, Rotunda Hospital
- Dr Karen McNamara, Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital
- Ms Martina Cronin, Clinical Midwife Manager 3, National Maternity Hospital, Holles St. Dublin
- Ms Ita Kinsella, Director of Midwifery, Midland Regional Hospital, Portlaoise
- Ms Helen Murphy, Director of Midwifery, University Hospital Galway
- Dr Lorraine Carroll, Assistant Professor in Midwifery, School of Nursing, Midwifery and Health Systems, University College Dublin
- Prof Deirdre Murphy, Chair of Obstetrics and Consultant Obstetrician, Trinity College Dublin and The Coombe Hospital
- Ms Eleanor Purcell, Lead Midwife for Fetal Monitoring, St Luke's General Hospital, Kilkenny
- Dr Cliona Murphy, Consultant Obstetrician and Gynaecologist and Clinical Director, National Women and Infants Health Programme

1.5 Stakeholder involvement

Stakeholders are people who have a common interest in improving health services. This includes those responsible for delivering and those receiving services related to the Guideline.

During the development process, the 19 maternity sites, their affiliated higher education institutions for midwifery, and service user representatives were invited to review the Guideline.

The Guideline Development Group would like to acknowledge the reviewers' contributions in the development of this Guideline (Appendix 3).

1.6 Disclosure of interest

Guideline developers and reviewers bring a range of experiences and perspectives to the work of the national Guideline Programme. It is likely that both Guideline developers and stakeholders/reviewers will have a variety of interests, arising from different contexts and activities done in a professional or personal capacity. These can include employment and other sources of income, speaking engagements, publications and research, and membership of professional or voluntary organisations. The involvement of individuals with relevant content expertise is essential for enhancing the value of Guideline recommendations, but these individuals may also have interests that can lead to conflicts of interest, as may peer reviewers, patient representatives and researchers.

All interests should be declared if, in the view of a reasonable person, they are relevant, or could be perceived to be relevant, to the work of the Clinical Practice Guideline in question[3]. Declaring an interest does not mean there is a conflict of interest.

It is important that interests are openly declared so they can be appropriately managed. Conflicts of interest can bias recommendations and ultimately harm women and the health system. Therefore, disclosures of interests and appropriate management of conflicts of interest, when identified, are essential to producing high-quality, credible health guidelines[4].

The Guidelines International Network (GIN), a global network of Guideline developers that aims to promote best practices in developing high-quality guidelines, developed a set of nine principles to guide how financial and non-financial conflicts of interest should be disclosed and managed. It is recommended that Guideline developers follow the GIN principles[5].

For this National Clinical Practice Guideline, all Guideline developers were asked to complete a conflict-of-interest declaration form. The guideline programme team will manage the response to declared interests in accordance with GIN principles. Conflicts of interest may be reported in the published Guideline, and declarations of interest can be made available.

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1.7 Disclaimer

These guidelines have been prepared to promote and facilitate the standardisation and consistency of good clinical practice using a multidisciplinary approach. The information in this Guideline is current at the time of publication.

The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the Clinician in light of clinical data presented by the woman and the diagnostic and treatment options available.

Clinical material offered in this Guideline does not replace or remove clinical judgment or the professional care and duty necessary for each specific woman.

Clinical care carried out in accordance with this Guideline should be provided within the context of locally available resources and expertise.

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3 NICE (2019) Policy on declaring and managing interests for NICE advisory committees https://www.nice.org.uk/Media/Default/About/Who-we-are/Policies-and-procedures/declaration-of-interests-policy.pdf

4 Traversy G, Barnieh L, Akl EA, Allan GM, Brouwers M, Ganache I, Grundy Q, Guyatt GH, Kelsall D, Leng G, Moore A, Persaud N, Schünemann HJ, Straus S, Thombs BD, Rodin R, Tonelli M. CMAJ. 2021, 193(2):E49-E54. DOI: 10.1503/cmaj.200651 https://www.cmaj.ca/content/193/2/E49

5 Holger J. Schünemann, Lubna A. Al-Ansary, Frode Forland, et al.; for the Board of Trustees of the Guidelines International Network. Guidelines International Network: Principles for disclosure of interests and management of conflicts in guidelines. Ann Intern Med. 2015;163:548-553. doi:10.7326/M14-1885. https://www.acpjournals.org/doi/10.7326/m14-1885

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible for the following:

- Discussing care with women in an appropriate environment, which enables respectful and confidential discussion. This includes the use of interpreter services where necessary
- Advising women of their choices and ensure informed consent is obtained
- Provide care within the professional scope of practice, meeting all legislative requirements and maintaining standards of professional conduct
- Applying standard precautions and additional precautions, as necessary, when delivering care
- Documenting all care in accordance with local and mandatory requirements.

1.8 Use of language

Within this guidance, we use the terms 'woman' and 'women's health'. However, it is important to acknowledge that people who do not identify as cis-gender women are excluded from this descriptor, including people who identify as transgender, gender diverse and gender non-binary[6]. While there has been a trend to remove the word 'woman/women' and use 'gender neutral' language in policy and practice in relation to women's reproductive health and wellbeing, there is no evidence base to inform this change.[7] We also appreciate that there are risks to desexing language when describing female reproduction[8] [9].

Services and delivery of care must be appropriate, inclusive and sensitive to the needs of people whose gender identity does not align with the sex they were assigned at birth. This includes training and education regarding diverse pathways to pregnancy and the use of practices which affirm the sexual and gender identities of all people using Obstetrics and Gynaecology services. Finally, all those using maternal and reproductive health care and services should receive individualised, respectful care, including the use of the gender nouns and pronouns they prefer.[7]

Language use is key to effectively communicate options, recommendations, and respectfully accept a woman's fully informed decision[10]. With this in mind, the use of birth is preferable to the term delivery in all circumstances and is used consistently where possible throughout the guidelines. It is acknowledged that in some circumstances (e.g., in the case of a medically indicated intervention or surgery) and in some contexts, substituting with the term delivery is considered appropriate and this term may be used instead.

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8 Brotto LA, Galea LAM. Gender inclusivity in women's health research. BJOG: An International Journal of Obstetrics & Gynaecology. https://obgyn.onlinelibrary.wiley.com/doi/full/10.1111/1471-0528.17231

9 Gribble KD, Bewley S, Bartick MC, *et al.* Effective Communication About Pregnancy, Birth, Lactation, Breastfeeding and Newborn Care: The Importance of Sexed Language. *Frontiers in Global Women's Health*. 2022;3. Accessed June 9, 2022. https://www.frontiersin.org/article/10.3389/fgwh.2022.818856

10 https://blogs.bmj.com/bmj/2018/02/08/humanising-birth-does-the-language-we-use-matter/

1.9 Adopting a trauma-informed approach to maternity care

Many women accessing maternity services may have experienced historical or current trauma prior to, or during pregnancy – including emotional, physical, sexual abuse, rape and torture. The perinatal period (pregnancy, birth and the postpartum) can be a time when previous trauma is triggered[11]. Maternity care procedures which may seem routine and 'non-invasive' to healthcare professionals (HCPs), e.g., abdominal palpation or providing breastfeeding support can be triggering for some women with a history of trauma, as can intimate procedures such as vaginal examinations[12].

Trauma-informed care (TIC) is a developing approach to healthcare which recognises the importance of psychological safety, and the need to prevent or resist re-traumatisation of individuals[13]. It is based on 4 key principles (known as the 4Rs): (1) realisation of trauma; (2) recognition of trauma; (3) responding to trauma and (4) resisting re-traumatisation[14] . A trauma-informed approach to maternity care means that all staff in an organisation have an understanding of the impact of trauma on individuals, families and organisations[15]. While a universal approach is yet to be agreed, within clinical practice and research, many organisations recognise the need to move towards becoming trauma-informed in the provision of maternity care[15 16]. Such an approach requires commitment, investment and transformation within maternity services.

In simple terms, HCPs should recognise the impact of women's previous or current history of trauma (whether disclosed or not) and adopt a universally sensitive approach to care provision that recognises the impact of trauma on service users and HCPs. Examples of this include ensuring clear communication and consent is sought before any procedures/interventions, ensuring women are provided with dignity and respect at all times.

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12 Montgomery E. Feeling safe: a metasynthesis of the maternity care needs of women who were sexually abused in childhood. Birth 40:88-95. Birth. 2013 Jun;40(2):88-95. doi: 10.1111/birt.12043

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Chapter 2:
Clinical Practice Guideline

Background

Maternity services endeavour to provide high-quality, safe care for women and babies, ensuring women are empowered to make informed choices in collaboration with their healthcare professionals [1]. The National Maternity Strategy seeks to improve the quality and safety of maternity services and standardise care across them [2]. The development of national clinical practice guidelines enables the standardisation of practice across all maternity settings.

Auscultation of the fetal heart rate (FHR) is a universally accepted standard of care to assess fetal well-being, in an effort to identify fetuses who might have, or be at risk of developing hypoxia[4]. Assessment of fetal wellbeing throughout pregnancy, labour and birth is considered to be a core component of maternity care by international expert bodies, including the National Institute for Health and Care Excellence (NICE), International Federation of Gynecology and Obstetrics (FIGO), Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), Society of Obstetricians and Gynaecologists of Canada (SOGC) and the International Confederation of Midwives (ICM)[1 2 5-7].

Recommendations relevant to this Guideline can also be found in:

- Health Service Executive (2020). National Standards for Antenatal Education in Ireland. Ireland[17]
- Health Service Executive (2022) National Consent Policy. Ireland[18]
- Health Service Executive (2023) National Clinical Practice Guideline: Induction of Labour. Ireland[19]
- Health Service Executive (2023) National Clinical Practice Guideline: Vaginal Birth after Caesarean Section. Ireland[20]
- Health Service Executive (2024) National Clinical Practice Guideline: Reduced Fetal Movements. Ireland[21]

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17 https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/child-health-and-wellbeing/antenatal-ed.pdf

18 https://healthservice.hse.ie/staff/procedures-guidelines/hse-consent-policy/#:~:text=The%20policy%20describes%20how%20every,treated%20as%20a%20single%20event

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- Health Service Executive National Clinical Guideline: Fetal Growth Restriction – Recognition, Diagnosis and Management (2025)[22]

Definitions

First stage of labour is when there are regular uterine contractions and there is progressive cervical dilatation from 4cm (NCG Intrapartum Care for Women on the Supported Care Pathway – due 2025)

Passive second stage of labour the time from when there is full dilatation of the cervix before or in the absence of involuntary or active pushing (NCG Intrapartum Care for Women on the Supported Care Pathway – due 2025)

Active second stage of labour is when the baby is visible or, there is involuntary or active pushing with full dilatation of the cervix (NCG Intrapartum Care for Women on the Supported Care Pathway – due 2025)

Section 1: Methods and Limitations of FHR Monitoring

Clinical Question 2.1: What are the methods of FHR monitoring?

Evidence Statement

Antenatal FHR Monitoring

Auscultation of the fetal heart (FH) is typically performed using a Pinard stethoscope or a hand-held Doppler device and recorded as a single measure of the heart rate at that time [8]. Although auscultation of the FH is unlikely to have any predictive value, NICE (2019) and RANZCOG (2022) suggest that auscultation may provide reassurance to women [9 10]. Electronic fetal monitoring in the form of a cardiotocograph (CTG) is intended to identify fetuses at risk of intrauterine hypoxia and to prevent fetal death [11] however due to the lack of evidence NICE (2019) does not recommend the routine use of antenatal CTG for fetal assessment in women with an uncomplicated pregnancy [9].

A 2015 Cochrane Systematic review that examined the effectiveness of antenatal CTG in improving outcomes for babies versus no CTG found no studies that included women at low risk of complications [12]. The four studies [13-16] included in the review were on women at increased risk of complications, and only one was of high quality [16]. This study showed no significant difference in perinatal mortality (PNM) (RR 1.53, 95% CI 0.51 to 4.61, one study, N = 530); however, it was underpowered to assess this outcome [16]. The review found no significant difference in potentially preventable PNM (RR 2.46, 95% CI 0.96 to 6.30, four studies, N = 1627). There was no significant difference in the risk of caesarean section for women (RR 1.06, 95% CI 0.88 to 1.28, 19.7% versus 18.5%, three trials, N = 1279)[12]. The review concluded that there is no clear evidence that antenatal CTG improves perinatal outcomes.

22 McMahon, G., McDonnell, B., Mackin, D., Kent, E., Geary, M. National Clinical Practice Guideline: Fetal Growth Restriction – Recognition, Diagnosis and Management. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. June 2025

Intrapartum FHR Monitoring

The aim of intrapartum FHR monitoring in the form of intermittent auscultation (IA) or CTG is to enable the early recognition of the fetus with hypoxia/acidosis so that timely and effective resuscitative actions can be taken before adverse perinatal outcomes occur [5-7 18].

Intermittent Auscultation (IA)

IA is the technique of listening to and counting the fetal heartbeats for short periods during established labour, using a Pinard or Doppler [8]. The use of the external transducer of a CTG to auscultate the fetal heart should not be used as the FHR is averaged and displayed as a digital interface. This is not the same as counting the FHR using a Pinard or Doppler for one minute and should not be considered as a method of IA [17].

Pinard versus Doppler

There is international consensus among professional bodies including NICE, FIGO, RANZCOG, SOGC that IA is an appropriate method of intrapartum FHR monitoring for low risk women[1 2 5 6 18 19]. A 2017 Cochrane review evaluated the effectiveness of a Pinard and Doppler for IA of the fetal heart during labour [4]. It identified two studies[20 21] that compared Doppler with Pinard for IA during labour. The studies included women with uncomplicated pregnancies [21] and existing obstetric and medical risk factors [20]. The review found no clear difference in low Apgar scores <7 at five minutes (average RR 0.76, 95% CI 0.20 to 2.87; two trials, 2598 babies, very low-quality evidence). There was no clear difference between groups for perinatal mortality (RR 0.69, 95% CI 0.09 to 5.40; 2597 infants, two studies, very low-quality evidence), or neonatal seizures (RR 0.05, 95% CI 0.00 to 0.91; 627 infants, one study, very low-quality evidence). Only one study reported primary outcomes for women [20]. This study found that women allocated to the Doppler monitoring group had higher rates of caesarean section for fetal distress than women allocated to routine Pinard monitoring group (RR 2.71, 95% CI 1.64 to 4.48, one trial, 627 women, moderate-quality evidence). The Cochrane review concluded that IA for FHR in labour with a Doppler identifies more FHR abnormalities (tachycardia, bradycardia, early and late decelerations), but leads to an increase in caesarean sections compared to using a Pinard without showing any significant difference in low Apgar <7 scores at five minutes, perinatal death and admission to NICU/NNU [4].

A 2019 systematic scoping review undertaken by Blix *et al.* to identify methods of IA, effects and accuracy included two additional studies [22 23] in the meta-analysis (four studies, 8436 women and babies)[24]. The review concluded that although abnormal FHR was detected more often when using a Doppler than with a Pinard (risk ratio 1.77, 95% confidence interval 1.29 – 2.43), the difference did not affect the clinical outcomes. The quality of the evidence found low confidence in the effect estimates, except for stillbirth and neonatal death, which were assessed as moderate [24].

Electronic FHR Monitoring in the form of CTG

CTG monitors the fluctuations of the FHR and provides a trace of the FHR and maternal uterine contractions. Continuous CTG can be performed with an external and/or internal monitor. External methods of monitoring involve placing an ultrasound transducer onto the maternal abdomen over the fetal anterior shoulder and repositioning until a signal is achieved. Internal methods of monitoring involves attaching a fetal scalp electrode (FSE – spiral or clip) to the fetal scalp when the membranes are ruptured and sufficient cervical dilatation has occurred [25]. The ultrasound transducer detects the Doppler shift, which the CTG machine can interpret as an FHR. Uterine activity is monitored via an external abdominal transducer, known as the 'toco'. The transducer is placed over the fundus of the maternal abdomen and held in place by an elastic belt to monitor the frequency of uterine contractions [26]. It only provides accurate information on the frequency of uterine contractions, and it is not possible to extract reliable information on the intensity and duration of uterine contractions [1]. There is a lack of evidence to demonstrate the effectiveness of CTG monitoring over IA, in both low and high-risk labours [27].

A 2017 Cochrane systematic review of 12 studies compared continuous CTG versus IA in the intrapartum period [27]. Six studies included women at increased risk of complications [28-33] and a further three studies included both groups of women[34-36] or did not specify [37-39]. The review found no significant improvement in overall perinatal mortality (risk ratio (RR) 0.86, 95% confidence interval (CI) 0.59 to 1.23, N = 33,513, 11 trials, low quality evidence), but was associated with a halving of neonatal seizure rates (RR 0.50, 95% CI 0.31 to 0.80, N = 32,386, 9 trials, moderate quality evidence). There was no difference in cerebral palsy rates in early childhood (between 18 months and four years) when continuous CTG monitoring was compared with IA (RR1.75, 95% CI 0.84 to 3.63, N=13,252, 2 trials, low quality evidence). There was a statistically significant increase in caesarean sections (RR 1.63, 95% CI 1.29 to 2.07, N = 18,861, 11 trials, low quality evidence). Women were also more likely to have assisted vaginal births (RR 1.15, 95% CI 1.01 to 1.33, N = 18,615, 10 trials, low quality evidence)[27].

There is consensus opinion among professional bodies such as NICE, FIGO and RANZCOG that CTG monitoring should be considered in situations where there is a high-risk of fetal hypoxia/acidosis, whether due to maternal risk factors (such as maternal pyrexia, vaginal bleeding), intrauterine fetal growth concerns, meconium stained liquor or excessive uterine activity as can occur with induction or augmentation of labour[1 2 5]. Furthermore, NICE and FIGO recommend continuous CTG monitoring when FHR abnormalities are detected during IA [1 2].

A 2013 retrospective study examined the impact of internal monitors on maternal and neonatal outcomes[40]. When a fetal scalp electrode (FSE) was used (n = 625 women), the risk of any maternal fever (Adjusted Odd Ratio (AOR) 1.5; 95% CI, 1.0-2.1), maternal fever before delivery (AOR, 1.8; 95% CI, 1.0-3.2), and maternal fever at >12 hours after delivery (AOR, 1.4; 95% CI, 0.9-2.3) were not statistically significantly different compared with no internal monitors. The use of a FSE alone was associated with a decreased risk of caesarean delivery compared with no internal monitors (7.5% vs 9.7%; AOR, 0.5; 95% CI, 0.4-0.7). The composite neonatal outcome (5-minute Apgar score ≤3, cord pH <7.1, cord base excess ≤-12, or admission to Level 3 NICU) was not statistically significantly different compared between the FSE and no internal monitors groups (2.5% vs 3.7%; AOR, 0.8; 95% CI, 0.5-1.5)[40].

The CTG can be displayed either electronically or on paper depending on the resources available. Electronic systems allow the CTG to be displayed in the room as well as transmitting it to a central monitoring system which is thought to enable the obstetric team and midwifery shift leader to oversee multiple CTGs without having to disturb the woman in labour [25].

Brown *et al.* 2016 conducted a retrospective cohort study and analysed the data of 2,855 births to compare the use of continuous CTG monitoring with central monitoring versus CTG monitoring only[41]. The study found no significant difference in umbilical cord lactate, Apgar score, neonatal intensive care unit (NICU) admission or perinatal death. These findings were similar to earlier studies [42 43]. Furthermore, Browne *et al.* found that even on optimally staffed units, the use of central monitoring was associated with reduced one-to-one midwifery care. An ethnographic study conducted by Small *et al.* in 2021 found that central monitoring altered how maternity teams worked [44]. The authors found that there was the potential to undermine patient safety as discussions, decision-making, and communication focused around the central monitor, rather than in the labour room[44]. Despite the lack of evidence to support the use of central monitoring, the 2022 Ockenden Review of Maternity Services in the Shrewsbury and Telford Hospital NHS Trust included the use of central monitoring as an essential action for all obstetric units[45].

Clinical Practice

Descriptions of the methods of FHR monitoring and the procedure for undertaking FHR monitoring are outlined in appendices 4 and 5 respectively.

Antenatal period: Although there is no evidence that auscultation of the FH has any predictive value, it is the consensus of the Guideline Development Group (GDG) that it is reasonable to offer women attending routine antenatal care, auscultation of the FHR from the threshold of viability, currently 23+0 weeks' gestation in the Republic of Ireland. Auscultation of the FHR should be carried out using a Pinard or Doppler. Antenatal CTG is not recommended as part of routine antenatal care. The criteria for antenatal CTG monitoring will be addressed in CQ 2.6.

Intrapartum period: FHR monitoring is recommended when labour is diagnosed (see page 22). The method of FHR monitoring should depend on the antenatal and intrapartum risk factors, planned place of birth and the woman's preference. IA is an appropriate method of intrapartum FHR monitoring for women without any apparent risk factors for fetal compromise. Either the Pinard or Doppler should be used to perform intermittent auscultation. The use of the external transducer of a CTG machine to auscultate the FHR does not constitute IA and should not be used.

Electronic fetal monitoring (EFM) in the form of CTG (referred to as CTG throughout the document) should be used for women with risk factors for fetal compromise, but should not be used in isolation or replace clinical assessment and judgement.

Criteria for use of intrapartum IA and CTG will be addressed in CQs 2.8 and 2.9.

Recommendations

1. **All women attending routine antenatal care should be offered auscultation of the fetal heart (FH) using a Pinard or Doppler from 23+0 weeks' gestation. The FH should be auscultated for at least 60 seconds and documented as a single rate in the healthcare record. The baseline FHR of 110 to 160 bpm should be considered as normal. The maternal pulse should be palpated simultaneously to differentiate between the maternal and fetal heart rates.**
2. **Antenatal CTG is not recommended as part of routine antenatal care.**
3. **The use of the external transducer of a CTG to confirm the FHR should not be used.**
4. **All women should be recommended to avail of a method of intrapartum FHR monitoring. The method of monitoring (IA/CTG) should depend on the individual assessment of risk factors.**
5. **There is insufficient evidence to recommend the use of central monitoring.**

Clinical Question 2.2: What are the limitations of FHR monitoring?

Evidence Statement

Limitations of IA

IA can be used to correctly identify the baseline fetal heart rate, presence of accelerations, and decelerations [46 47]. IA is unable to differentiate the type of decelerations or variability, however the parameters necessary to highlight the fetus requiring further assessment and monitoring can be detected [46 47]. Studies that have compared intrapartum IA and CTG found them to be equivalent with respect to long-term neonatal outcomes (low-quality evidence)[27]. However, these limitations do not appear to be clinically significant when monitoring women with uncomplicated pregnancies who are at low risk of uteroplacental insufficiency[8 48].

Limitations of CTG monitoring

Numerous inconsistencies in observers' visual interpretation and subsequent classification of CTG tracings have been described. These inconsistencies can result in an increase in obstetric interventions [27 49 50] without decreasing the number of adverse perinatal outcomes [1 51]. Intra-rater reliability involves repeated measurements made by a single observer (rater) of the same CTG, whereas inter-rater reliability involves several observers (raters) who evaluate the same CTG [52].

A recent systematic review evaluated the inter- and intra-rater observer reliability in the interpretation and classification of FHR monitoring [53]. It included 49 studies with 577 raters and 6315 CTG tracings (inter-rater reliability and agreement) and 123 raters and 1170 CTG tracings twice (intra-rater reliability and agreement)[53]. It found that intra-rater reliability agreement levels were higher than inter-rater counterparts, meaning the same rater was more consistent when interpreting the same CTG twice than two different raters who interpreted the same tracing [53]. There was a higher intra- and inter-rater reliability and agreement for basic features (baseline, variability, accelerations and decelerations) than for the overall classification of CTGs. Inter-rater reliability agreement was also higher in normal CTG classifications than in abnormal classifications. Furthermore, the review found no clear association between rater experience, profession and reliability [53].

Computerised Decision-Making Supports

Assessment of CTGs remains subjective [1 54]. To overcome the inter- and intra-observer variability, computerised methods to analyse CTGs have been developed for both the antenatal and intrapartum periods.

Computerised Antenatal CTG

Computerised antenatal CTG has been developed to provide objective and consistent interpretation[55]. Computerised CTG provides objective data, reduces intra- and inter-rater variation and is more accurate than clinicians in predicting umbilical acidosis and low Apgar scores [56]. A 2015 Cochrane review compared the effectiveness of computerised CTG versus the traditional standard visual antenatal CTG interpretation [12]. Two studies (N = 469 women with increased risk of complications and at variable gestations) were included in the review [57 58]. Although the review found a significant reduction in perinatal mortality with computerised CTG (RR 0.20, 95% CI 0.04 to 0.88, two studies, 0.9% versus 4.2%, 469 women, moderate quality evidence), there was no significant difference identified in potentially preventable deaths (RR 0.23, 95% CI 0.04 to 1.29). The meta-analysis was deemed underpowered to assess this outcome, or any other measure of adverse perinatal outcomes [12]. It concluded that further studies on computerised CTG use in specific populations of women with increased risk of complications are warranted [12].

A recent systematic review of 3 RCTs comparing antenatal computerised CTG with visual standard antenatal CTG in the prevention of perinatal mortality[59] concluded that for women with high-risk pregnancies, there was no significant difference between potentially preventable perinatal mortality, caesarean section (CS) and Apgar score [59]. Despite the lack of strong evidence, computerised antenatal CTG is becoming an acceptable standard of practice as it is seen to reduce potential risks of human error [59-61].

Intrapartum CTG monitoring

The known limitations of CTG monitoring have led to the development of computerised systems. Expert systems (ESs) represent a form of applied artificial intelligence designed to assist in complex decision-making. The use of ESs in intrapartum care collates information on maternal and fetal characteristics, such as FHR, uterine contractions and gestational age, to provide a comprehensive overview of the labour and/or issue an alert if the fetal condition becomes critical [62]. A Cochrane Systematic review evaluated the effectiveness of intrapartum CTG monitoring with an Expert System (ES) compared to (1) continuous or intermittent CTG without ES or (2) intermittent auscultation with a Pinard or Doppler [63]. With limited studies available, the authors concluded that the results were underpowered to evaluate the association between CTG monitoring with an ES and primary outcomes; incidence of caesarean section, perinatal mortality, incidence of neonatal seizures, acidaemia [63]. Other studies have evaluated the effectiveness of decision support software on perinatal morbidity and mortality [64]. The INFANT trial assessed the use of decision support software in interpreting intrapartum CTG monitoring and runs on the Guardian K2 Medical Systems. INFANT analyses the quality of fetal heart signals and displays baseline heart rate; heart-rate variability; accelerations and type and timing of decelerations; the quality of the signal; and the contraction pattern. It then makes an assessment of the overall pattern, which, if necessary, will result in a colour-coded alert [26]. This RCT included 24 maternity sites across the UK and Ireland and recruited over 47,000 women. It found no evidence that using decision support software in conjunction with CTG reduced the likelihood of poor neonatal outcomes when compared to CTG alone [64].

Despite the limitations discussed, intrapartum FHR monitoring (both IA and CTG) should be considered a tool for providing information on the fetal condition. The findings from FHR monitoring should be reviewed as part of the overall clinical picture for the woman and baby[2].

Adjunctive Tests

Adjunctive tests have been developed to be used alongside CTG in an effort to improve the assessment of fetal well-being. The ultimate aim is to improve fetal outcomes and decrease unnecessary intervention.

Adjunctive tests in the antenatal period

A full discussion of antenatal adjunctive tests is beyond the scope of this guideline, however include the following:

Biophysical profile (BPP) – an assessment of overall fetal wellbeing through the combination assessment of CTG and ultrasonic measurement of fetal movements, fetal tone, fetal breathing and estimation of amniotic fluid volume [65].

Modified biophysical profile (MBPP) – an assessment of overall fetal wellbeing based only on fetal CTG and estimation of amniotic fluid volume [65].

Fetal and umbilical artery or venous Doppler ultrasound – ultrasonic measurement of blood flow through blood vessels of interest can indicate high vascular impedance and possible feto-placental compromise [65].

Adjunctive tests in the intrapartum period

The use of ST waveform analysis (STAN) has been developed to monitor the fetal electrocardiographic waveform during labour [66]. A 2015 Cochrane Systematic review compared the effects of analysis for fetal electrocardiogram (ECG) waveforms during labour with alternative methods of fetal monitoring [66]. When compared to CTG alone, seven trials (26,446 women) and one trial of PR interval analysis (957 women) were identified. It found that the use of ST waveform analysis made no obvious difference to primary outcomes: births by caesarean section (RR 1.02, 95% CI 0.96 to 1.08; data from 26,446 women, 6 trials, high quality evidence), the number of babies with severe metabolic acidosis at birth (cord arterial pH less than 7.05 and base deficit greater than 12 mmol/L) (average RR 0.72, 95% CI 0.43 to 1.20; data from 25,682 babies, 6 trials, moderate quality), or babies with neonatal encephalopathy (RR 0.61, 95% CI 0.30 to 1.22; data from 26,410 babies, 6 trials, high quality evidence). There were on average fewer fetal blood scalp samples taken during labour (average RR 0.61, 95% CI 0.41 to 0.91; data from 9671 babies, 4 trials, high quality evidence), there were marginally fewer operative vaginal births (RR 0.92, 95% CI 0.86 to 0.99; data from 26,446 women, 6 trials), but no obvious difference in the number of babies with low Apgar scores <7 at five minutes (RR 0.95, 95% CI 0.73 to 1.24; data from 15302 babies, 5 trials, high quality evidence) or babies requiring neonatal intubation (RR 1.37, 95% CI 0.89 to 2.11; data from 12544 babies, 2 trials, high quality evidence) or babies requiring admission to the special care unit (RR 0.96, 95% CI 0.89 to 1.04; data from 26,410 babies, 6 trials, high quality evidence). There were no differences in perinatal deaths (RR 1.71, 95% CI 0.67 to 4.33; data from 26,446 babies, 6 trials). No trial reported on the outcome of cerebral palsy[66].

Clinical Practice

The use of computerised antenatal CTG has not led to significant difference in potential perinatal mortality, caesarean section and Apgar score when compared to standard visual CTG interpretation. It is the consensus of the Guideline Development Group that due to the lack of evidence for its effectiveness in potentially preventable neonatal outcomes, computerised antenatal CTG should not be not routinely recommended until further evidence is available.

For the intrapartum period, there is insufficient evidence that Expert Systems used in conjunction with CTG reduce the likelihood of poor neonatal outcomes when compared to CTG alone.

The use of ST waveform analysis (STAN) has made no significant difference to primary outcomes, or babies with neonatal encephalopathy when compared to CTG alone and therefore is not recommended.

Intrapartum FHR monitoring (both IA and CTG) should be considered as a tool to provide information on the fetal condition and should be reviewed as part of the overall clinical picture for the woman and baby.

Recommendations

6. Due to the lack of evidence for its effectiveness in potentially preventable neonatal outcomes, computerised antenatal CTG should not be routinely recommended until further evidence is available.
7. For the intrapartum period, there is insufficient evidence to recommend the use of Expert Systems.
8. The use of ST waveform analysis (STAN) has made no significant difference to primary outcome, or babies with neonatal encephalopathy and therefore is not recommended.
9. Intrapartum FHR monitoring (both IA and CTG) should be used as a tool to provide information on the fetal condition and should be reviewed as part of the overall clinical picture.
10. All types of FHR monitoring are subject to limitations and clinicians should consider each individually when offering FHR monitoring.

Section 2: Information Sharing and Decision-Making

Clinical Question 2.3: When and in what form should information be provided to women when discussing the options of FHR monitoring?

Evidence Statement

The provision of information and the seeking consent involves a continuous process. It is good practice, where possible, to seek consent well in advance of labour so that there is sufficient time to respond to questions and provide adequate information [67]. The national standards for antenatal education recommend that information provided should be standardised, evidence-based and easily accessible in a variety of formats and languages, where possible [68]. The types of FHR monitoring should be discussed with the woman as part of her antenatal care and these discussions and decisions should be documented in the woman's healthcare record [2 67]. The discussions should be underpinned by the understanding that alternate options of FHR monitoring may be recommended in the event of the maternal/fetal condition changing [2 69]. The resource guide for the national antenatal education programme for women and their chosen birth partner recommends that options of FHR monitoring should be discussed in late pregnancy[70]. Several professional bodies provide information leaflets to inform women of the options of FHR monitoring available to them[5 18 71]. The use of information leaflets should be used to prepare women to discuss the options with their healthcare provider [72]. When information leaflets are accompanied by recommendations, there is a higher rate of patient satisfaction in terms of the explanation provided by the healthcare professional [73].

Clinical Practice

The options of intrapartum FHR monitoring should be discussed with the woman in the antenatal period. In order to provide consistent, evidence-based information on the types and appropriateness of monitoring, a nationally developed patient information leaflet should be used to guide the discussion (Appendix 6). This leaflet should be available in multiple languages. In line with the national curriculum for antenatal education, the discussion should take place ideally from 32 weeks' gestation.

Recommendations

11. Discussions on the options of FHR monitoring should occur in the antenatal period. A national standardised evidence based information leaflet should be used to guide the discussion.

Clinical Question 2.4: What information should be provided to women when discussing the options of FHR monitoring?

Evidence Statement

There is a paucity of evidence that specifically addresses what women want in terms of the information regarding FHR monitoring; however, a 2024 systematic review explored how continuous electronic fetal monitoring affects women's experiences of labour [74]. The review included 18 studies found that fetal monitoring technologies affected women's experiences both positively and negatively. Women expressed conflicting feelings of reassurance [75-87] versus fear and anxiety [75-77 80 82 82 84 86-88] when CEFM was used.

Nevertheless, women should be provided with information on the methods of FHR monitoring in a manner that is understandable to them. The discussion should be guided by the National Consent Policy[67]. Communication should occur at a time and in a manner that will maximise the woman's ability to understand the information required and communicate her choice. Risk is significant where a reasonable person in the woman's position would consider it to be significant. Therefore, all risks should be disclosed to the woman [67]. Information about risk should be presented in a balanced way, and the use of visual aids may help maximise the understanding of risk.

Pregnant women need to receive sufficient information about:

- the benefits and risks of interventions or
- of not intervening on the viability and health of the fetus[67]

The National Consent Policy (2022) informs healthcare professionals on how to manage situations where a woman declines declines to accept a recommeded intervention such as a method of FHR monitoring[67]. A detailed account of the discussions with the woman should be recorded in the HCR and should include sufficient information about the benefits and risks of interventions or of not intervening on the viability and health of the fetus[67].

Clinical Practice

The options of intrapartum FHR monitoring should be discussed with the woman in the antenatal period. In line with the national curriculum for antenatal education, the discussion should take place ideally from 32 weeks' gestation.

It is the consensus of the writing group that the discussion should include the following:

- The aim of FHR monitoring (IA and CTG)
- The limitations of FHR monitoring (IA and CTG)
- Evidence to support the recommendation for a method of FHR monitoring according to the risk profile of the pregnancy
- The rationale for escalating monitoring from IA to CTG.

This discussion and the recommended method of FHR monitoring should be documented in the HCR. When a woman opts for a method of monitoring not recommended by the healthcare professional (i.e. declining CTG monitoring in the presence of known risk factors or declining intermittent auscultation), the woman's choice and decision should be respected. In such circumstances, the discussion should

include the risks of not availing of the recommended method of FHR monitoring. The discussion should also include the alternative methods of monitoring available and the associated risks and benefits. It is unnecessary to revisit the woman's decision unless there are changes in the maternal or fetal condition. The discussion should be documented contemporaneously in the woman's HCR. In cases where this discussion occurs in the intrapartum period, consideration should be given to the timing of the discussion, i.e. when the woman is not experiencing pain, or is distressed. She should have a support person present if she wishes.

Recommendations

12. **The discussion should include the methods of FHR monitoring, benefits, reliability, limitations and evidence to support the recommendation of a method of FHR monitoring.**
13. **Shared decision-making and maternal choice should inform the method used. It is not necessary to revisit the woman's decision unless there are changes in the maternal or fetal condition**

Section 3: FHR Monitoring in the Antenatal Period

Clinical Question 2.5: What are the clinical indications for antenatal FHR monitoring?

Evidence Statement

Antenatal FHR monitoring is used in the assessment of fetal wellbeing in an effort to identify fetuses who might have – or be at risk of developing – hypoxia, with the ultimate aim of reducing adverse neonatal outcomes through the use of appropriate intervention [4 12]. As noted previously, there is a lack of evidence to support the use of CTG as part of routine fetal assessment in low-risk pregnancies, nevertheless several national guidelines have made recommendations regarding antenatal CTG monitoring and specific maternal/fetal conditions including those concerning induction of labour [89], reduced fetal movements [90], fetal growth restriction [91], hypertension in pregnancy [92], preterm prelabour rupture of membranes [93].

A Cochrane Systematic review assessed the effectiveness of antenatal CTG in improving maternal and fetal outcomes [12]. Comparison of standard or computerised CTG versus no CTG demonstrated no significant difference in perinatal mortality (risk ratio (RR) 2.05, 95% confidence interval (CI) 0.95 to 4.42, 2.3% versus 1.1%, four studies, N = 1627, low quality evidence) or potentially preventable perinatal mortality – defined as perinatal mortality excluding lethal congenital anomalies (RR 2.46, 95% CI 0.96 to 6.30, four studies, N = 1627). Similarly, there was no significant difference identified in caesarean section rates (RR 1.06, 95% CI 0.88 to 1.28, 19.7%). Despite the lack of high quality evidence demonstrating that antenatal CTG monitoring decreases the risk of fetal death[94 95], it is widely integrated into clinical practice [12 71].

Clinical Practice

As discussed in CQ 2.1, women attending routine antenatal care should be offered auscultation of the FHR from 23+0 weeks' gestation.

Due to the lack of evidence for the efficacy of antenatal fetal surveillance and evidence-based recommendations, it is the consensus of the Guideline Development Group that the following women with at-risk pregnancies should be offered an increased level of fetal surveillance in the form of antenatal CTG monitoring as part of their individualised care pathway:

- Any medical condition which constitutes a significant risk of fetal compromise (i.e. hypertension/ pre-eclampsia, abdominal trauma, antepartum haemorrhage)
- Women reporting reduced fetal movements
- Pre-term prelabour rupture of membranes
- Threatened preterm labour
- External cephalic version
- Abnormal umbilical artery Doppler
- Fetal growth restriction/small for gestational age
- Induction of labour

- Post-term pregnancy from 42+0 weeks
- Known fetal anomaly which requires monitoring
- Multiple pregnancy

This list is not exhaustive and should not replace clinical judgement. Individual factors should be taken into consideration when deciding to initiate antenatal FHR monitoring. The decision should be made in partnership with the woman following a discussion regarding the risks, benefits, and efficacy of antenatal CTG monitoring.

Recommendations

14. Women with maternal or fetal risk factors should be offered antenatal CTG monitoring as part of their individualised pathway of care.

Clinical Question 2.6: When should FHR monitoring be performed in the antenatal period?

Evidence Statement

The decision to commence CTG monitoring at a particular gestation depends on a number of considerations. Considerations include the prognosis for neonatal survival, the risk of fetal death, the severity of the maternal condition and the potential for iatrogenic prematurity complications arising from false-positive test results[71]. When offering antenatal FHR monitoring to women with pregnancies at high-risk of stillbirth or with multiple comorbidities that increase the risk of stillbirth, the woman's wishes are critical in the decision-making process[71].

Gestational Age Considerations – Fetal Physiology

The integrity of the autonomic nervous system, which regulates the FHR, is a prerequisite for a healthy fetus. Fetal hypoxia is believed to result in specific pathophysiological adaptation in the fetus, which in turn may cause changes in the FHR parameters; therefore, accepted 'normal' limits for FHR parameters are used when interpreting antenatal CTGs [12]. Where a fetus is not acidotic or neurologically depressed, its heart rate will temporarily accelerate with fetal movement. Therefore, FHR reactivity is believed to be a good indicator of normal fetal autonomic function. The loss of reactivity is commonly associated with a fetal sleep-wake cycle but may also result from any cause of central nervous system depression, including fetal acidaemia[96]. The normal FHR varies with vagal and sympathetic tone adjustments and therefore, varies with gestational age due to maturation of the fetal nervous system.

There is a lack of international guidance or evidence regarding the gestational age at which antenatal CTG monitoring should be performed. Professional bodies such as NICE, FIGO and RANZCOG have not developed specific clinical guidance for antenatal CTG monitoring. Other guidelines, such as the SOGC clinical practice guideline No. 441: antenatal fetal health surveillance, suggest that antenatal CTG monitoring may be considered before 32 weeks' gestation for the most at-risk fetuses, such as early onset of fetal growth restriction, and when delivery may be offered for fetal indications [97].

CTG monitoring is recommended from 28+0 weeks' gestation, as the fetal organs are relatively mature [98]. Antenatal CTG monitoring undertaken prior to 28+0 weeks' gestation should be cautiously interpreted due to the immature autonomic nervous system of the fetus [60]. A physiologically higher baseline can be expected, with a lower frequency and amplitude of accelerations, reduced variability and sporadic decelerations [60 98]. The antenatal CTG should be conducted for at least 20 minutes but it may be necessary to extend the monitoring for 40 minutes or longer to take into account the variations of the sleep-wake cycle [71]. Fetal sleep cycle is associated with reduced baseline variability along with the absence of fetal movements.

Paper Speed

The horizontal scale for CTG registration and viewing is commonly referred to as "paper speed", and available options are usually 1, 2 or 3 cm/min. Ireland and the United Kingdom typically use 1 cm/min, while in the Netherlands it is usually 2 cm/min, and in North America and Japan it is almost exclusively 3 cm/min[1]. FIGO suggests that the inadvertent use of different paper speeds may lead to erroneous interpretations of CTG features. Therefore, the paper speed selected should be familiar to all users [1 99].

Clinical Practice

Antenatal FHR Monitoring

Women who present with a pregnancy-related concern and who are over 23+0 weeks' gestation should be offered auscultation of the fetal heart to exclude fetal demise.

Antenatal CTG monitoring of the preterm fetus

There is a lack of evidence to inform best practice with regard to the gestational age at which CTGs should be performed. Antenatal CTGs should be compared with previous traces (if available). Abnormal features may include a change in baseline rate, variability and/or the presence of decelerations.

For a fetus ≥26+0 – 27+6 weeks' gestation: Auscultation of the fetal heart should be the first line of FHR monitoring[98]. CTG monitoring should only be considered when there are risks of fetal hypoxia present. The decision for CTG monitoring should be made on a case-by-case basis by a senior obstetrician, following a discussion with the woman. CTG should be performed and interpreted with caution, taking the clinical picture into account.

For a fetus ≥ 28+0 weeks' gestation: a CTG should be performed as part of any assessment where there is reason to be concerned about the fetal well-being.

Frequency of antenatal CTG monitoring

There is a lack of evidence to recommend the frequency of antenatal CTG monitoring. Women identified as requiring antenatal CTG monitoring should have an individual plan of care indicating the required frequency of antenatal CTG monitoring. This plan should be made by a senior obstetrician following a comprehensive risk assessment and documented in the HCR. Ideally, the frequency of CTG monitoring should not exceed two over a 24-hour period.

Prior to commencement of an antenatal CTG

Women should be provided with a full explanation as to the rationale for monitoring and should be documented in the HCR. The CTG should be performed as outlined in Appendix 5.1.2 Antenatal CTG monitoring. Document the following on the CTG and in the HCR/MN-CMS/FetaLink:

- The woman's name and hospital number
- The indication for commencing the CTG including gestation and risk factors
- The date and time the CTG was commenced (ensure the date and time on the monitor is synchronised with any other clocks in the room)
- Maternal pulse.

Quality trace

Ensure adequate quality of FHR and uterine activity recordings with necessary adjustments if required. Change the machine and/or transducers if there are any artefacts.

Care provided

The midwife should remain with the woman to observe the CTG at the beginning of the monitoring period and intermittently throughout the trace to exclude concerning features requiring immediate intervention. If appropriate to leave, the midwife should ensure that the woman has access to a call bell and understands how to use it to summon help if required. Prompt action should be taken if there are any changes in the maternal or fetal condition.

Recommendations

15. **Women identified as requiring antenatal FHR monitoring should have an individualised plan of care regarding the frequency and type of monitoring (IA/CTG).**
16. **Women presenting between 23+0 and 25+6 weeks' gestation with a pregnancy-related concern should be offered auscultation of the fetal heart to confirm fetal life.**
17. **Women presenting between 26+0 to 27+6 weeks' gestation with a pregnancy-related concern should be offered auscultation of the fetal heart as the first line of FHR monitoring to confirm fetal life. CTG monitoring should only be considered when there are risks of fetal hypoxia present. The decision for CTG monitoring should be made on a case-by-case basis by a senior obstetrician, following a discussion with the woman. CTG should be performed and interpreted with caution, taking the clinical picture into account. A decision to expedite birth should not be made solely on the findings of an antenatal CTG.**
18. **Women presenting from 28+0 weeks' gestation with a pregnancy related concern and who have risks factors that may affect fetal well-being, should be offered CTG monitoring from 28+0 weeks' gestation as part of their individualised plan of care.**

Clinical Question 2.7: How should an antenatal CTG be analysed and classified?

Evidence Statement

Professional bodies such as NICE and FIGO recommend that a systematic assessment of the CTG features (baseline, variability, accelerations and decelerations) should be taken when analysing a CTG [1 2]. Both professional bodies agree that the following parameters outlined in Figure 1: should be considered as normal [1 2].

Figure 1: Antenatal CTG parameters

CTG features	Normal parameters	Description
Baseline rate	110-160 bpm	Determine baseline FHR by looking at the mean FHR, excluding accelerations and decelerations, over a period of 10 minutes when the FHR is stable
Baseline variability	5-25 bpm	Refers to the minor oscillations in the FHR, which usually occur at 3 to 5 cycles a minute. It can be calculated by estimating the difference in beats per minute between the highest heart rate and the lowest heart rate in a 1-minute segment of the trace between contractions, excluding decelerations and accelerations
Accelerations	Presence of accelerations	Transient increases in FHR of 15 bpm or more, lasting 15 seconds
Decelerations	No decelerations	Transient episodes when the FHR slows to below the baseline level by more than 15 bpm, with each episode lasting 15 seconds or more

Clinical Practice

It is the consensus of the GDG that a systematic assessment of the CTG should be performed and documented whenever the CTG is reviewed. The use of a standardised antenatal CTG pro forma for classification can aid systematic analysis (Appendix 7). The CTG should be classified and documented as either ***normal*** or ***abnormal.*** All relevant events which may affect the FHR (i.e. vaginal examinations, changes in maternal position, fetal movements etc.) should be annotated on the CTG trace.

The CTG classification should be completed and documented:

- On completion of a normal CTG, after no less than 20 minutes and once all reassuring features are noted
- When the CTG is identified as abnormal
- Every 20 minutes where an antenatal CTG has been continued longer than the initial 20-minute period.

Where an antenatal CTG is assessed as abnormal following systematic review, prompt escalation to the obstetric team and senior midwife is required. A plan of care should be documented in the HCR. The documentation should include:

- A description of abnormal CTG features,
- An overall assessment of the full clinical picture and risk assessment,
- A clear plan for ongoing care including whether the CTG should remain continuous or alternatively, when it should be repeated

If continuous CTG monitoring is required in the antenatal period, transfer to a clinical area with one-to-one midwifery care is advisable.

Recommendations

19. **A systematic assessment of the antenatal CTG should be performed and documented whenever the CTG is reviewed. The use of a standardised antenatal CTG pro forma for classification can aid systematic analysis. The CTG should be classified and documented as either normal or abnormal. A sample antenatal CTG proforma can be found in Appendix 7.**
20. **Where an antenatal CTG is assessed as abnormal following a systematic review, prompt escalation to the obstetric team and senior midwife is required. A plan of care should be documented in the woman's healthcare record.**

Section 4: Intrapartum Risk Assessment

Clinical Question 2.8: How is the initial risk assessment used to determine the appropriate method of FHR monitoring in labour?

Evidence Statement

Labour is a continuous process and the monitoring of both maternal and fetal wellbeing, with associated ongoing risk assessment, is an essential component of management and care planning [100]. A full clinical assessment should be undertaken when a pregnant woman presents in early or established labour to determine whether IA or CTG is offered as the initial method of FHR monitoring [2 61 100]. This should include a review of any risk factors and consideration of whether any complicating factors have arisen which might change recommendations about place of birth [61].

At the initial assessment, confirm with the woman which method of FHR monitoring is recommended as part of their personalised care plan[2]. The Saving Babies Lives care bundle for reducing perinatal mortality recommends the use of a risk assessment tool on admission and then throughout labour, to guide the nature, frequency and interpretation of FHR monitoring [100]. The risk assessment should be explained to the woman, and women should be advised that the recommended method of FHR monitoring may change over the course of the labour [2].

Several national guidelines including induction of labour [89], vaginal birth after caesarean[91], fetal growth restriction [101] and management of breech presentation[102] have made specific recommendations in relation to intrapartum CTG monitoring. Intrapartum FHR monitoring of the preterm fetus (24+0 – 28+0 weeks' gestation) is challenging as there is a lack of reference standards for CTG interpretation in the preterm fetus [103]. NICE, FIGO, and the ACOG do not describe patterns of normality and CTG interpretation in fetuses less than 37 weeks' gestation [1 2 51]. However, other professional bodies, including RANZCOG and the SOGC, recommend intrapartum CTG monitoring for pregnancies less than 37+0 weeks due to the increased incidence of adverse perinatal outcomes [5 6]. Neonatal outcomes at this gestation depend on maturity at birth and birth weight, rather than the mode of delivery [104]. The ACOG Practice Bulletin No. 16 suggests that the decision to monitor the preterm fetus before 28+0 weeks' gestation should be made following a discussion between the obstetrician, paediatrician and the woman concerning the likelihood of survival or severe morbidity of the preterm infant (based on gestational age, estimated fetal weight, and other factors) and issues related to the mode of delivery [51].

Clinical Practice

The consensus of the guideline development group is that intrapartum CTG monitoring is recommended for women with the following maternal/fetal risk factors (Table 1). Continuous CTG monitoring should be considered if, based on clinical assessment and obstetric review, there are concerns about other antenatal factors not listed below that may lead to fetal compromise (refer to Figure 2: initial risk assessment, which is placed at the front of the document for reference). This list is not exhaustive.

Table 1: Antenatal Risk Factors

Maternal Risk Factors
• Any hypertensive disorders of pregnancy requiring medication • Prolonged rupture of membranes greater than 24 hours • Any vaginal blood loss other than a show • Suspected chorioamnionitis or maternal sepsis • Pre-existing diabetes (type 1 or type 2) and gestational diabetes • Previous caesarean section or other full-thickness uterine scar • No antenatal care/poor attendance with scheduled antenatal appointments (more than 2 'Did not attend' (DNA)
Fetal Risk Factors
• Non-cephalic presentation including breech, transverse, oblique and cord, including while a decision is made about mode of birth • Fetal growth restriction (EFW below 3rd centile) • Small for gestational age (EFW below 10th centile) • Abnormal Doppler scan results, reduced liquor volume or reduced growth velocity • Advanced gestational age (more than 42+0 weeks at the onset of established labour) • Anhydramnios, oligohydramnios or polyhydramnios as confirmed by a departmental scan • Two or more episodes of reduced fetal movements • Preterm labour – following a clinical assessment of the woman's condition, the decision to commence continuous intrapartum CTG monitoring should be made following a discussion between the woman, senior obstetrician and senior paediatrician/neonatologist. This discussion should include the likelihood of survival or severe morbidity of the preterm infant.

Recommendations

21. **An initial risk assessment should be undertaken when a pregnant woman presents in early or established labour to determine the most appropriate form of FHR monitoring (IA or CTG).**
22. **The decision to commence continuous intrapartum CTG monitoring in preterm labours less than 28+0 weeks' gestation should be made following a clinical assessment of the woman's condition, and a discussion between the woman, senior obstetrician and senior paediatrician/neonatologist. This discussion should include the likelihood of survival or severe morbidity of the preterm infant.**

Clinical Question 2.9: What is the ongoing intrapartum risk assessment?

Evidence Statement

Ongoing Risk Assessment

The MBRRACE-UK Perinatal Confidential Enquiry (2017) focused on term, singleton, intrapartum stillbirth and intrapartum-related neonatal death, found that the use of FHR monitoring in the form of IA or CTG cannot be used in isolation and are only part of a complex assessment of fetal wellbeing [100]. The *'failure to recognise an evolving problem, or the transition from normal to abnormal, was a common theme. It was rarely due to a single issue, more commonly appearing to arise from a more complex failure of situational awareness and ability to maintain an objective overview of a changing situation'* page viii [100]. It is recommended that a standardised risk assessment tool be developed nationally [61]. In the UK, the Healthcare Improvement Studies Institute is collaborating with the RCOG, Royal College of Midwives to develop a national programme to roll out tools and training to monitor and respond to a baby's wellbeing during labour [105]. As part of the tools, a standardised risk assessment tool has being developed and is currently in the pilot phase of the project [105].

A recent observational prospective study investigated the hypothesis that risk factors in addition to an abnormal FHR pattern are independently associated with adverse neonatal outcomes of labour [106]. The study sought to investigate the hypothesis that risk factors in addition to an abnormal FHR pattern are independently associated with a 5-minute Apgar score <7, and a composite adverse neonatal outcome of labour, defined as 5-minute Apgar score <7, resuscitation by intubation and/or perinatal death. Analysis was based on 302 137 vaginal births at 37-42 weeks inclusive. It was found that suspected FGR, induction of labour and nulliparity were all independently associated with a 34-50% higher risk of the 5-minute Apgar<7 ($P \leq 0.001$ after adjustment for other risk factors). Pyrexia during labour was associated with an 87% higher risk (OR 1.87, 95% CI 1.46-2.40) and use of oxytocin was associated with a 27% increased risk (OR 1.27, 95% CI 1.14-1.41) of a 5-minute Apgar score<7. Vaginal births with both meconium and abnormal FHR pattern had a four-fold higher risk (OR 4.26, 95% CI 3.74-4.87) compared with vaginal births with neither meconium nor abnormal FHR pattern [106]. The study concluded that monitoring the FHR in isolation is insufficient to assess fetal wellbeing during labour. To optimise detection of deterioration, escalation, decision-making and action, the FHR must be interpreted in the context of multiple risk factors, including the presence of meconium, maternal pyrexia and suspected FGR, as well as important demographic and contextual risk factors [106].

In the United Kingdom, the Each Baby Counts report identified fetal monitoring as a critical contributory factor where improvement in care may have prevented the outcome [107]. In response to these findings, NHS England: Saving Babies Lives version 3 recommends a number of interventions for effective intrapartum fetal monitoring [61]. The use of a buddy system/fresh eyes whereby a discussion between the midwife caring for the woman and another midwife or doctor occurs at regular intervals throughout labour. The discussion should include the FHR (IA or CTG), review of antenatal and intrapartum risk factors and should lead to escalation if indicated [61]. Conversely, NHS England: Saving Babies Lives acknowledges that there is no evidence to inform the optimal frequency of a buddy system or its effectiveness. It is suggested that performing fresh eyes hourly for CTG monitoring and four hourly for IA may be beneficial. However, the frequency of fresh eyes should be decided with local commissioners of maternity services [61].

The Saving Babies Lives care bundle also recommend that a systematic clinical review of maternal and fetal wellbeing should be conducted at regular intervals throughout labour and documented in a structured proforma[61] and is reflected in the recent NICE guidance on fetal monitoring in labour [2]. It is recommended that a full assessment of the woman and her fetus is carried out every hour. This assessment includes the following[2]:

- maternal antenatal risk factors for fetal compromise
- fetal antenatal risk factors for fetal compromise
- new or developing intrapartum risk factors
- progress in labour including characteristics of contractions (frequency, strength and duration)
- FHR monitoring, including changes to the FHR pattern.

International professional bodies have broadly identified intrapartum risk factors, including the frequency of contractions[1 2 5], prolonged rupture of membranes [2], maternal pyrexia [2 5], vaginal bleeding [2 5 6], intrauterine infection [2 6], liquor – meconium [1 2 5 6], blood stained[5], absent liquor following amniotomy[5] and change in maternal observations [2]. There is some ambiguity regarding regional analgesia and the use of continuous CTG monitoring, in terms of the timing (CTG during siting of epidural versus after siting) with no delineation between epidural and combined spinal-epidural [1 2 5]. The SOCG Fetal Health Surveillance – Intrapartum Consensus Guideline recommends that the use of IA is appropriate with initiation and continued use of epidural anaesthesia provided that there are no maternal or fetal risk factors for adverse perinatal outcomes and/or obstetrical consideration, BMI is <35kg/m^2, frequency of IA is increased after initial dose and subsequent epidural boluses, maternal vital signs remain stable post-epidural and patient controlled epidural anaesthesia is used [6].

Clinical Practice

A systematic assessment of the maternal and fetal condition should be carried out every hour or more frequently if there are FHR concerns and documented contemporaneously. Each assessment should include:

- maternal and fetal antenatal risk factors for fetal compromise
- new or developing intrapartum risk factors
- how labour is progressing, including frequency, strength and duration of contractions
- FHR monitoring (IA/CTG), including changes to the FHR pattern.

The use of a buddy system or ‘fresh eyes’ may be used in CTG interpretation however, there is insufficient evidence to support its required use.

Continuous CTG monitoring should be offered for women who have or develop any of the new intrapartum risk factors listed in Table 2. (See Figure 3 at front of document).

Table 2: Intrapartum Risk Factors

Intrapartum Risk Factors
• Contraction lasting more than 2 minutes (hypertonus)
• 5 or more contractions in 10 minutes for at least 20 minutes
• Meconium-stained liquor (any grade)
• Fresh vaginal bleeding that develops in labour
• Blood-stained liquor not associated with VE
• Use of oxytocin
• Maternal pyrexia (≥38°C on a single reading or 37.5°C or above on 2 consecutive occasions 1 hour apart)
• Suspected chorioamnionitis or sepsis
• Pain reported by the woman that appears to differ from the pain normally associated with contractions
• Maternal pulse over 120 bpm on 2 occasions, 30 minutes apart
• Severe hypertension (a single reading of either systolic of 160 mmHg or more or diastolic of 110 mmHg or more)
• Hypertension (either systolic of ≥140 mmHg or diastolic blood pressure of ≥90 mmHg on 2 consecutive readings taken 30 minutes apart)
• A reading of 2+ of protein on urinalysis and a single reading of either raised systolic blood pressure (≥140 mmHg) or raised diastolic blood pressure (≥90 mmHg)
• Confirmed delay in the first or second stage of labour
• Regional analgesia: In cases where antenatal or intrapartum maternal or fetal risk factors are present, continuous CTG, monitoring is recommended during epidural placement and for the duration of labour. In the absence of antenatal or intrapartum maternal or fetal risk factors, CTG monitoring should be commenced once the epidural is sited.
• Consider continuous CTG monitoring if, based on clinical assessment and obstetric and midwifery review, there are concerns about other intrapartum factors not listed above that may lead to fetal compromise.

Recommendations

23. **A systematic assessment of the maternal and fetal condition should be undertaken every hour or more frequently if there are FHR concerns and documented in the healthcare record. The presence of new intrapartum risk factors should warrant an obstetric and midwifery team review. Continuous CTG monitoring should be recommended if not already in progress.**
24. **The use of a buddy system/fresh eyes may be used as part of a regular systematic review which includes FHR monitoring (IA or CTG), and a review of antenatal and intrapartum risk factors.**

Clinical Question 2.10: Should an admission CTG be offered to women without risk factors for intrapartum hypoxia?

Evidence Statement

An admission CTG (aCTG) consists of a short, usually 20 minute recording of the FHR and uterine activity on admission to the labour ward with signs of labour [94 108]. It is thought that the use an aCTG identifies those fetuses of low-risk women at greatest risk of intrapartum fetal hypoxia who may benefit from continuous intrapartum CTG monitoring [108 109]. A 2017 Cochrane Systematic review compared the effects of aCTG with IA on maternal and neonatal outcomes for pregnant women without risk factors for intrapartum hypoxia [94]. Four RCTs (13,296 women) were included in the review [108 110-112].

The review found that the difference in the average treatment effect across included trials between the aCTG group and the IA group in caesarean section has a risk ratio (RR) of 1.20 and a 95% confidence interval (CI) of 1.00 to 1.44, four trials, 11,338 women (moderate quality evidence). There was no significant difference between the aCTG group and the IA group in terms of instrumental vaginal birth (RR 1.10, 95% CI 0.95 to 1.27, 4 trials, 11,338 women) (low quality evidence) and fetal and neonatal deaths (RR 1.01, 95% CI 0.30 to 3.47, 4 trials, 11,339 infants) (moderate quality evidence). Women allocated to aCTG had, on average, significantly higher rates of continuous EFM during labour (RR 1.30, 95% CI 1.14 to 1.48, 3 trials, 10,753 women) and fetal blood sampling (RR 1.28, 95% CI 1.13 to 1.45, 3 trials, 10,757 women) than women allocated to IA. There was no significant difference between the groups in hypoxic ischaemic encephalopathy (HIE) (RR 1.19, 95% CI 0.37 to 3.90, 1 trial, 2367 infants) (very low quality) and neonatal seizures (RR 0.72, 95% CI 0.32 to 1.61, 1 trial, 8056 infants) (low quality). The review found no evidence of benefit for the use of the aCTG for low-risk women in admission to the labour ward. It concluded that the probability of an aCTG increases the caesarean section rate by approximately 20%. The data was underpowered to detect possible differences in perinatal mortality [94].

A subsequent 2018 RCT assessed the effect of aCTG versus IA in low-risk pregnancy during assessment for possible labour on caesarean section rates [113]. Some 3034 women were randomised to receive IA or an aCTG on admission for possible onset of labour. The study found no statistical difference between the groups in caesarean section or in any other outcome other than the use of continuous CTG during labour, which was lower in the IA group.

Professional bodies, including NICE, FIGO, and SOGC, do not recommend admission CTG for women at low risk of complications [1 2 6]. The NICE (2022) guidance on intrapartum fetal monitoring recommends using an individualised risk assessment at the onset of labour to determine the most appropriate form of FHR monitoring [2].

Clinical Practice

When a pregnant woman presents in early or established labour, an initial assessment of maternal and fetal risk factors should be undertaken to determine the most appropriate form of FHR monitoring (IA or CTG). In the absence of antenatal maternal or fetal risk factors, an admission CTG is not recommended.

Recommendations

25. **In the absence of any maternal or fetal risk factors, an admission CTG is not recommended.**

Section 5: Intrapartum Fetal Heart Rate Monitoring

Clinical Question 2.11: How can fetal health be confirmed using intermittent auscultation in labour?

Evidence Statement

Quiet and active periods of FHR cycling are evidence of an intact central nervous system. The presence of accelerations suggests the integrity of the somatic nervous system, indicating a healthy fetus that not only has sufficient reserves to supply the central organs but also has enough glucose and oxygen to use on non-essential somatic activity. Accelerations may be associated with fetal movement, either stimulated or spontaneous [46] and is a hallmark of a healthy non-hypoxic fetus [3]. Auscultation of the fetal heart during a period of fetal movements should note the presence of an acceleration is indicative of a non-hypoxic fetus [46]. With the exclusion of sentinel events (i.e. cord prolapse, placenta abruption, uterine rupture), for the fetus to become hypoxic, it will show signs of decelerations and then a gradually rising baseline, which can be identified by following the principles of IA. FHR changes due to other causes may also be detected, such as an evolving fetal tachycardia [46].

Baseline FHR, the presence of accelerations and decelerations can be correctly identified using IA [46]. The baseline FHR should be determined by auscultating the fetal heart and counting the number of beats over a period of one minute [46]. NICE (2022) guideline on fetal monitoring in labour recommends that the fetal heart should be auscultated immediately after a palpated contraction for at least one minute to exclude decelerations and be documented as a single rate[2]. Although variability or the type of deceleration cannot be identified using IA, auscultating the fetal heart immediately after a contraction will identify decelerations that warrant further investigation[46]. This would be observed on the CTG as late decelerations or decelerations that are slow to recover. Decelerations that occur exclusively during contractions are not usually associated with poor neonatal outcomes; the parameters necessary to highlight the fetus requiring further assessment can be identified[46]. Professional bodies, including NICE, FIGO, RANZCOG, and SOGC, suggest that the normal parameters for a baseline FHR are 110-160 bpm [1 2 5 6].

Clinical Practice

Initial Assessment: In addition to the initial risk assessment outlined previously in CQ 2.8, the initial assessment of the FH using IA should be undertaken as outlined in Appendix 5.2.1 – Initial intrapartum assessment using IA.

Recommendations

26. **Confirming fetal health by IA should be undertaken using a structured approach. The assessment should include abdominal palpation and auscultation of the fetal heart using a Pinard or Doppler during a period of fetal movement to exclude fetal hypoxia. The maternal heart rate should be palpated on each occasion to differentiate between the two heart rates.**
27. **The baseline FHR should be determined by auscultating the fetal heart for at least one minute between contractions and count the rate. The baseline FHR should range between 110-160 bpm. A single figure should be documented in the healthcare record.**

Clinical Question 2.12: What is the recommended practice for performing IA in established labour?

Evidence Statement

There is international consensus by professional bodies and organisations including FIGO, NICE, RANZCOG, SOGC, and the Health Service Executive (HSE) that IA is an appropriate method of intrapartum FHR monitoring for low risk women[1 2 5 6 18], however there is no evidence regarding the ideal device, optimal timing, frequency and duration for IA practice[24].

A systematic scoping review was undertaken by Blix *et al.* (2019) to identify methods, effects and accuracy of intrapartum IA[24]. The review included eleven guidelines[7 48 114-122] and found that not all studies provided detailed descriptions of the techniques used for IA. It found that despite the recommendation of IA for low-risk women, there are variances regarding the frequency, timing, and duration for IA and absence of any trials that assessed the optimal timing or duration for auscultation on neonatal and maternal outcomes[24]. Notably, of the eleven guidelines included in the scoping review, only two guidelines[115 122] were deemed to be "good" in terms of the overall quality assessment[24].

Frequency, timing and duration of auscultation:

During the first stage of labour, the majority of guidelines recommend an auscultation frequency of every 15-30 minutes [115-121 123]. Two guidelines recommend a frequency of 15 minutes[114 122] while one made no specific recommendation regarding the frequency of auscultation [7].

In the second stage of labour, one guideline recommended a frequency of every 5-15 minutes [121], two offered no recommendation[7 122] and the remaining eight guidelines recommended auscultation every 5 minutes or after each contraction [114-120 123] and one recommends auscultation every 15 minutes during passive fetal descent and every 5-15 minutes during active pushing [121].

The systematic review found that specific recommendations were made in relation to the timing of auscultation[24]. Six guidelines recommend that auscultation should be performed during and after a contraction [114-118 123], two immediately after a contraction[119 122], and one between contractions [120]. Two guidelines lack a description of the timing of auscultation[7 121]. One guideline recommends auscultation of the fetal heart between contractions to assess the FHR baseline [123]. Three guidelines recommend auscultating over three contractions if the FHR is not always in the normal range [115 118 122].

There is also a variance regarding the duration of auscultation[24]. Among the guidelines recommending auscultation for at least 60 seconds [114-117 119 120 122], one recommends 15-60 seconds [123]. Two other guidelines do not describe the duration of auscultation [7 121]. A number of guidelines recommend documentation of the FHR as a single count (in bpm)[114 115 122].

Recommended observations during auscultation: A number of guidelines reviewed recommend observation of the frequency or pattern of contractions [114 118-120 123] and fetal movements [114 122]. Four recommend recording of the maternal pulse to differentiate it from the FHR [114 119 120 122.]

Definitions of normal and abnormal FHR: there was a lack of detailed description of normal auscultation findings, with the exception of the FHR baseline rate [24]. Danish and Norwegian guidelines define the normal FHR baseline rate as between 110-150 bpm [117 118]. All other guidelines define the normal baseline rate as between 110-160 bpm [114-116 119 120 122 123].

Similarly, there was a lack of detailed descriptions of abnormal FHR features [7 115-119]. Other guidelines provide a various descriptions of abnormal FHR such as the presence of repetitive or prolonged (>3 minute) decelerations [114], rising baseline rate or decelerations [122]; tachycardia (FHR > 160 bpm for >10 minutes), bradycardia (FHR< 110 bpm for >10 minutes)[120]; irregular rhythm and presence of FHR decreases or decelerations from the baseline, tachycardia or bradycardia [123].

One guideline provides a systematic classification of normal and abnormal auscultation findings[123]. Its normal findings include a baseline rate of 110-160 bpm, regular rhythm, and the absence of FHR decreases or decelerations from the baseline. Abnormal findings include any of the following: irregular rhythm, presence of FHR decreases or decelerations from the baseline, tachycardia (>160 bpm for >10 min), or bradycardia (10 min)[123].

Since the systematic review[24], NICE updated its guidance on fetal monitoring in labour [2]. It is recommended that IA be carried out immediately after a palpated contraction for at least one minute, repeated at least once every 15 minutes in the first stage of labour, recording it as a single rate on the partogram and in the woman's HCR. Accelerations and decelerations should be recorded (if heard)[2]. The auscultation of an acceleration immediately after a palpated contraction should warrant further investigation as accelerations after a contraction are physiologically unlikely, particularly as labour progresses, and are possibly more likely to be an 'overshoot' following a deceleration[46]. Other observations include the palpation and recording of the maternal pulse hourly, or more frequently if there are any concerns, to ensure differentiation between the maternal and fetal heartbeats[2]. In the event of the fetal heartbeat not being detected, urgent real-time ultrasound assessment to check fetal viability should be offered. In the second stage of labour (either signs of, or where a woman is in confirmed second stage of labour), IA should be performed immediately after a palpated contraction for at least one minute, repeated at least once every five minutes and record it as a single rate on the partogram and in the woman's HCR. The maternal pulse should be simultaneously palpated to differentiate between the maternal and FHRs. If there are any concerns about differentiating between the two heart rates, help should be sought and consider changing the method of FHR monitoring[2]. Notably, recommendations related to IA remain unchanged in the most recent RANZCOG Intrapartum Fetal Surveillance Guideline[5].

Documentation

Blix *et al.* (2019) found that most guidelines recommended documenting the FHR as a single counted number in beats per minute and the presence or absence of accelerations and decelerations [5 26 117 120 124 125].

Clinical Practice

In the first stage of labour, refer to Appendix 5.2.2 Intrapartum Intermittent Auscultation. Perform IA at least once every fifteen minutes. In the event of no fetal heartbeat detected, offer urgent real-time ultrasound assessment to check fetal viability and seek an obstetric review.

In the second stage: refer to Appendix 5.2.2 Intrapartum Intermittent Auscultation. Caution should be exercised when women transition between the first and second stage of labour in terms of ensuring adequate FHR monitoring and ongoing risk assessment; therefore once the woman has signs of, or is confirmed to be in the second stage of labour:

Perform IA immediately after a palpated contraction for at least one minute, repeat at least every five minutes or after every contraction (whichever comes first).

Palpate the woman's pulse simultaneously to differentiate between the maternal and FHRs. If there are concerns about differentiating between the maternal and FHRs, escalate your concerns and recommend changing the method of FHR monitoring.

Recommendations

28. When performing IA, the maternal pulse should be palpated simultaneously to ensure differentiation between the maternal and fetal heartbeats.
29. When auscultating the fetal heart, the presence of accelerations and/or decelerations should be recorded in the healthcare record.
30. In the event of no fetal heartbeat being detected, urgent real-time ultrasound assessment should be offered to check fetal viability and an obstetric review should be sought.
31. In the first stage of labour, IA should be carried out immediately after a palpated contraction for at least one minute, and repeated at least once every 15 minutes.
32. Once the woman shows signs of the second stage of labour or is confirmed to be in the second stage of labour, IA should be undertaken immediately after a palpated contraction for at least one minute, and repeated every 5 minutes or after every contraction – whichever comes first.
33. If there are concerns about differentiating between the maternal heart rate and FHR, changing the method of FHR monitoring is recommended.
34. The fetal heart should be recorded as a single rate on the partogram and/or in the woman's healthcare record.

Clinical Question 2.13: When should IA convert to CTG monitoring in labour?

Evidence Statement

The NICE (2022) guideline on fetal monitoring in labour recommends that the presence of any risk factors for fetal hypoxia must prompt immediate action[2]. Women should be advised to have continuous CTG monitoring if FHR concerns arise with IA and are ongoing or if intrapartum maternal or fetal risk factors develop[2]. Abnormal findings on intermittent auscultation are noted to be a baseline below 110bpm or above 160bpm or an increase of 20 beats a minute or more from the start of labour, or a deceleration is heard[2].

A rise in baseline FHR is often a compensated response of the fetus to hypoxic stress[124] and warrants a thorough assessment of possible causes[46]. It is recommended that when using IA, if there is an increase in the FHR as plotted on the partogram of 20 beats a minute or more from the beginning of labour, or if the deceleration is heard, intermittent auscultation should be undertaken more frequently (i.e. after three consecutive contractions)[2].

An interval between two contractions of less than two minutes should lead to the evaluation of uterine contractions over a 10-minute period. Five or more contractions detected over a 10 minute period is considered as tachysystole and warrants continuous CTG monitoring[2].

A full clinical review should be undertaken taking into account any antenatal and existing or new intrapartum risk factors (such as tachysystole, development of meconium, sepsis), and included maternal observations, progress of labour including frequency, strength and duration of contractions [2 125]. If FHR concerns are confirmed, summon help and recommend continuous CTG monitoring [2].

If CTG monitoring was commenced due to concerns arising from IA but the CTG is classified as normal after a period of 20 minutes, and there are no new or existing antenatal or intrapartum maternal or fetal risk factors, IA can be recommenced [2 114].

Clinical Practice

Ongoing risk assessment is a key component of intrapartum FHR monitoring and should be used in conjunction with IA (refer to CQs 2.8 and 2.9). In the event of any new or developing intrapartum risk factors, the transition from IA to CTG monitoring should be recommended. If the CTG monitoring is normal after 20 minutes and in the absence of any intrapartum maternal or fetal risk factors, the woman should be offered IA.

If FHR concerns are suspected during intermittent auscultation, the FHR should be auscultated more frequently (i.e., after 3 consecutive contractions). If FHR concerns are confirmed, escalate care and recommend continuous CTG monitoring.

If, during IA, there is an increase in the FHR of 20 bpm or more from the beginning of labour or if a deceleration is heard, escalate care and recommend continuous CTG monitoring.

In the event of experiencing difficulty in auscultating the FHR for at least one minute following a palpated contraction (for example, due to maternal position), document the reason and include a plan of care in the maternal notes. The plan should include steps to mitigate the difficulty, i.e., changing the maternal position. If these steps do not remedy the difficulty in auscultation, a recommendation should be made to move to CTG monitoring.

Recommendations

35. **The presence of any new or developing intrapartum risk factors warrants a transition from IA to CTG monitoring.**
36. **If FHR concerns are suspected during intermittent auscultation, the FHR should be auscultated more frequently (i.e., after 3 consecutive contractions). If FHR concerns are confirmed, escalate care and recommend continuous CTG monitoring.**
37. **If, during IA, there is an increase in the FHR of 20 bpm or more from the beginning of labour or if a deceleration is heard, care should be escalated and continuous monitoring should be commenced.**
38. **Where a CTG has been commenced due to concerns arising from IA and is classified as normal after 20 minutes, and there are no intrapartum maternal or fetal risk factors present, IA can be recommenced.**
39. **If during IA, there is difficulty in auscultating the FHR for at least one minute following a palpated contraction, and the difficulty in auscultating persists despite taking remedial actions, continuous CTG monitoring is recommended.**

Clinical Question 2.14: What is the recommended practice for undertaking continuous intrapartum CTG monitoring?

Evidence Statement

The decision to commence continuous CTG monitoring should be informed by the initial and ongoing risk assessment as discussed previously (CQs 2.8 and 2.9) as well as taking into consideration the woman's preferences[2].

Commencing continuous intrapartum CTG monitoring

Based on the initial and ongoing risk assessments, whereby continuous CTG monitoring is recommended, a discussion with the woman should take place to outline the following[2]:

- A combination of antenatal risk factors, intrapartum risk factors and continuous CTG monitoring is used to evaluate the fetal condition in labour
- Continuous CTG monitoring is used to record the FHR and the labour contractions
- Continuous CTG monitoring may restrict the woman's mobility and the option to labour in water
- A normal CTG indicates that the fetus is coping well with labour
- Changes to the FHR during labour are common and are not necessarily concerning; however, they may represent developing fetal compromise. Therefore, continuous CTG monitoring is advised if these occur
- If there are changes in the CTG trace or if the CTG is not normal, there is less certainty about the fetal condition and continuous CTG monitoring is advised, in conjunction with a full assessment, including checks for developing intrapartum risk factors such as the presence of meconium, sepsis and slow progress in labour
- Advice regarding the woman's care during labour and birth will be based on an assessment of several factors, including her preferences, her wellbeing and the condition of the fetus, as well as the findings from the CTG

Special considerations in intrapartum CTG monitoring

Quality trace: The CTG trace should be of sufficient quality that the basic features can be identified[1].

Confirming the FHR signal sources from a maternal heart rate (MHR). Fetal monitoring technology may not always differentiate a FHR signal source from an MHR. Therefore, fetal life should be confirmed by independent means prior to commencing CTG monitoring, for example, by auscultation of the FH using a Pinard [126]. If unable to hear the fetal heart, confirm fetal life using obstetric ultrasonography [126].

Regular confirmation that the CTG trace represents the true FHR should occur in specific situations including the following [126]:

- After commencing CTG monitoring or changing transducer
- Following maternal position changes, for example in the active second stage
- When the CTG trace shows abrupt changes in the baseline rate, variability, or pattern (decelerations to accelerations) especially in the second stage of labour
- When the baseline MHR is within about 15 bpm of the FHR

- When unable to determine the baseline FHR and variability occurring between consecutive uterine contractions

Methods to verify the source and/or accuracy of the recorded FHR pattern include the following:

- Verification of the FHR with a fetal stethoscope/Pinard
- Ultrasound imaging
- Fetal scalp electrode
- Verification of the MHR using either pulse oximetry (Sp02), the Toco MP transducer plate, maternal ECG or manual determination of the maternal pulse [126].

If concerns about differentiation between the maternal and FHR remain, or if the FHR cannot be heard, an urgent review should be sought[2].

A recent study, including 213,798 births, compared external methods of FHR monitoring (ultrasound (US) and US and maternal heart rate (MHR) with a FSE and their association with adverse fetal and neonatal outcomes[127]. The study found that the external FHR monitoring method by CTG without simultaneously recording the maternal pulse is associated with neonatal acidemia and neonatal encephalopathy. Infants who were monitored with US only had a 1.7-fold risk of neonatal encephalopathy (OR, 1.70; 95% CI, 1.30-2.21) compared with women with US and MHR or FSE. They also had a 2.4-fold risk of UA BE ≤-12.0 mmol/L (OR, 2.37; 95% CI, 2.00-2.81) reflecting the metabolic component of a low pH. The authors concluded that given the importance of timely recognition of changes in FHR patterns, either simultaneous MHR recording or FSE should be routinely used in labour in term pregnancies [127].

Wireless transducers/telemetry: A systematic review undertaken by Murray *et al.* (2024) explored how continuous electronic fetal monitoring affects women's experiences of labour [74]. The review found that women's feelings of restricted movement were predominantly associated with wired forms of CEFM [77-84 86 88 89 130], whereas wireless forms of CEFM were associated with increased movement and mobility [79 80 128-130], feelings of empowerment, respect and being in control [77 80 128 129]. The authors of the systematic review concluded that healthcare professionals should prioritise the use of technologies that foster the freedom of movement and provide a sense of choice and control[74]. CTG machines with wireless transducers or telemetry functions enable women who require continuous CTG monitoring to be more mobile compared to traditional CTG machines. Some wireless/telemetry CTGs can be used underwater, which enables women to receive hydrotherapy if desired. It is essential that healthcare professionals check the manufacturers' instruction manual to ensure that the CTG machine has this function prior to use. If wireless transducers are used and there is signal loss which is not resolved by reducing the distance between the base and the woman, switch to wired transducers as soon as possible in order the confirm whether or not there is a FHR concern[2].

CTG monitoring in the second stage of labour: CTG interpretation in the second stage of labour can be more challenging than the first stage of labour, and there should be a lower threshold for seeking a second opinion or assistance[2]. Accelerations coinciding with uterine contractions, particularly in the second stage of labour, may indicate possible erroneous recording of the maternal heart rate, as the FHR more frequently decelerates with a contraction, while the maternal heart rate increases[131]. Accelerations in the FHR in the second stage of labour should be investigated to ensure that the maternal pulse is not being recorded[2]. The FHR should be differentiated from the maternal heart rate at least once every 5 minutes. If there are any concerns regarding the differentiation of the fetal and maternal heart rates, a fetal scalp electrode (FSE) should be considered. If maternal and FHRs cannot be differentiated, birth should be expedited[2].

If decelerations are recorded, other features of the CTG that may indicate signs of fetal hypoxia should be assessed (for example, a rise in baseline or reduced variability)[2]. As fetal hypoxia is more common and rapid in the second stage, an increase in baseline FHR of 20 beats a minute or more should be considered as a pathological feature in the active second stage of labour[2]. If CTG concerns arise in the active second stage of labour, obtain an obstetric review. A documented plan of care should include time limits for the next review[2].

Clinical Practice

Prior to the commencement of intrapartum CTG monitoring

Women should be provided with a full explanation of the rationale for continuous CTG monitoring, which should be documented in the HCR.

When performing an intrapartum CTG

Undertake the CTG as outlined in Appendix 5.2.3 Intrapartum CTG monitoring.

Document the following on the CTG and in the HCR/MN-CMS/FetaLink:

- The woman's name and hospital number
- The indication for commencing the CTG, including gestation and risk factors
- The date and time the CTG was commenced (ensure the date and time on the monitor is synchronised with any other clock in the room)
- Maternal pulse

Ensure that the CTG has sufficient recording of the fetal heart and uterine activity so that its features can be identified. If not, take action to improve the CTG (for example, by repositioning the fetal heart rate transducer, applying a fetal scalp electrode, or by repositioning the toco MP transducer plate).

If wireless transducers are used and there is signal loss that is not resolved by reducing the distance between the base and the woman, switch to wired transducers as soon as possible to confirm whether or not there is an FHR concern.

Recommendations

40. Prior to commencing intrapartum CTG monitoring, the woman should be provided with a full explanation of the rationale for continuous CTG monitoring, which should be documented in her health care records.
41. Prior to commencing CTG monitoring, fetal life should be confirmed independently by auscultating the fetal heart using a Pinard or Doppler and simultaneously palpating the maternal pulse.
42. The maternal pulse rate should be continuously monitored and recorded on the CTG by either pulse oximetry (Sp02) or the Toco MP transducer plate.

    If there are any concerns that the CTG is not differentiating the FHR signal from the maternal HR, or when unable to determine the baseline FHR between consecutive contractions,

    - The FHR should be confirmed by independent means, including verification of the FHR with a fetal stethoscope/Pinard, ultrasound imaging, application of a fetal scalp electrode (where appropriate)
    - The maternal HR should be verified by using either pulse oximetry (Sp02), the Toco MP transducer plate, maternal ECG or manual determination of the maternal pulse
43. When monitoring multiple pregnancies, the offsetting function on the CTG should be used to enable a more accurate assessment of each FHR. This separates the baselines by an offset of 20 bpm by switching on trace separation. Unless contraindicated, an FSE to monitor twin one should be considered.
44. The CTG trace should be of sufficient quality to facilitate interpretation of its features. If not, remedial action should be taken to improve the quality of the trace (for example, by repositioning the toco transducer plate or using a fetal scalp electrode where appropriate).

Clinical Question 2.15: How should intrapartum CTGs be analysed and classified?

Evidence Statement

The NICE guideline on intrapartum fetal monitoring recommends that analysis of an intrapartum CTG should with the structured systematic assessment of the following CTG features[2]:

- contractions
- baseline FHR
- variability
- the presence or absence of decelerations including the characteristics of decelerations if present
- presence or absence of accelerations

Analysis of a CTG should include a review of the previous FHR monitoring results, including any previous CTG traces. This should form part of the hourly risk assessment (previously addressed in CQ 2.9), in conjunction with other antenatal or intrapartum risk factors, to determine if there are any changes in baseline FHR, variability or decelerations[2]. If changes in the FHR are noted over time, it is advised to review the antenatal or intrapartum risk factors for fetal hypoxia. If there is a stable baseline FHR between 110 and 160 beats a minute and normal variability, this signifies good fetal oxygenation. It is recommended that the maternal and fetal heartbeats should be differentiated hourly or more frequently if there are any concerns[2].

Classification of an intrapartum CTG should include contractions, baseline FHR, variability and decelerations, and it should be included as part of the full assessment of the woman and baby. The categorisation of CTGs is a tool that quickly communicates the current state of the CTG and should be used in conjunction with the assessment of antenatal and intrapartum risk factors[2]. NICE and FIGO recommend that intrapartum CTGs should be categorised as **normal, suspicious or pathological**[1 2].

The NICE guideline on fetal monitoring recommends that the following parameters be included in the classification of intrapartum CTG[2].

Figure 4: Intrapartum CTG parameters

Intrapartum CTG parameters	
Contractions defined as bell-shaped gradual increases in the uterine activity signal followed by roughly symmetric decreases, with 45-120 seconds in total duration[1]. **Tachysystole:** a frequency of 5 or more contractions in 10 minutes[2] **Hypertonus:** a contraction lasting 2 minutes or longer[2]	
Normal	Up to 4 contractions in 10 minutes[2]
Suspicious	5 or more contractions in 10 minutes, leading to reduced resting time between contractions **or** hypertonus
Pathological	
Actions	If 5 or more contractions per 10 minutes are present, perform a full risk assessment and take action to reduce contraction frequency[2]

Baseline fetal heart rate (FHR)

Determine baseline FHR by looking at the mean FHR, excluding accelerations and decelerations, over a period of 10 minutes when the FHR is stable. When deciding if there is any change in baseline FHR, compare it with earlier CTG traces or recordings of FHR[2]

Stable baseline: usually 110 to 160 beats per minute (bpm). Lower FHR's are expected with post-term pregnancies, with higher baseline rates in preterm pregnancies[2]. When deciding if there is any change in baseline FHR, compare it with earlier CTG traces or recordings of FHR.

Rising baseline:

A rise in baseline FHR defined as an increase of 20bpm or more from the previous stable baseline rate may represent either developing infection or hypoxia[2].

Intrapartum CTG parameters	
Normal	Stable baseline of 110 to 160 bpm
Suspicious	Increase in baseline FHR of 20 bpm or more from the start of labour or since the last review an hour ago, **or** 100 to 109 bpm **or** Unable to determine baseline
Pathological	Below 100 bpm, **or** Above 160 bpm **or** An increase in the baseline FHR of 20 bpm or more in active second stage labour [2]

Variability refers to the minor oscillations in the FHR, which usually occur at 3 to 5 cycles a minute. It can be calculated by estimating the difference in beats per minute between the highest heart rate and the lowest heart rate in a 1-minute segment of the trace between contractions, excluding decelerations and accelerations. The absence of variability is considered a very concerning feature [2]

Normal	5 to 25 bpm
Suspicious	Fewer than 5 bpm for between 30 and 50 minutes, **or** more than 25 bpm for **up to** 10 minutes
Pathological	Fewer than 5 bpm for **more than** 50 minutes, **or** more than 25 bpm for more than 10 minutes, **or** sinusoidal
Actions	**Obtain an urgent review by an obstetrician or senior midwife and consider expediting birth if:** • There is an isolated reduction in variability to fewer than 5 bpm for more than 30 minutes when combined with antenatal or intrapartum risk factors, as this is associated with an increased risk of adverse neonatal outcomes, **or** • There is a reduction in variability to fewer than 5 bpm combined with other CTG changes, particularly a rise in the baseline FHR, as this is a strong indicator for fetal compromise [2]

Decelerations: Transient episodes when the FHR slows to below the baseline level by more than 15 bpm, with each episode lasting 15 seconds or more. An exception to this is that in a trace with reduced variability, decelerations may be 'shallow'. Decelerations in the intrapartum period should be described as **'early'**, **'variable'** or **'late'** [2]

Early decelerations: Repetitive and periodic slowing of the FHR with onset early in the contraction and return to baseline at the end of the contraction. These are uncommon, benign and usually associated with head compression. They are not accompanied by any other changes, such as reduced variability or a rise in the baseline FHR [2]

Intrapartum CTG parameters	
Variable decelerations: Intermittent and periodic slowing of the FHR with a variable time in relation to the contraction [2]. The following characteristics of variable decelerations should be considered as **concerning***: • Lasting more than 60 seconds • Reduced variability within the deceleration • Failure or slow return to baseline FHR • Loss of previously present shouldering	
Shouldering: defined as a slight increase in heart rate preceding and/or following decelerations [3]	
Late decelerations: Repetitive and periodic slowing of the FHR with onset mid to end of the contraction and the lowest point more than 20 seconds after the peak of the contraction, and ending after the contraction [2]	
Prolonged deceleration: single prolonged deceleration lasting 3 minutes or more [2]	
Repetitive decelerations: decelerations that occur with over 50% of contractions	
Normal	No decelerations, **or** early decelerations, **or** variable decelerations that are not evolving to have **concerning characteristics***
Suspicious	Repetitive variable decelerations with any concerning characteristics for less than 30 minutes, **or** variable decelerations with any concerning characteristics for more than 30 minutes, **or** repetitive late decelerations for less than 30 minutes
Pathological	Repetitive variable decelerations with any concerning characteristics for more than 30 minutes, **or** repetitive late decelerations for more than 30 minutes, **or** acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more

Accelerations: Transient increases in FHR of 15 bpm or more, lasting 15 seconds or more [2]. In the intrapartum period, the presence of FHR accelerations, even with reduced variability, is generally an indication that the baby is healthy. The absence of accelerations on an otherwise normal CTG trace does not indicate fetal acidosis [2].

Overall classification of intrapartum CTG (contractions, baseline, variability, decelerations) (NICE, 2022)	
Normal	All 4 features are normal
Suspicious	Any 1 feature is suspicious
Pathological	Any 1 feature is pathological **or** 2 or more features are suspicious

Clinical Practice

Classification of intrapartum CTG

The classification provided by NICE (2022) should be used to analyse the intrapartum CTG in conjunction with the assessment of antenatal and intrapartum risk factors (NICE). ***It should not be used to categorise antenatal CTGs***.

Previous FHR monitoring results should be reviewed together with the developing clinical picture for both the woman and the fetus. As previously outlined in CQ 2.9, undertake and document a systematic assessment of the condition of the woman and fetus every hour or more frequently if there are FHR concerns. The hourly assessment should include consideration of existing and evolving risk factors for hypoxia and include classification of the CTG. The review should determine if there are any changes to CTG features, particularly the contractions, baseline FHR, variability or decelerations.

The use of a standardised intrapartum CTG pro forma for classification can aid systematic analysis (Appendix 8). The CTG should be categorised and documented as either ***normal, suspicious or pathological.*** These terms should be used when seeking a review. All relevant events which may affect the FHR (i.e. vaginal examinations, changes in maternal position, fetal movements etc.) should be annotated on the CTG trace. The CTG classification should be completed and documented at least every hour or sooner if there are FHR concerns.

Special considerations

CTG monitoring technology is not always able to differentiate a FHR signal source from a maternal heart rate (MHR) source. Therefore prior to the commencement of CTG monitoring, the FHR should be confirmed by auscultating the FH using a Pinard or Doppler. If unable to hear the FH, obtain an urgent obstetric review to confirm fetal life using obstetric ultrasonography.

The maternal pulse should be monitored and recorded simultaneously with the FHR by using pulse oximetry, maternal ECG or the Toco MP transducer plate.

If there are any concerns that the CTG is not differentiating the FHR signal from the MHR, or when unable to determine the baseline FHR between consecutive contractions, the FHR should be confirmed by independent means. Methods to verify the source and/or accuracy of the recorded FHR pattern include using a Pinard, ultrasound imaging, fetal scalp electrode (FSE). The maternal HR can be verified by using either pulse oximetry (Sp02), by the Toco MP transducer plate, maternal ECG or manual determination of the maternal pulse. If concerns about differentiation between the FHR and maternal HR remain, or if the FHR cannot be heard, an urgent obstetric review should be sought.

CTG monitoring in the active second stage of labour

Due to the increased risk of erroneous FHR detection, the FHR should be differentiated from the maternal heart rate using either pulse oximetry or toco MP transducer plate. If there are concerns in the differentiation of the maternal and FHRs, a fetal scalp electrode should be considered, however birth should be expedited if a FSE cannot be applied. If decelerations are recorded, assess the other features of the CTG (for example, rise in baseline or reduced variability) which may indicate signs of fetal hypoxia.

The CTG should be classified every 30 minutes however if there are FHR concerns, an obstetric review should be obtained earlier. A combination of existing or new maternal or fetal risk factors, combined with changes in the CTG should warrant a lower threshold of escalation. If CTG concerns arise in the active second stage of labour, obtain an urgent obstetric review, consider discouraging pushing and stopping any oxytocin infusion (if used) to allow the FHR to recover, unless birth is imminent. A documented plan of care should include time limits for the next review.

Wireless transducers/telemetry: If wireless transducers are used and there is signal loss, reposition the base of the CTG near the woman however, ensure the base is protected against water sprays or splashes. If signal loss persists, switch to wired transducers as soon as possible in order to confirm whether there is a FHR concern.

Recommendations

45. A standardised intrapartum CTG pro forma for classification should be used to aid a systematic analysis of the CTG. The classification provided by NICE Fetal Monitoring in Labour (2022) should be used to categorise the intrapartum CTG in conjunction with the assessment of antenatal and intrapartum maternal and fetal risk factors. Intrapartum CTGs should be categorised as normal, suspicious or pathological. These terms should be used to describe the CTG and when seeking an obstetric review.
46. In the first stage of labour, the CTG should be categorised and documented at least every hour or sooner if there are FHR concerns.
47. In the passive second stage of labour, the CTG should be categorised and documented at least every hour or sooner if there are FHR concerns.
48. In the active second stage of labour, the CTG should be categorised and documented at least every 30 minutes however if there are FHR concerns, an obstetric review should be obtained. At all times, the necessary escalation based on CTG features should not be delayed until the next CTG classification is due. CTG concerns should be relayed to the obstetrician and senior midwife in a timely fashion regardless of the timing of classification.
49. In the active second stage of labour, if there are concerns in the differentiation of the maternal and FHR, a fetal scalp electrode (FSE) should be considered. If the FSE cannot be applied, urgent obstetric review should be sought.
50. All relevant events which may affect the FHR (e.g. vaginal examinations, changes in maternal position, vomiting, toilet breaks, fetal movements) should be annotated on the CTG trace.

Clinical Question 2.16: How should decisions be made based on intrapartum CTG classification?

Evidence Statement

Labour is a continuous process and the monitoring of both maternal and fetal wellbeing, with the associated risk assessment, is a core element of intrapartum care [100]. Ongoing risk assessment of antenatal and intrapartum risk factors, in conjunction with interpretation of the CTG trace should be undertaken every hour [2]. Decision making on how to manage labour should be based on the overall clinical picture and include maternal observations, contraction frequency and labour progress[2].

NICE (2022) provide the following guidance based on **intrapartum CTG classifications**[2]:

- **Normal:** Continue standard care. In the event that the CTG was commenced due to FHR concerns arising from IA, and there are no antenatal or intrapartum risks factors present, fetal monitoring can revert to IA, if the women wishes.
- **Suspicious and there are no other concerning factors:** Perform a full risk assessment, including a full set of maternal observations, taking into account the whole clinical picture, and document the findings. If there are accelerations present, then fetal acidosis is unlikely[2]. If the CTG was previously normal, consider possible underlying causes for the change in the FHR. Most likely causes include, maternal position, hypotension and excessive uterine frequency[2].
- **Suspicious and there are additional intrapartum risk factors such as slow progress, sepsis or meconium:** Perform a full risk assessment, including a full set of maternal observations, taking into account the whole clinical picture, and document the findings. Possible underlying causes should be considered and if present, conservative measures should be undertaken[2]. An urgent review by an obstetrician or senior midwife should be sought and a fetal scalp stimulation test should be considered[2].
- **Pathological:** An urgent review by an obstetrician and senior midwife should be sought. Acute events such as cord prolapse, suspected placenta abruption or suspected uterine rupture should be excluded. Perform a full risk assessment, including a full set of maternal observations, taking into account the whole clinical picture, and document the findings. Possible underlying causes should be considered, and if they are present, conservative measures should be undertaken[2].
- **If the CTG remains pathological after implementing conservative measures:** Obtain a further urgent review by an obstetrician and a senior midwife. Evaluate the whole clinical picture and consider expediting birth. There should be a low threshold for expediting birth if there are evolving intrapartum risk factors for fetal compromise [2].
- **Acute bradycardia or a single prolonged deceleration for 3 minutes or more:** Seek urgent obstetric review. If there has been an acute event such as cord prolapse, suspected placenta abruption or suspected uterine rupture, expedite birth. Possible underlying causes should be considered, and if they are present, conservative measures should be undertaken[2]. Prepare for an urgent birth, including a request for anaesthetic, paediatric or neonatal support. Expedite birth if the acute bradycardia persists for 9 minutes, or less if there are significant antenatal or intrapartum risk factors for fetal compromise. If the FHR recovers at any time up to 9 minutes, reassess any decision to expedite the birth, but consider other antenatal and intrapartum risk factors[2]. If a decision is made to expedite birth, the timings should be documented, including the time of seeking an urgent review and the time the decision was made[2].

Clinical Practice

Based on the following CTG classifications, risk assessment and complete set of maternal observations, it is the consensus of the GDG that the following actions are taken:

Figure 5: Decision making on how to manage labour should be based on the overall clinical picture, including maternal observations, contraction frequency and labour progress

Classification	Actions
Normal:	• Continue standard care • In the event that the CTG was commenced due to FHR concerns arising from IA, and there are no antenatal or intrapartum risk factors present, fetal monitoring can revert to IA, if the woman wishes
Suspicious, and there are no other concerning factors:	• If the CTG was previously normal, consider possible underlying causes for the change in the FHR and take conservative measures (addressed in CQ 2.17)
Suspicious and there are additional intrapartum risk factors such as slow progress, sepsis or meconium:	• Possible underlying causes should be considered and if present, conservative measures should be undertaken • An urgent review by an obstetrician and senior midwife should be obtained and documented in the HCR
Pathological:	• An urgent review by an obstetrician and senior midwife should be obtained • Acute events such as cord prolapse, suspected placenta abruption or suspected uterine rupture should be considered • Other possible underlying causes should be considered, and if present, conservative measures should be undertaken
If the CTG remains pathological after implementing conservative measures:	• Obtain a further urgent review by an obstetrician and senior midwife • Evaluate the whole clinical picture and consider expediting birth. If there are evolving intrapartum risk factors for fetal compromise, there should be a low threshold for expediting birth
Acute bradycardia or a single prolonged deceleration for 3 minutes or more:	• Obtain an urgent review by an obstetrician and senior midwife • If there has been an acute event such as cord prolapse, suspected placenta abruption or suspected uterine rupture, expedite birth • Possible underlying causes should be considered, and if present, conservative measures should be undertaken • Preparations should be made for an urgent birth and include a request for paediatric or neonatal support in line with local obstetric emergencies activation protocols • If the acute bradycardia persists for 9 minutes or less, if there are significant antenatal or intrapartum risk factors for fetal compromise, expedite birth • If the FHR recovers at any time up to 9 minutes, reassess any decision to expedite the birth, but consider other antenatal and intrapartum risk factors • If a decision is made to expedite birth, the timings should be documented in the healthcare record and include the time of seeking an urgent review and the time of the decision was made

Recommendations

51. It is recommended that decisions regarding the management of labour should be made based on the overall clinical picture and include maternal observations, contraction frequency and labour progress.
52. In the event of a CTG remaining pathological after implementing conservative measures (addressed in CQ 2.17) further obstetric and midwifery review should be sought and expediting birth should be considered. If there are evolving intrapartum risk factors for fetal compromise such as slow progress, sepsis or meconium, there should be a lower threshold for expediting birth.

Clinical Question 2.17: What conservative measures should be taken to resolve possible underlying causes of FHR concerns?

Evidence Statement

Conservative measures, also referred to as intrauterine fetal resuscitation, consist of interventions that aim to increase oxygen delivery to the placenta and enhance fetoplacental perfusion[132]. In the event of a suspicious or pathological CTG, fetal hypoxia/acidosis should be suspected, and an appropriate response is required to avoid an adverse neonatal outcome[1]. In the event of concerning CTG features/ classification, possible underlying causes should be identified (if present) and remedial action taken to reverse them. This would lead to subsequent recovery of adequate fetal oxygenation and return to a normal CTG trace[1]. Possible reversible underlying causes include maternal position, hypotension, and excessive contraction frequency [1 2 5].

Maternal position: Aortocaval compression can occur in the supine position, leading to reduced placental perfusion. Turning the woman to her side may correct the changes in the FHR pattern [1] by reducing compression of the aorta and inferior vena cava and improving uteroplacental blood flow [132]. This effect may be more pronounced in women with multiple pregnancy or polyhydramnios due to the increased size of the gravid uterus [133]. Transient cord compression (often seen on the CTG as variable decelerations) is another common cause of CTG changes, and these can sometimes be reversed by changing the maternal position [134 135].

Hypotension: Sudden maternal hypotension can also occur during labour, and can be seen after epidural or spinal analgesia [136]. A maternal systolic fall of more than 20% of the baseline systolic figure will significantly reduce uterine perfusion [137]. It is usually reversible by rapid fluid administration and/or intravenous vasoactive drugs such as phenylephrine or ephedrine [1]. Intravenous fluids, however, should not be used to treat FHR abnormalities unless the woman is hypotensive or has signs of sepsis [2].

Excessive contraction frequency (tachysystole): is defined as a frequency of five or more contractions in 10 minutes or uterine hypertonus (a contraction lasting 2 minutes or longer)[2 134]. Excessive contraction frequency is the most frequent cause of fetal hypoxia/acidosis [1]. Any form of induction or augmentation of labour, including the use of oxytocin, has the potential to cause uterine hyperstimulation/tachysystole[89] and may be reversed by stopping oxytocin infusion, removing administered prostaglandin if possible, and/or starting acute tocolysis with beta-adrenergic agonists [1].

Both maternal hypotension and tachysystole can be associated with neuraxial block (epidural, spinal, or combined spinal epidural), and it is important that both are addressed equally. Vasopressor drugs given by anaesthesia providers are likely to rapidly correct hypotension, but signs of uterine tachysystole should also be sought. These conditions are more common with CSE or when higher-dose opioids are used in the initiation of analgesia. This may partly be due to a rapid fall in maternal circulating catecholamines after analgesia and loss of their balancing tocolytic effect.

A 2018 Cochrane Systematic review evaluated the use of tocolytics during labour for uterine tachysystole or suspected fetal distress, or both, on fetal, maternal and neonatal outcomes [138]. The review included eight studies (734 women), in predominantly high-income countries and compared ß2-adrenergic agonists versus no tocolytic agent, whilst awaiting emergency delivery. They found that the incidence of abnormal fetal heart trace is probably lower with tocolytic treatment (RR 0.28, 95% CI 0.08 to 0.95; 2 studies, 43 women; moderate-quality evidence), but the effects on the number of babies with Apgar score below seven were uncertain (low-quality evidence). The review concluded that there was insufficient evidence to determine the effects of tocolytics for uterine tachysystole or suspected fetal distress during labour. In light of the current evidence, the National Clinical Practice Guideline – Induction of Labour recommends that in the event of hyperstimulation/tachysystole, tocolysis with betamimetics should be considered, however birth of the baby should be expedited if the CTG is classified as pathological, despite tocolysis [89].

Maternal oxygen administration: The practice of maternal oxygen administration has been thought to reduce FHR concerns; however, there is a lack of consensus concerning its benefits and possible harm [135]. A 2012 Cochrane review assessed the effects of maternal oxygenation for fetal distress during labour on perinatal outcomes [135]. No trials addressing maternal oxygen therapy for fetal distress were found. Two randomised trials that addressed the use of prophylactic oxygen therapy during labour were included. The review found that abnormal cord blood pH values (less than 7.2) were recorded significantly more frequently in the oxygenation group than the control group (RR 3.51, 95% CI 1.34 to 9.19). The practice of maternal oxygenation administration as a response to FHR concerns is not recommended [2], due to the vasoconstriction of the placental bed secondary to increased oxygen tension, particularly in a growth-restricted fetus [139].

Active second stage of labour: The onset of maternal pushing in the active second stage decreases maternal oxygenation, leading to a reduction in the oxygenation of placental venous sinuses, therefore increasing the risk of acidemia. Hyperstimulation secondary to the use of oxytocin infusion during the second stage may further increase the risk of acidemia as further reduction in utero-placental perfusion [27 49 50]. Discouraging the woman from pushing until the situation is reversed may be considered, unless birth is imminent [1 2].

Clinical Practice

In the event of FHR concerns, use the following conservative measures to resolve any possible underlying causes.

- A change in maternal position, such as left lateral to relieve aortocaval compression and improve cardiac output. It may also counteract transient cord compression resulting in variable decelerations.
- Maternal hypotension: the rapid administration of intravenous (IV) fluids may be considered. In instances of hypotension secondary to epidural top-up, commence IV fluids, change maternal position to left lateral and call an anaesthetist to review.

- Tachysystole: Measures include the reduction in infusion rate/discontinuation of oxytocin and commencement of tocolysis with betamimetics such as terbutaline (refer to National Clinical Practice Guideline – Induction of Labour 2022).[23]

The administration of IV fluids should not be used routinely as part of conservative measures to treat FHR abnormalities. The administration of maternal facial oxygen as part of conservative measures to FHR concerns is not recommended. Urgent action should be taken to resolve any FHR concerns in the second stage of labour, however if there is no improvement, birth should be expedited.

Recommendations

53. **Conservative measures should be used to resolve any possible underlying causes, such as maternal hypotension, tachysystole and maternal aortocaval compression.**
54. **The administration of IV fluids should not be used routinely as part of conservative measures to treat FHR abnormalities.**
55. **The administration of maternal facial oxygen as part of conservative measures to address FHR concerns is not recommended.**
56. **Urgent action should be taken to resolve any FHR concerns in the second stage of labour, however if there is no improvement, an urgent obstetric review should be obtained and birth expedited.**

Clinical Question 2.18: What is the role of fetal scalp stimulation and fetal blood sampling as second-line tests of fetal wellbeing in labour?

Evidence Statement

As previously addressed in CQ 2.2, CTGs have a high false-positive rate, which can result in an increase in interventions [27 49 50] without decreasing the number of adverse perinatal outcomes [1 132]. Many fetuses demonstrating abnormal features on the CTG are providing a physiological response to the stresses of labour and can have sufficient reserves to continue in labour[49 140]. Abnormal FHR patterns that do not respond to conservative measures require further assessment of fetal well-being or expedite delivery[2 132]. Additional assessments include fetal scalp stimulation (FSS) and fetal blood sampling (FBS)[2 132 141 142].

Fetal Scalp Stimulation (FSS) is performed during a vaginal examination whereby the healthcare professional applies a rubbing pressure to the fetal scalp with the examining fingers with the aim of stimulating a FHR acceleration on the CTG [132]. It should be considered as an adjunct to CTG monitoring when there are FHR concerns in the presence of antenatal or intrapartum risk factors for fetal compromise [2].

23 Mitchell J.M, Nolan C, El Shaikh M, Cullinane, S, Borlase D. National Clinical Practice Guideline: Induction of Labour. National Women and Infants Health Programme and The Institute of Obstetricians and Gynaecologists. October 2023. www.hse.ie/eng/about/who/acute-hospitals-division/woman-infants/clinical-guidelines/ncpg-induction-of-labour-guideline.pdf

Fetal Blood Sampling (FBS) involves collection of a capillary sample of blood from the fetal scalp to assess pH or lactate. Following rupture of amniotic membranes, an amnioscope is placed vaginally to allow visualisation of the fetal head. A small laceration to the fetal head is made and a blood sample is taken from the fetal scalp [141].

A 2017 Cochrane Systematic review evaluated the effectiveness and safety of cCTG when used as a method of FHR monitoring[27]. Of the thirteen studies, seven included CTG and FBS [28 30 32 33 38 39 143]. The review found in the subgroup of CTG and FBS there was an increase in instrumental vaginal birth ($P = 0.04$; $I^2 = 77\%$), but less neonatal acidosis ($P = 0.04$; $I^2 = 76.5\%$) in the fetal blood sampling subgroup. Notably, there were no subgroup differences for the other main outcomes including caesarean section rates, neonatal seizures or long-term abnormal neurological outcomes[27]. A subsequent RCT, the Flamingo trial (Fetal LActate: MeasurING Outcomes) was unable to demonstrate the effectiveness of including FBS to CTG monitoring on birth by caesarean section versus CTG alone[144].

A further 2023 Cochrane review evaluated fetal scalp stimulation as a second-line assessment of intrapartum fetal well-being in cases of non-reassuring CTG traces and found insufficient evidence to inform clinical practice[142]. Two studies were included in the review; one pilot study (50 women) compared FSS and CTG with FBS and CTG[145] and a second study (327 women) compared manual FSS (abdominal or vaginal scalp stimulation) and CTG with CTG alone[146]. The pilot study found that when compared with FBS and CTG, FSS and CTG may reduce the risk of caesarean section (risk ratio (RR) 0.38, 95% confidence interval (CI) 0.16 to 0.92; very low-certainty evidence)[145]. The comparison between FSS and CTG with CTG alone found FSS and CTG may make little or no difference to the risk of caesarean section compared to CTG alone, although the evidence is very uncertain (RR 0.83, 95% CI 0.59 to 1.18; very low-certainty evidence)[146].

A large randomised controlled trial of 2500 women was planned in Ireland. The fetal Intrapartum Randomised Scalp Stimulation Trial (FIRSST NCT05306756) aimed to compare digital fetal scalp stimulation with fetal blood sampling as second-line tests of fetal wellbeing in labour[147]. The trial closed early due to insufficient randomisations, reflecting a reluctance to perform FBS following the change in NICE guidance. Nevertheless, the study found no difference in rates of adverse perinatal and maternal outcomes when dFSS was compared to FBS[148].

Due to very low-quality evidence about FBS's effectiveness and invasive nature, NICE has removed recommendations about FBS from the latest guideline [2]. Despite limited evidence of benefit, NICE recommend that FSS be performed in a suspicious CTG with risk factors for fetal compromise [2].

Clinical Practice

Despite the limited robust evidence supporting the use of second-line tests in assessing fetal well-being, clinicians may opt to use FSS or FBS to aid clinical decision-making.

Fetal Scalp Stimulation (FSS) is performed by stimulating the fetal scalp digitally with the index and middle finger for 30-60 seconds. Observe the CTG over a five to ten-minute interval and observe for an acceleration of the FHR. In situations where an acceleration is not observed in response to FSS, consider fetal compromise, and expedited birth may be required.

Fetal Blood Sampling (FBS) is a technically more challenging procedure to perform than FSS and is not available in all maternity sites in Ireland. The decision to perform FBS should be informed by the availability of resources (equipment and trained personal in performing FBS), the time the procedure takes, notably the median interval of 18 minutes between the decision to perform and the result[149] and the wishes of the woman. Where there is clear evidence of acute fetal compromise, FBS should not be undertaken and urgent birth should be expedited.

The following parameters should be used for the interpretation of FBS results [122]:

pH	Lactate	Interpretation
7.25 or above	4.1 mmol/l or below	Normal
7.21 to 7.24	4.2 to 4.8 mmol/l	Borderline
7.20 or below	4.9 mmol/l or above	Abnormal

Interpretation of FBS results should take into account any previous pH or lactate measurements and the clinical picture of the woman and fetus, such as progress in labour.

Recommendations

57. **Fetal scalp stimulation and fetal blood sampling may be considered as second-line tests to CTG monitoring when there are FHR concerns. The following factors should be taken into consideration when making the decision to use FSS or FBS; the invasiveness of the procedure, availability of resources, the time the procedure takes and the woman's wishes.**

Section 6: Storage of CTGs

Clinical Question 2.19: How should CTGs be stored?

Evidence Statement

CTG paper is not intended for long-term archive storage as the dyes used in thermal paper tend to react with solvents and other chemical compounds used in adhesives, and if in contact with the thermal print, the print may be destroyed over time. Therefore, another medium of storage should be considered[126]. Measures to ensure the long lasting legibility and durability of thermal printouts include; storing CTG traces separately in an air-conditioned place and the use of plasticiser-free envelopes or divider sheets for protection, laminating films and systems with water-based adhesives. However, using such envelopes cannot prevent the fading effect caused by other external agents[66].

CTG recordings (either paper or electronic) should be considered as part of the HCR and should be filed as such. As technology evolves and there is a shift towards electronic charts and digital archives, a secure back up system needs to be in place[1]. CTG and associated healthcare records should be retained indefinitely – up to the lifetime of the woman and eight years after death[150]. It is advisable that a tracing system is in place if CTGs are stored separately from the maternal HCR, so that they can be retrieved as required. It is advisable to photocopy CTG traces if there is a concern that the baby may have sustained a possible brain injury and store them indefinitely[2].

Clinical Practice

CTG traces should be considered as part of the maternal HCR and stored in line with the manufacturer's instructions. CTG and associated HCRs should be retained indefinitely – up to the lifetime of the woman and eight years after death. Due to the possibility of paper deterioration, CTGs should ideally be stored electronically.

Recommendation

58. **CTG traces should be considered as part of the maternal healthcare record and should be stored electronically if possible. CTGs and associated maternal healthcare records should be retained indefinitely – up to the lifetime of the woman and eight years after death.**

Chapter 3: Development of Clinical Practice Guideline

3.1 Literature search strategy

A comprehensive literature review was undertaken for each CQ and included national and international publications.

The search included electronic databases PUBMED, MEDLINE, CINAHL, and the Cochrane Library. The search was limited to publications in the English language; however, no date restrictions were placed on any of the search terms. We searched databases using relevant headings and keywords. Key words and terms used included but not limited to "fetal heart rate monitoring", "methods", "labour", "antenatal", "intrapartum", "adjunctive tests", "intermittent auscultation", "electronic fetal monitoring", "effectiveness", "technology" and "risk assessment". Keywords were combined with Boolean operators to further focus the search. A lack of high-quality data on maternal and neonatal outcomes associated with fetal heart rate monitoring was observed. Where evidence was lacking, guidelines from professional associations/bodies were reviewed. These included the National Institute for Health and Care Excellence (NICE), International Federation of Gynecology and Obstetrics (FIGO), Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), Society of Obstetricians and Gynaecologists of Canada (SOGC), Norwegian Gynecological Association and the International Confederation of Midwives (ICM). Further studies were identified through a bibliography search and are referenced where appropriate throughout the document.

3.2 Appraisal of evidence

Following a comprehensive literature review, the quality, validity and relevance of the evidence gathered were critically appraised by the guideline developers under the following headings:

- Study design
- Relevance of primary and secondary outcomes
- Consistency of results across studies
- Magnitude of benefit versus magnitude of harm
- Applicability to practice context

A number of evidence-based recommendations for FHR monitoring were agreed upon. They have been adapted to reflect care in the Irish healthcare setting.

3.3 AGREE II process

While being developed, the guideline was assessed using the AGREE II checklist (Appendix 9) as recommended by the Department of Health in the 'How to Develop a National Clinical Guideline Manual', 2019[24].

The purpose of AGREE II is to provide a framework to:

1. Assess the quality of guidelines;
2. Provide a methodological strategy for the development of guidelines; and
3. Inform what information and how information ought to be reported in guidelines

3.4 Literature review

Chapter two reports details of supportive evidence-based literature for this guideline. The team reviewed and discussed the results from these searches as it reviewed the literature.

The following steps were taken to ensure a comprehensive review of the literature with continuous input and discussion between the guideline development group:

- The GDG met to consider the CQs to be addressed
- The initial literature search was undertaken in March 2023 by a Researcher and Clinical Guidelines Development Manager (NWIHP) and subsequently completed by a member of the GDG. New emerging evidence was reviewed, and the relevance to the CQs was discussed. It was decided whether inclusion was applicable to the development of the guideline.
- The GDG met regularly to review the evidence, discuss clinical practice and agree on recommendations.
- Where there was no evidence to support certain CQs, clinical practice and recommendations were made based on group consensus and expertise.

3.5 Grades of recommendation

GRADE offers a transparent and structured process for developing and presenting evidence summaries and for carrying out the steps involved in developing recommendations[25].

While we acknowledge that for this particular work an extensive GRADE approach is not possible, we have used the suggested language set out in the GRADE table when making recommendations[26] (Appendix 10).

24 Department of Health (2019). How to develop a National Clinical Guideline. Available at: https://www.gov.ie/en/collection/cd41ac-clinical-effectiveness-resources-and-learning/

25 Guyatt, Gordon, *et al.* "GRADE Guidelines: 1. Introduction – GRADE Evidence Profiles and Summary of Findings Tables." *Journal of Clinical Epidemiology*, vol. 64, no. 4, 2011, pp. 383-94, https://doi.org/10.1016/j.jclinepi.2010.04.026

26 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. doi: 10.1016/j.ajog.2013.07.012. PMID: 23978245

3.6 Future research

An important outcome of the guideline development process is in highlighting gaps in the evidence-base.

Some suggested topics in this broad area include:

- High quality trials on the use of FHR methods to assess both short-term and long-term health outcomes for women and their babies, comparing different monitoring tools with clear identification of the risk status and parity of the labouring women.
- Computerised antenatal and intrapartum CTG monitoring to assess both short-term and long-term health outcomes for women and their babies, comparing different monitoring tools with clear identification of the risk status and parity of the labouring women
- Evaluation of centralised FHR monitoring to assess both short-term and long-term health outcomes for women and their babies.

Chapter 4: Governance and Approval

4.1 Formal governance arrangements

This guideline was written by the developers under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group was formed to review the guideline prior to submission for final approval with the National Women and Infants Health Programme. The roles and responsibilities of the members of each group and their process were clearly outlined and agreed upon.

4.2 Guideline development standards

This guideline was developed by the GDG within the overall template of the HSE National Framework[27] for developing Policies, Procedures, Protocols and Guidelines (2023) and under supervision of the Guideline Programme Team.

A review was conducted by a group of experts, specialists and advocates (the EAG) prior to approval by the Clinical Advisory Group (CAG) of the National Women and Infants Health Programme with final sign off for publication by CAG Co-Chairs, the Clinical Director of NWIHP and the Chair of the IOG. See Appendix 11 for list of CAG members.

27 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

Chapter 5: Communication and Dissemination

A communication and dissemination plan for this guideline has been developed by the GPT and endorsed by the NWIHP. Effective ongoing clear communication is essential in explaining why the guideline is necessary and securing continued buy-in. It provides an opportunity to instil motivation within staff, helps overcome resistance to change and gives an opportunity for feedback[28].

The Clinical Guideline will be circulated and disseminated through the Guideline Programme Team as well as through the professional networks who participated in developing and reviewing the document.

Senior management within the maternity units are responsible for the appropriate dissemination of new and updated guidelines. Local hospital groups including guideline committees are also instrumental in the circulation of new and updated guidelines and promoting their use in the relevant clinical settings.

The HSE will make this guideline available to all employees through standard networks as well as storing it in the online PPPG repository. Electronic versions available on the NWIHP (https://www.hse.ie/eng/about/who/acute-hospitals-division/woman-infants/clinical-guidelines/) and RCPI (https://www.rcpi.ie/faculties/obstetricians-and-gynaecologists/national-clinical-guidelines-in-obstetrics-and-gynaecology/) websites and other communication means can be used to maximise distribution. The NWIHP website will also provide a training webinar introducing each guideline and where relevant a downloadable version of the recommended algorithm will be available.

28 Department of Health (2018). NCEC Implementation Guide and Toolkit. Available at: https://www.gov.ie/en/collection/cd41ac-clinical-effectiveness-resources-and-learning/?

Chapter 6: **Implementation**

6.1 Implementation plan

Implementation was considered at the beginning and throughout the guideline development process. The local multidisciplinary clinical team, senior executive and clinical management in each maternity and gynaecology unit are ultimately responsible for the appropriate structured adoption and implementation of the guidelines within their area of responsibility. They must ensure that all relevant personnel under their supervision have read and understood the guideline and monitor both its effectiveness and adoption.

Within each site, local multidisciplinary teams are responsible for the clinical implementation of Guideline recommendations and ensuring that their local clinical practices and processes reflect and are aligned with the guideline recommendations

The following have been put in place to help facilitate the implementation of this guideline.

- Quick Summary Document (QSD) for clinical staff (includes key recommendations, auditable standards, algorithms and recommended reading)
- Clinical Guideline mobile application
- Plain language summary
- Patient information leaflet

6.2 Education plans required to implement the Guideline

It is acknowledged that this guideline should be complemented by ongoing education, training, and assessment where required. Maternity sites are required to ensure that relevant staff undertake MDT training in fetal monitoring pending the development and phased implementation of the national curriculum for MDT training in fetal heart rate monitoring. This guideline will inform the development of the national curriculum.

6.3 Barriers and facilitators

To ensure successful implementation of guidelines, it is first necessary to look at potential barriers and facilitators. Taking these into account when developing the implementation plan should improve levels of support from relevant users [29 30.]

Barriers may be categorised as internal (specific to the guideline itself) or external (specific to the clinical environment).

29 National Women and Infants Health Programme (2024). National Training Standards for Fetal Monitoring, Obstetric Emergencies and Neonatal Resuscitation. https://www.hse.ie/eng/about/who/acute-hospitals-division/woman-infants/

30 Department of Health (2018). NCEC Implementation Guide and Toolkit. Available at: https://health.gov.ie/national-patient-safety-office/ncec/

The Guideline Development Group has aimed to address any internal barriers during the development of this Guideline.

Potential external barriers include:

- Structural factors (e.g. budget or service redesign)
- Organisational factors (e.g. lack of facilities or equipment)
- Individual factors (e.g. knowledge, skills, training)
- Woman's perceptions

In the case of this guideline, it will be necessary to examine possible barriers and consider implementation strategies to address them. By example, this may include discussion with relevant management groups with regards budgetary impact or providing training to the relevant staff. Additional time may be required in the antenatal setting to counsel the woman on the methods and options of FHR monitoring. Staff training may be required to ensure information is delivered in an unbiased manner.

6.4 Resources necessary to implement recommendations

The implementation of this Guideline should be undertaken as part of the quality improvement of each hospital. Hospitals should review existing service provision against this Guideline, identifying necessary resources required to implement the recommendations in this Guideline. This may include the provision of additional equipment including:

- Pinard/Doppler
- Wireless CTG machines
- Pulse oximetry
- Toco MP transducer plate

Chapter 7: Audit and Evaluation

7.1 Introduction to audit

It is important to audit both the implementation of the Guideline and its influence on outcomes to ensure that this Guideline positively impacts the care of the woman. Institutions and health professionals are encouraged to develop and undertake regular audits of Guideline implementation. Personnel tasked with the job of conducting the audit should be identified upon receipt of the most recent version of the Guideline.

7.2 Auditable standards

Audits using the key recommendations as indicators should be undertaken to identify where improvements are required and enable changes as necessary. They should also provide evidence of continuous quality improvement initiatives.

Auditable standards for this Guideline include:

1. Classification of antenatal CTG as normal or abnormal
2. Appropriate method of intrapartum FHR monitoring, based on the woman's initial risk assessment, ongoing risk assessments and maternal choice
3. Appropriate classification of intrapartum CTG as normal, suspicious or pathological
4. Appropriate utilisation of IA
5. Utilisation of telemetry wireless monitoring

7.3 Evaluation

Evaluation is defined as a formal process to determine the extent to which the planned or desired outcomes of an intervention are achieved[31].

Implementation of this Guideline will be audited periodically at national level, with standards for this set by the NWIHP. Evaluation of the auditable standards should also be undertaken locally by senior hospital clinical management to support implementation.

31 Health Information Quality Authority (2012). National Standards for Safer Better Healthcare [Internet]. Available from: https://www.hiqa.ie/reports-and-publications/standard/national-standards-safer-better-healthcare

Chapter 8: Revision Plan

8.1 Procedure for the update of the Guideline

This guideline may need to be amended, updated, or revised as new evidence emerges. It will be reviewed at the national level every three years, or earlier if circumstances require it, and updated accordingly[32].

The Guideline Development Group will be asked to review the literature and recent evidence to determine if changes will be made to the existing Guideline. If the Guideline Development Group are unavailable, the GPT and the NWIHP senior management team will select a suitable expert to replace them.

If no amendments are required to the Guideline following the revision date, the details on the revision tracking box must still be updated, which will be a new version number and date.

The recommendations set out in this Guideline remain valid until a review has been completed.

8.2 Method for amending the Guideline

As new evidence becomes available, it is inevitable that Guideline recommendations will fall behind current evidence-based clinical practice. Therefore, it is essential that clinical guidelines are reviewed and updated as new evidence becomes available.

To request a review of this Guideline, one of the following criteria must be met:

a. 3 years since the Guideline was published

b. 3 years since the last review was conducted

c. Update required as a result of new evidence

Correspondence requesting a review of the Guideline should be submitted to the National Women and Infants Health Programme. Any such requests should be dealt with in a timely manner.

32 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

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Supporting Evidence

GRADE: http://www.gradeworkinggroup.org/

AGREE: http://www.agreetrust.org/agree-ii/

HSE: https://www.hse.ie/eng/about/who/qid/nationalframeworkdevelopingpolicies/

Glossary
(for the purpose of this guideline)

AGREE Appraisal of Guidelines for Research and Evaluation

ACOG American College of Obstetricians and Gynaecologists

BPM Beats Per Minute

BPP Biophysical Profile

CAG Clinical Advisory Group

CQ Clinical Question

CTG Cardiotocograph

DNA Did Not Attend

EAG Expert Advisory Group

EFM Electronic Fetal Monitoring

EFW Estimated Fetal Weight

ES Expert System

FBS Fetal Blood Sample

FHR Fetal Heart Rate

FSE Fetal Scalp Electrode

FSS Fetal Scalp Stimulation

GDG Guideline Developer Group

GPT Guideline Programme Team

GRADE Grading of Recommendations, Assessments, Developments and Evaluations

HCR Health Care Record

HIE Hypoxic Ischaemic Encephalopathy

HIQA Health Information and Quality Authority

HSE Health Service Executive

IA Intermittent Auscultation

ICM International Confederation of Midwives

IOG Institute of Obstetricians and Gynaecologists

FIGO International Federation of Gynaecology and Obstetrics

MBPP Modified Biophysical Profile

MHR Maternal Heart Rate

NICE National Institute for Health and Care Excellence

NICU Neonatal Intensive Care Unit

NCEC National Clinical Effectiveness Committee

NWIHP National Women and Infants Health Programme

PPPG Policy, Procedures, Protocols and Guidelines

RCT Randomised Controlled Trial

RANZCOG Royal Australian and New Zealand College of Obstetricians and Gynaecologists

RCOG Royal College of Obstetricians and Gynaecologists

RCPI Royal College of Physicians of Ireland

RR Relative Risk

SOGC Society of Obstetricians & Gynaecologists of Canada

STAN ST Waveform Analysis

WHO World Health Organisation

Appendix 1:
Expert Advisory Group Members 2024-

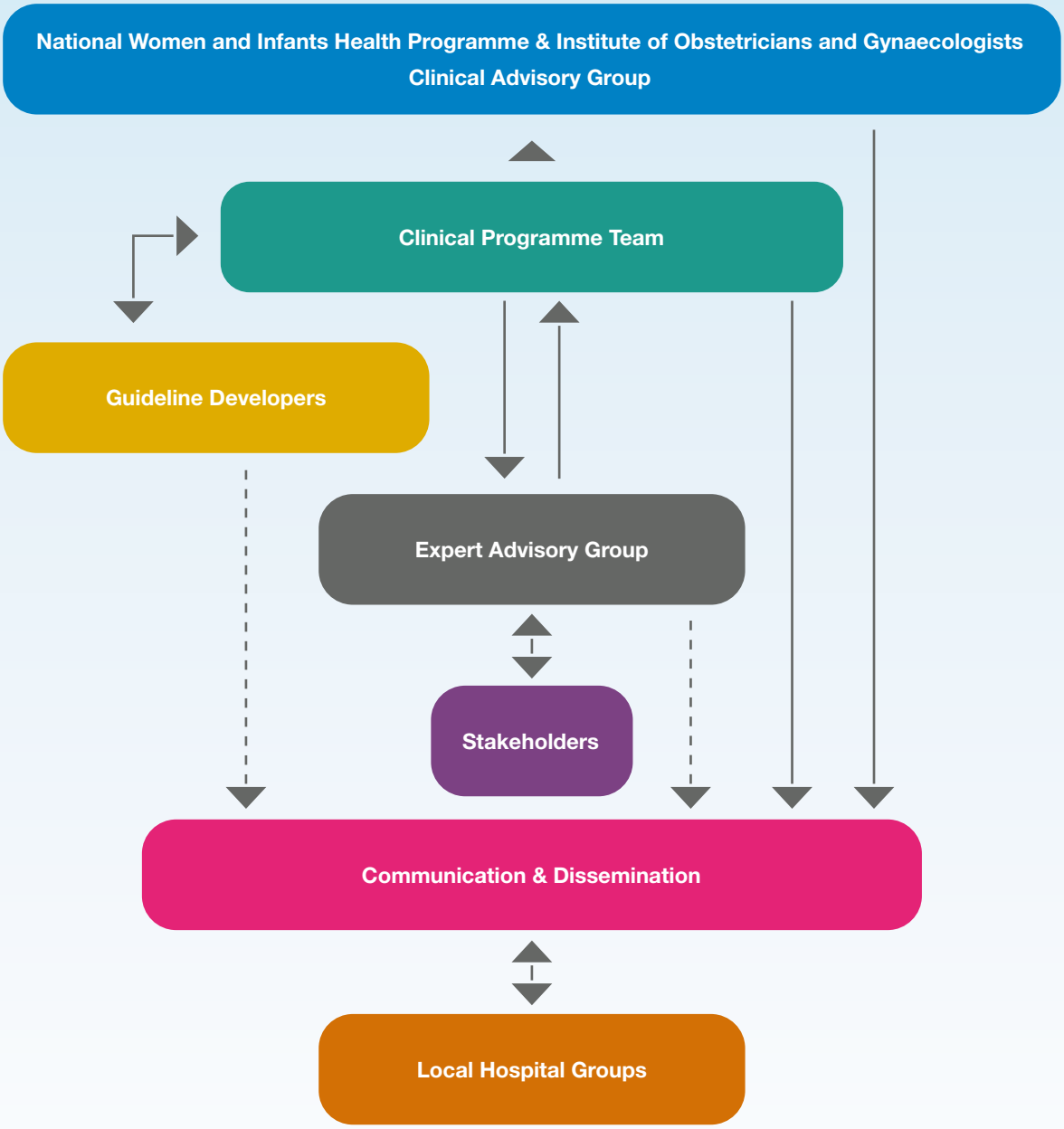
Member	Profession	Location
Dr Mairead Butler	Consultant Obstetrician and Gynaecologist	University Hospital Waterford
Dr Nicholas Barrett	Consultant Anaesthesiologist, Lead for Obstetric Anaesthesiology services	Limerick University Hospital
Dr Venita Broderick	Consultant Obstetrician and Gynaecologist	National Maternity Hospital Dublin
Ms Siobhan Canny	Group Director of Midwifery	Saolta University Health Care Group
Ms Triona Cowman	Director of the Centre for Midwifery Education	Centre for Midwifery Education, The Coombe Hospital
Ms Marie Culliton	Lab Manager/Chief Medical Scientist	National Maternity Hospital Dublin
Ms Niamh Connolly-Coyne *And* Ms Mandy Daly	Board of Directors Members *(Shared nomination)*	Irish Neonatal Health Alliance
Ms Sinéad Curran	Dietician Manager	National Maternity Hospital
Dr Niamh Conlon	Consultant Histopathologist	Cork University Hospital
Ms Georgina Cruise	National Manager	Patient Advocacy Service
Dr Orla Donohoe	Specialist Registrar, Obstetrics and Gynaecology and SWEC Fellow	St George Hospital, Sydney, Australia
Ms Alana Dineen	Senior Clinical Pharmacist	Cork University Maternity Hospital
Prof Maeve Eogan	Consultant Obstetrician and Gynaecologist National Clinical Lead SATU (HSE)	Rotunda Hospital, Dublin
Dr Brendan Fitzgerald	Consultant Perinatal Pathologist	Cork University Hospital
Dr Daniel Galvin	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital

Member	Profession	Location
Ms Stacey Grealis	Patient Research Partner	Independent Living Movement Ireland
Ms Fiona Hanrahan	Director of Midwifery and Nursing	Rotunda Hospital, Dublin
Ms Laura Harrington	Principal Medical Social Worker	National Maternity Hospital, Dublin
Ms Marita Hennessy	Post-Doctoral Researcher	Pregnancy Loss Research Group, INFANT Centre, University College Cork
Ms Caroline Joyce	Principal Clinical Biochemist PhD Candidate	Cork University Hospital University College Cork
Dr Chaitra Jairaj	Consultant Perinatal Psychiatrist	The Coombe Hospital, Dublin Midland Regional Hospital Portlaoise
Dr Cathy Monteith	Consultant Obstetrician and Gynaecologist	Our Lady of Lourdes Hospital Drogheda
Prof John Murphy	Consultant Neonatologist Clinical Lead for the National Clinical Programme for Paediatrics and Neonatology	National Women and Infants Health Programme
Ms Janet Murphy	Advanced Midwifery Practitioner	University Hospital Waterford
Dr Jill Mitchell	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital
Dr Aisling McDonnell	Specialist Registrar, Obstetrics and Gynaecology	Mater Misericordiae University Hospital Dublin
Dr Ciara McCarthy	General Practitioner ICGP and NWIHP Women's Health Lead	Irish College of General Practitioners
Ms Orla McCarthy	Clinical Specialist Physiotherapist in Pelvic Health	Cork University Maternity Hospital
Dr Donough J. O'Donovan	Director Neonatal Intensive Care Unit Consultant Neonatologist/Paediatrician	University College Hospital Galway

Member	Profession	Location
Mr Fergal O' Shaughnessy *And* Dr Brian Cleary *(Shared nomination)*	Senior Pharmacist, Honorary Lecturer *And* Chief Pharmacist, Honorary Clinical Associate Professor and Medications Lead, Maternal and Newborn Clinical Management System	Rotunda Hospital Dublin Royal College of Surgeons in Ireland
Dr Gillian Ryan	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Prof Valerie Smith	Chair of Midwifery	University College Dublin
Ms Nora Vallejo	Advanced Midwife Practitioner	The Coombe Hospital, Dublin

Member 2021-2023	Profession	Location
Dr Katherine Astbury	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Dr Richard Duffy	Consultant Perinatal Psychiatrist	Rotunda Hospital Dublin
Ms Clare Farrell	Physiotherapy Manager	Coombe Women and Infants University Hospital, Dublin
Ms Marie Finn	Medical Social Work Counsellor	Saolta University Health Care Group
Prof Declan Keane	Consultant Obstetrician, Gynaecologist, *Professor of* Obstetrics and Gynaecology	National Maternity Hospital Dublin, Royal College of Surgeons in Ireland
Ms Áine Kelly	Physiotherapy Manager	The Coombe Hospital, Dublin
Dr Fergus McCarthy	Consultant Obstetrician, Gynaecologist	Cork University Maternity Hospital, University College Cork
Dr Sarah Petch	Specialist Registrar, Obstetrics and Gynaecology	National Maternity Hospital Dublin
Ms Margaret Quigley	National Lead for Midwifery	Office of Nursing and Midwifery Services Director

Appendix 2:
Guideline Programme Process



Appendix 3: **Stakeholder review and contribution**

Representatives from the Maternity Services, Tipperary University Hospital
Representatives from the National Maternity Hospital, Dublin
Representatives from the School of Nursing and Midwifery, Trinity College Dublin
Representatives from the Maternity Services, University Hospital Kerry
Representatives from the Women and Infants Services, Sligo University Hospital
Representatives from the Maternity Services, Wexford General Hospital
Siobhan Canny – Saolta Hospital Group Director of Midwifery
Representatives from the University Maternity Hospital Limerick
Representatives from Our Lady of Lourdes Hospital, Louth Hospitals
Representatives from University College Dublin – School of Nursing, Midwifery and Health Systems
Representatives from The Coombe Hospital, Dublin
Representatives from the School of Nursing and Midwifery, Dundalk Institute of Technology

Appendix 4: **Methods of Fetal Heart Rate Monitoring**

Methods of Fetal Heart Rate Monitoring	
Pinard	A hollow, cylindrical shape, made typically from wood, plastic or metal. It amplifies sound associated with the closing of the fetal heart valves sounds, via bone conduction in real time [152].
Doppler	A small hand-held ultrasound device that uses ultrasound technology to detect heart motion, such as the moving heart walls or valves. The Doppler converts the information into a sound that represents cardiac events [152].
Cardiotocograph (CTG)	A continuous electronic record of the FHR obtained via an ultrasound transducer placed on the woman's abdomen over the anterior shoulder of the fetus (external or indirect CTG). A second transducer is placed on the woman's abdomen over the uterine fundus to record simultaneously the presence of any uterine activity. Both FHR and uterine activity are traced simultaneously and recorded either on a paper strip and/or electronically [12].

Appendix 5: **Procedure for undertaking Fetal Heart Rate (FHR) monitoring**

Procedure for undertaking FHR monitoring	
5.1 Antenatal FHR monitoring	
5.1.1 Auscultation of the FH	Using a Pinard or Doppler, the fetal heart (FH) should be auscultated for at least 60 seconds preceded by an abdominal palpation, fundal height measurement and discussion on fetal movements. The baseline FHR of 110 to 160 bpm should be considered as normal. The maternal pulse should be palpated simultaneously to differentiate between the maternal and fetal heart rates.
5.1.2 Antenatal CTG	Prior to commencing a CTG, fetal life should be confirmed by independent means, by auscultating the FH with a Pinard or Doppler as described above. Ensure the woman is sitting or lying in a semi-reclined position. Position the ultrasound transducer to record the FHR. Ensure that the paper speed of 1cm per minute is set. Position the toco and reference the UA channel to ensure any uterine activity is recorded. Provide the woman with the event/movement marker with instructions to press it when a fetal movement is felt. This places an annotation onto the CTG so the FHR can be compared to fetal movements. In the event of monitoring multiple pregnancies, use the offsetting function on the CTG. This separates the baselines by an offset of 20 bpm by switching on trace separation [95].
5.2 Intrapartum FHR monitoring	
5.2.1 Initial assessment using IA	Perform an abdominal palpation to determine the fetal lie, position, presentation and descent in order to ascertain the optimum position for auscultation of the fetal heart. Using either a Pinard or Doppler, auscultate the FH during fetal movement in order to exclude chronic hypoxia. If there are no spontaneous movements at this time, auscultate immediately following an abdominal palpation – an acceleration should be anticipated following stimulation, and the presence of chronic hypoxia can be excluded[46]. In order to determine the baseline FHR, auscultate the FH for at least one minute between contractions and count the rate, excluding accelerations. A single figure should be documented in bpm. The baseline FHR should rate between 110-160 bpm. No decelerations should be heard.

Procedure for undertaking FHR monitoring	
	If using a Doppler for auscultation, do not rely on the range shown on the screen, as there have been instances where the machine has miscalculated the FHR [153 154].
5.2.2 Intrapartum Intermittent Auscultation	Palpate the maternal pulse simultaneously from the FHR to differentiate between the two heart rates. The baseline FHR should range between 110 and 160 bpm. Palpate the maternal pulse simultaneously from the FHR to differentiate between the two heart rates. This should be done on the initiation of each auscultation. Record the FH as a single rate on a partogram and/or in the HCR.
5.2.3 Intrapartum CTG monitoring	Prior to commencing a CTG, fetal life should be confirmed by independent means, by auscultating the FH with a Pinard or Doppler as described previously. Position the ultrasound transducer to record the FHR. Ensure that the paper speed of 1cm per minute is set. Position the toco and reference the UA channel to ensure any uterine activity is recorded. In the event of monitoring multiple pregnancies, use the offsetting function on the CTG. This separates the baselines by an offset of 20 bpm by switching on trace separation [95].

Appendix 6: **Patient Information Leaflet**

This information is intended to complement a discussion with the midwives and doctors caring for you and the type of fetal heart rate monitoring that is right for you and your baby.

What is fetal heart rate monitoring, and why is it offered?

Monitoring your baby's heartbeat (fetal heart rate monitoring) is a way of assessing your baby's well-being. It does not tell what will happen during birth, but gives a picture of how your baby is doing right now. Fetal monitoring may help identify changes in your baby's normal heart rate.

How do we listen to your baby's heartbeat and when will you have fetal monitoring?

There are two types of monitoring the fetal heart rate.

1. With a handheld Doppler or a Pinard stethoscope

A handheld **Doppler** (also called a sonicaid) is a battery-operated ultrasound device that is placed on your abdomen (tummy). You can hear the heartbeat through the device's speakers. It is waterproof and can be used in a birthing pool.

A **Pinard** stethoscope is a non-electrical device shaped like a small trumpet. One end is placed on your tummy, and the midwife listens to your baby's heartbeat by putting their ear to the other end. Only the midwife using the Pinard will hear your baby's heartbeat.

Using a handheld Doppler or a Pinard in pregnancy

We can listen to your baby's heartbeat with a Doppler or Pinard during your pregnancy. The National Clinical Guideline on Fetal Heart Rate Monitoring (2025) recommends offering this from 23 weeks of pregnancy. This means that from 23 weeks of pregnancy, we will offer to listen to your baby's heartbeat when you attend antenatal appointments or if you are admitted to hospital.

Using a handheld Doppler or a Pinard in labour

If your labour is low-risk and has no complications, we can use a handheld Doppler or a Pinard to check your baby's heartbeat. This is called intermittent auscultation or 'listening in'. It is the recommended way to monitor your baby's heartbeat if you are in labour between 37 weeks and 42 weeks pregnant and do not have any complications in your pregnancy or labour.[1]

Intermittent auscultation lets you move about freely in labour because you are not connected to a machine with cables. This type of monitoring can be done at home or in the hospital. Each time we check your baby's heartbeat, we will listen for one minute. We do this right after a contraction, at regular times during labour, as it is the best time to see how your baby is coping with labour.

There is a lack of high-quality studies showing clear short- and long-term health benefits of fetal heart rate monitoring for mothers and babies. Research shows that using a Doppler picks up more changes in the baby's heartbeat than using a Pinard, but this can lead to more caesarean section births without showing any clear improvement in the baby's outcome.[2]

How often we listen to your baby's heartbeat depends on your labour progress. The National Guideline on fetal monitoring recommends listening to the baby's heartbeat every 15 minutes in the first stage of labour and at least every 5 minutes in the second stage of labour.[1]

If there are any worrying changes in your baby's heartbeat, we will recommend continuous CTG monitoring. This might continue until your baby is born. However, if there are no concerns with your baby's heartbeat, we may offer to return to listening in at regular intervals instead.

2. CTG Monitoring (cardiotocograph)

CTG monitoring is a continuous recording of your baby's heartbeat.

Two discs are placed on your tummy and are held in place by two belts. One disc records the baby's heartbeat and the other records your contractions. Usually, these discs are connected to the CTG with wires, but more maternity units now have wireless options so that you can move around easily during labour.

Having a CTG during pregnancy

If you attend the Delivery Suite/Labour Ward, Day Assessment, or are admitted to the Antenatal Ward with a pregnancy-related issue, CTG monitoring may be recommended. The decision to offer CTG monitoring will depend on how far along you are in your pregnancy.

It is recommended that if you are 28 weeks pregnant or more and are in hospital with a pregnancy-related concern, you should be offered CTG monitoring.[1]

If you are between 26 weeks and less than 28 weeks pregnant and are in hospital with a pregnancy-related concern, your obstetrician will decide whether CTG monitoring is needed based on your specific situation.[1]

Having a CTG during labour

If you have any complications in your pregnancy, such as needing to be induced, having high blood pressure, or concerns about your baby's growth, you may be advised to have CTG monitoring during labour. This type of monitoring can only be done in the hospital. While you can stand, move around the bed, and change positions, your ability to move freely might be limited because the discs that monitor the baby's heartbeat are connected to the monitor with cables. Some hospitals offer wireless CTG monitoring, which allow you to move around more freely or even use the birthing pool. Talk to your midwife or doctor if you would like to know more about using wireless options.

A large review of studies compared CTG versus intermittent auscultation and looked at women who had straightforward pregnancies and women who had complications, like high blood pressure or concerns about the baby's growth. The review found that both methods were equally good when it came to the baby's long-term outcomes. There was no difference in the number of babies who died during or shortly after birth (about one in 300). Fits or seizures in babies were rare (about one in 500 births) but less likely when CTG monitoring was used. There was no difference in the rate of cerebral palsy. However, using continuous CTG monitoring was linked to more caesarean births and assisted vaginal births (like forceps or vacuum), which carry risks for the mother.[3]

Sometimes it may be difficult to monitor your baby's heartbeat so we may recommend using a fetal scalp electrode (FSE), also called a 'clip'. This is a small spiral that is attached to the skin on your baby's head. It stays in place during labour and gives a more accurate reading of your baby's heartbeat. The wire is connected to the CTG monitor and is removed as your baby is born.

Decision-making about fetal monitoring

Your midwife or doctor will recommend a type of monitoring for you, taking into account any risk factors and your preferences. This plan might change as labour goes on, but any changes will be discussed with you. Their advice follows the national fetal heart rate monitoring guideline.[1] If you decide to decline the recommended type of fetal monitoring, it is important that you have a discussion with your midwife or doctor during your pregnancy.

If you have any questions, write them down and talk to your midwife or doctor at your next appointment.

The national guideline for fetal heart rate monitoring can be accessed here

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2. Martis R, Emilia O, Nurdiati DS, Brown J. Intermittent auscultation (IA) of fetal heart rate in labour for fetal well-being. Cochrane Database of Systematic Reviews 2017, Issue 2. Art. No.: CD008680. DOI: 10.1002/14651858.CD008680.pub2
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Appendix 7:
Antenatal CTG proforma

Antenatal CTG proforma (sample) – not for intrapartum use			
ANTENATAL CTG: Analysis from __ __:__ __hrs to __ __:__ __hrs			**Date:**
Gestation:	**Risk factors:**	**Indication for CTG:**	**Maternal pulse:**
Fetal Movements	**Membranes ruptured**	**Meconium**	**Uterine activity**
☐ Normal ☐ Reduced ☐ Change in movement	☐ Yes Date: _____ Time: _____ ☐ No	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No
ANTEPARTUM CTG	**Reassuring**	**Non-Reassuring**	
Baseline rate	110-160bpm **Rate:**	Less than 110bpm **Rate:** Greater than 160bpm **Rate:** Unstable/difficult to determine ☐	
Variability	At least 5bpm **Rate:**	**Less than** 5bpm for **more than** 50 mins	
Accelerations	Present	None for greater than 50 mins	
Decelerations	None	Unprovoked decelerations Decelerations related to uterine tightening (not in labour)	
Classification **(Tick one)**	**CTG NORMAL ☐** **(All 4 features normal)**	**CTG ABNORMAL ☐** **(1 or more non-reassuring features)**	
Clinical Management Plan			
Signed: _____ Print: _____ Designation: _____			

Appendix 8: **Intrapartum CTG proforma**

Intrapartum CTG proforma (sample) – not to be used in the antepartum period				
Date:	**Time:**	**Mat. Pulse:**	**Previous FH baseline rate:**	**New risk factors: Y/N**
Contractions:	☐ < 5 in 10 mins	☐ 5 or more in 10 min **or** ☐ hypertonus		
Baseline Rate	☐ 110-160 bpm _____ bpm	☐ increase of 20 bpm or more **or** ☐ 100-109 bpm **or** ☐ Unable to determine baseline		☐ Baseline below 100 bpm **or** ☐ Above 160 bpm **or** ☐ Increase of 20 bpm in active 2nd stage
Variability	☐ 5-25 bpm	☐ < 5bpm for 30 min with risk factors **or** ☐ < 5bpm for 50 min without risk factors **or** ☐ > 25 bpm for up to 10 min		☐ < 5bpm for more than 50 mins **or** ☐ > 25 bpm for >10 mins **or** ☐ Sinusoidal
Decelerations	☐ None **or** ☐ Early **or** ☐ Variable without concerning features	☐ Repetitive variable with **any** concerning features < 30 mins **or** ☐ Variable with **any** concerning features for > 30 mins **or** ☐ Repetitive late decelerations <30 mins		☐ Repetitive variable with **any** concerning features > 30 mins **or** ☐ Repetitive late decelerations for > 30 mins **or** ☐ Acute bradycardia **or** ☐ Single prolonged deceleration ≥ 3mins
		* repetitive defined as decelerations occur over 50% of contractions		
Overall Classification	**NORMAL (all features are green)**	**SUSPICIOUS (any one feature is yellow)**		**PATHOLOGICAL (any one red, or 2 or more yellow)**
Signed: _____ Print: _____ Designation: _____				

Appendix 9: AGREE II checklist[33]

AGREE Reporting Checklist 2016

This checklist is intended to guide the reporting of Clinical Practice Guidelines.

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
DOMAIN 1: SCOPE AND PURPOSE		
1. OBJECTIVES *Report the overall objective(s) of the guideline. The expected health benefits from the guideline are to be specific to the clinical problem or health topic.*	☐ Health intent(s) (i.e., prevention, screening, diagnosis, treatment, etc.) ☐ Expected benefit(s) or outcome(s) ☐ Target(s) (e.g., patient population, society)	
2. QUESTIONS *Report the health question(s) covered by the guideline, particularly for the key recommendations.*	☐ Target population ☐ Intervention(s) or exposure(s) ☐ Comparisons (if appropriate) ☐ Outcome(s) ☐ Health care setting or context	
3. POPULATION *Describe the population (i.e., patients, public, etc.) to whom the guideline is meant to apply.*	☐ Target population, sex and age ☐ Clinical condition (if relevant) ☐ Severity/stage of disease (if relevant) ☐ Comorbidities (if relevant) ☐ Excluded populations (if relevant)	
DOMAIN 2: STAKEHOLDER INVOLVEMENT		
4. GROUP MEMBERSHIP *Report all individuals who were involved in the development process. This may include members of the steering group, the research team involved in selecting and reviewing/ rating the evidence and individuals involved in formulating the final recommendations.*	☐ Name of participant ☐ Discipline/content expertise (e.g., neurosurgeon, methodologist) ☐ Institution (e.g., St. Peter's hospital) ☐ Geographical location (e.g., Seattle, WA) ☐ A description of the member's role in the guideline development group	

33 AGREE Reporting Checklist is available on the AGREE Enterprise website, a free and open access resource to support the practice guideline field (www.agreetrust.org)

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
5. TARGET POPULATION PREFERENCES AND VIEWS *Report how the views and preferences of the target population were sought/considered and what the resulting outcomes were.*	☐ Statement of type of strategy used to capture patients'/publics' views and preferences (e.g., participation in the guideline development group, literature review of values and preferences) ☐ Methods by which preferences and views were sought (e.g., evidence from literature, surveys, focus groups) ☐ Outcomes/information gathered on patient/public information ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
6. TARGET USERS *Report the target (or intended) users of the guideline.*	☐ The intended guideline audience (e.g. specialists, family physicians, patients, clinical or institutional leaders/administrators) ☐ How the guideline may be used by its target audience (e.g., to inform clinical decisions, to inform policy, to inform standards of care)	
DOMAIN 3: RIGOUR OF DEVELOPMENT		
7. SEARCH METHODS *Report details of the strategy used to search for evidence.*	☐ Named electronic database(s) or evidence source(s) where the search was performed (e.g., MEDLINE, EMBASE, PsychINFO, CINAHL) ☐ Time periods searched (e.g., January 1, 2004 to March 31, 2008) ☐ Search terms used (e.g., text words, indexing terms, subheadings) ☐ Full search strategy included (e.g., possibly located in appendix)	
8. EVIDENCE SELECTION CRITERIA *Report the criteria used to select (i.e., include and exclude) the evidence. Provide rationale, where appropriate.*	☐ Target population (patient, public, etc.) characteristics ☐ Study design ☐ Comparisons (if relevant) ☐ Outcomes ☐ Language (if relevant) ☐ Context (if relevant)	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
9. STRENGTHS & LIMITATIONS OF THE EVIDENCE *Describe the strengths and limitations of the evidence. Consider from the perspective of the individual studies and the body of evidence aggregated across all the studies. Tools exist that can facilitate the reporting of this concept.*	☐ Study design(s) included in body of evidence ☐ Study methodology limitations (sampling, blinding, allocation concealment, analytical methods) ☐ Appropriateness/relevance of primary and secondary outcomes considered ☐ Consistency of results across studies ☐ Direction of results across studies ☐ Magnitude of benefit versus magnitude of harm ☐ Applicability to practice context	
10. FORMULATION OF RECOMMENDATIONS *Describe the methods used to formulate the recommendations and how final decisions were reached. Specify any areas of disagreement and the methods used to resolve them.*	☐ Recommendation development process (e.g., steps used in modified Delphi technique, voting procedures that were considered) ☐ Outcomes of the recommendation development process (e.g., extent to which consensus was reached using modified Delphi technique, outcome of voting procedures) ☐ How the process influenced the recommendations (e.g., results of Delphi technique influence final recommendation, alignment with recommendations and the final vote)	
11. CONSIDERATION OF BENEFITS AND HARMS *Report the health benefits, side effects, and risks that were considered when formulating the recommendations.*	☐ Supporting data and report of benefits ☐ Supporting data and report of harms/side effects/risks ☐ Reporting of the balance/trade-off between benefits and harms/side effects/risks ☐ Recommendations reflect considerations of both benefits and harms/side effects/ risks	
12. LINK BETWEEN RECOMMENDATIONS AND EVIDENCE *Describe the explicit link between the recommendations and the evidence on which they are based.*	☐ How the guideline development group linked and used the evidence to inform recommendations ☐ Link between each recommendation and key evidence (text description and/or reference list) ☐ Link between recommendations and evidence summaries and/or evidence tables in the results section of the guideline	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
13. EXTERNAL REVIEW *Report the methodology used to conduct the external review.*	☐ Purpose and intent of the external review (e.g., to improve quality, gather feedback on draft recommendations, assess applicability and feasibility, disseminate evidence) ☐ Methods taken to undertake the external review (e.g., rating scale, open-ended questions) ☐ Description of the external reviewers (e.g., number, type of reviewers, affiliations) ☐ Outcomes/information gathered from the external review (e.g., summary of key findings) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations (e.g., guideline panel considered results of review in forming final recommendations)	
14. UPDATING PROCEDURE *Describe the procedure for updating the guideline.*	☐ A statement that the guideline will be updated ☐ Explicit time interval or explicit criteria to guide decisions about when an update will occur ☐ Methodology for the updating procedure	
DOMAIN 4: CLARITY OF PRESENTATION		
15. SPECIFIC AND UNAMBIGUOUS RECOMMENDATIONS *Describe which options are appropriate in which situations and in which population groups, as informed by the body of evidence.*	☐ A statement of the recommended action ☐ Intent or purpose of the recommended action (e.g., to improve quality of life, to decrease side effects) ☐ Relevant population (e.g., patients, public) ☐ Caveats or qualifying statements, if relevant (e.g., patients or conditions for whom the recommendations would not apply) ☐ If there is uncertainty about the best care option(s), the uncertainty should be stated in the guideline	
16. MANAGEMENT OPTIONS *Describe the different options for managing the condition or health issue.*	☐ Description of management options ☐ Population or clinical situation most appropriate to each option	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
17. IDENTIFIABLE KEY RECOMMENDATIONS *Present the key recommendations so that they are easy to identify.*	☐ Recommendations in a summarized box, typed in bold, underlined, or presented as flow charts or algorithms ☐ Specific recommendations grouped together in one section	
DOMAIN 5: APPLICABILITY		
18. FACILITATORS AND BARRIERS TO APPLICATION *Describe the facilitators and barriers to the guideline's application.*	☐ Types of facilitators and barriers that were considered ☐ Methods by which information regarding the facilitators and barriers to implementing recommendations were sought (e.g., feedback from key stakeholders, pilot testing of guidelines before widespread implementation) ☐ Information/description of the types of facilitators and barriers that emerged from the inquiry (e.g., practitioners have the skills to deliver the recommended care, sufficient equipment is not available to ensure all eligible members of the population receive mammography) ☐ How the information influenced the guideline development process and/or formation of the recommendations	
19. IMPLEMENTATION ADVICE/TOOLS *Provide advice and/or tools on how the recommendations can be applied in practice.*	☐ Additional materials to support the implementation of the guideline in practice. For example: • Guideline summary documents • Links to check lists, algorithms • Links to how-to manuals • Solutions linked to barrier analysis (see Item 18) • Tools to capitalize on guideline facilitators (see Item 18) • Outcome of pilot test and lessons learned	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
20. RESOURCE IMPLICATIONS *Describe any potential resource implications of applying the recommendations.*	☐ Types of cost information that were considered (e.g., economic evaluations, drug acquisition costs) ☐ Methods by which the cost information was sought (e.g., a health economist was part of the guideline development panel, use of health technology assessments for specific drugs, etc.) ☐ Information/description of the cost information that emerged from the inquiry (e.g., specific drug acquisition costs per treatment course) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
21. MONITORING/ AUDITING CRITERIA *Provide monitoring and/or auditing criteria to measure the application of guideline recommendations.*	☐ Criteria to assess guideline implementation or adherence to recommendations ☐ Criteria for assessing impact of implementing the recommendations ☐ Advice on the frequency and interval of measurement ☐ Operational definitions of how the criteria should be measured	
DOMAIN 6: EDITORIAL INDEPENDENCE		
22. FUNDING BODY *Report the funding body's influence on the content of the guideline.*	☐ The name of the funding body or source of funding (or explicit statement of no funding) ☐ A statement that the funding body did not influence the content of the guideline	
23. COMPETING INTERESTS *Provide an explicit statement that all group members have declared whether they have any competing interests.*	☐ Types of competing interests considered ☐ Methods by which potential competing interests were sought ☐ A description of the competing interests ☐ How the competing interests influenced the guideline process and development of recommendations	

From: Brouwers MC, Kerkvliet K, Spithoff K, on behalf of the AGREE Next Steps Consortium. The AGREE Reporting Checklist: a tool to improve reporting of clinical practice guidelines. BMJ 2016;352:i1152. doi: 10.1136/bmj.i1152.

For more information about the AGREE Reporting Checklist, please visit the AGREE Enterprise website at http://www.agreetrust.org

Appendix 10: Grade of Recommendations[34]

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1A. Strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Consistent evidence from well-performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Strong recommendations can apply to most patients in most circumstances without reservation. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We strongly recommend… We recommend that …should be performed/ administered… We recommend that …. is indicated/ beneficial/ effective…
1B. Strong recommendation, moderate-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Strong recommendation and applies to most patients. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We recommend… We recommend that … should be performed/ administered… We recommend that … is (usually) indicated/ beneficial/ effective…

34 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. https://pubmed.ncbi.nlm.nih.gov/23978245/

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1C. Strong recommendation, low-quality evidence	Benefits appear to outweigh risk and burdens, or vice versa	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain	Strong recommendation that applies to most patients. Some of the evidence base supporting the recommendation is, however, of low quality	We recommend… We recommend that … should be performed/ administered… We recommend that … Is (maybe) indicated/ beneficial/ effective…
2A. Weak recommendation, high-quality evidence	Benefits closely balanced with risks and burdens	Consistent evidence from well-performed randomized, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Weak recommendation: best action may differ depending on circumstances or patients or societal values	We suggest… We suggest that… may/might be reasonable...
2B. Weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burdens, some uncertainty in the estimates of benefits, risks and burdens	Evidence from randomized, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Weak recommendation; alternative approaches likely to be better for some patients under some circumstances	We suggest… We suggest that … may/might be reasonable...

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
2C. Weak recommendation, low-quality evidence	Uncertainty in the estimates of benefits, risks, and burdens; benefits may be closely balanced with risks and burdens	Evidence from observational studies, unsystematic clinical experience, or from randomized, controlled trials with serious flaws. Any estimate of effect is uncertain	Very weak recommendation: other alternatives may be equally reasonable	We suggest … is an option We suggest that … may/might be reasonable.
Best practice	A recommendation that is sufficiently obvious that the desirable effects outweigh undesirable effects, despite the absence of direct evidence, such that the grading of evidence is unnecessary			We recommend… We recommend that … should be performed/ administered… We recommend that… Is usually) indicated/ beneficial/effective

Appendix 11: **NWIHP/IOG CAG membership (2024)**

Dr Cliona Murphy (Chair, 2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Director, National Women and Infants Health Programme.

Dr Venita Broderick (2024-). Clinical Lead Gynaecology, National Women and Infants Health Programme.

Dr Brian Cleary (2023-). Chief Pharmacist, Rotunda Hospital. Medications Lead, Maternal and Newborn Clinical Management System Project.

Angela Dunne (2023-). Director of Midwifery, National Women and Infants Health Programme.

Prof Seán Daly (2023-). Master, Consultant Obstetrician and Gynaecologist, Rotunda Hospital.

Prof Maeve Eogan (2023-). Consultant Obstetrician and Gynaecologist, Rotunda Hospital. Clinical Lead, Sexual Assault Treatment Units, National Women and Infants Health Programme.

Prof Richard Greene (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, National Perinatal Epidemiology Centre, University College Cork.

Prof John Higgins (2023-). Cork University Maternity Hospital, Consultant Obstetrician and Gynaecologist, Clinical Director, Ireland South Women and Infants Directorate.

Prof Shane Higgins (2023-). Master, Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Dr Mendinaro Imcha (2023-). Clinical Director, Consultant Obstetrician and Gynaecologist, University Maternity Hospital Limerick.

Prof John Murphy (2023-). Clinical Lead Neonatology, National Women and Infants Health Programme.

Dr Aoife Mullaly (2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Lead, Termination of Pregnancy Services, National Women and Infants Health Programme.

Prof John Morrison (2023-). Consultant Obstetrician and Gynaecologist, University Hospital Galway. Clinical Director, Saolta Maternity Directorate.

Kilian McGrane (2023-). Director, National Women and Infants Health Programme.

Prof Keelin O'Donoghue (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Lead, National Guidelines, National Women and Infants Health Programme.

Dr Suzanne O'Sullivan (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Director of Education and Training, Obstetrics and Gynaecology, Institute of Obstetricians and Gynaecologists. Chair, Institute of Obstetricians and Gynaecologists.

Prof Mike O'Connell (2023-). Master, Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital.

Ms Davinia O'Donnell (2024-). General Manager | National Women and Infants Health Programme.

Dr Vicky O'Dwyer (2023-). Consultant Obstetrician and Director of Gynaecology, Rotunda Hospital.

Dr Mairead O'Riordan (2024-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital.

Dr Fergal O'Shaughnessy (2025-) Senior Pharmacist, Rotunda Hospital.

Prof Nóirín Russell (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, Cervical Check.

Dr Carmen Regan (April 2024). Clinical Lead Obstetrics, National Women and Infants Health Programme.

Dr Orla Shiel (2024-). Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Ms Clare Thompson (2023-). Consultant Gynaecological Oncologist, The Mater, Dublin.