

1. Introduction and Who Guideline applies to

Cardiotocography (CTG) is a widely used tool for fetal assessment in the antenatal period. At present antenatal CTG is not thought to be useful as a method of routine fetal assessment in low risk pregnancies and its use in the antenatal period implies that a risk factor has been identified.

The most recent systematic review on Antenatal Cardiotocography for fetal assessment in high risk pregnancies (Cochrane 2015) concluded that:

- Comparison of traditional CTG versus no CTG showed no significant difference identified in perinatal mortality or potentially preventable deaths.
- Similarly, there was no significant difference identified in caesarean sections.
- However, comparison of computerised CTG versus traditional CTG showed a significant reduction in perinatal mortality with computerised CTG.

A normal CTG (traditional or computerised) is only a clinical diagnostic tool and cannot be used as a predictive or screening test. It only indicates current fetal state and it cannot predict catastrophes such as sudden abruption.

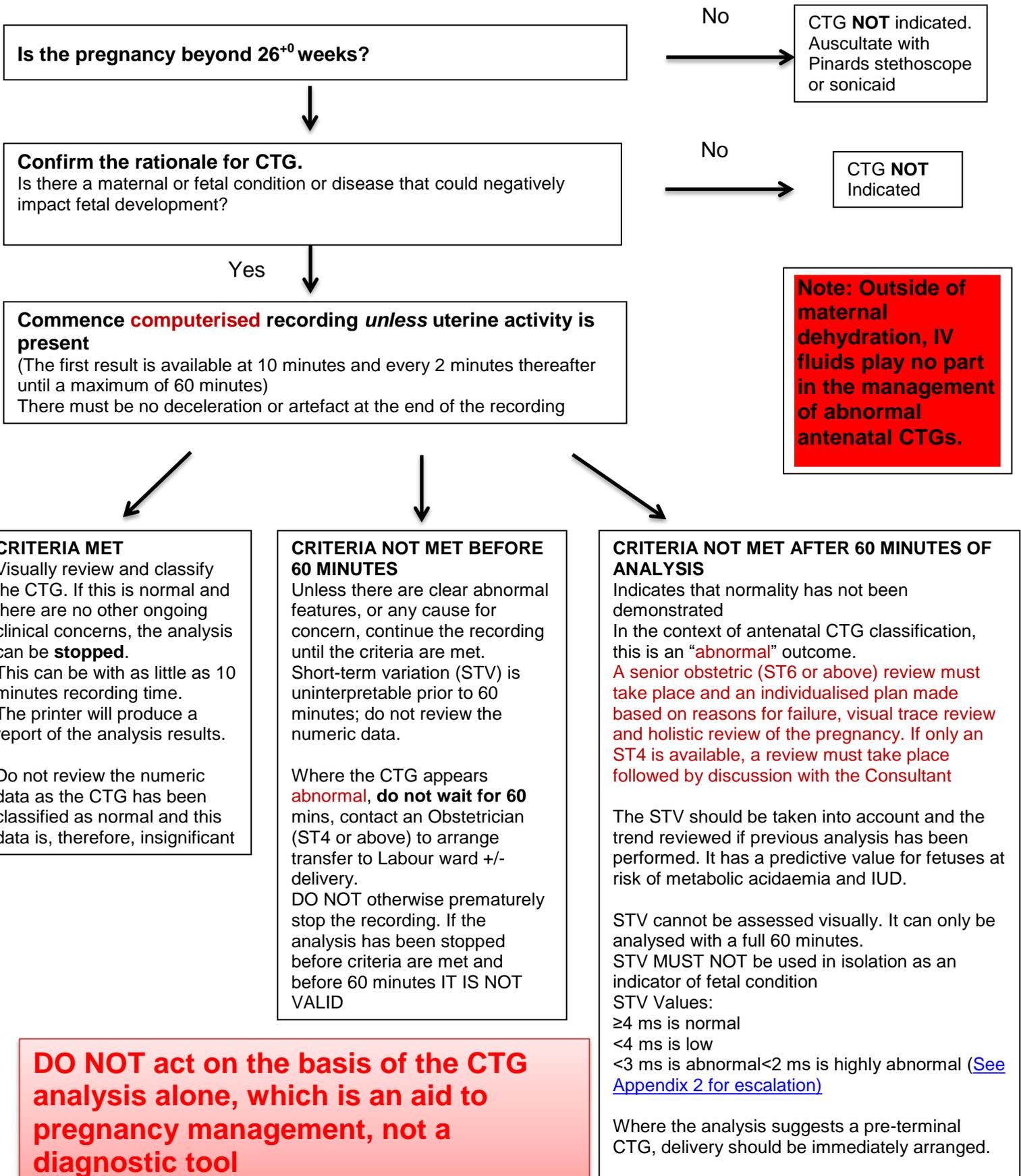
Related documents:

[Maternity Assessment Guideline](#)
[Reduced Fetal Movements Guideline](#)
[Multiple Pregnancy Guideline](#)

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Flow Chart for commencing Dawes/Redman CTG



N.B. if it is proving impossible to obtain a trace of interpretable quality after 10 minutes, without an obvious reason (i.e. significantly raised BMI, excessive fetal movements) Review entire clinical presentation and escalate concerns.

Antenatal Cardiotocography

Fetal monitoring may be carried out antepartum either on an in-patient or outpatient basis for on-going surveillance of the fetus. All women who present with an antepartum problem should have at least auscultation of the fetal heart at any gestation. If there is clinical indication then computerised electronic fetal monitoring should be performed. It must be noted that computerised CTG is contraindicated in the presence of uterine activity.

CTG should only be performed in the antenatal period for fetal surveillance as per clinical indications. *All Women will be offered computerised CTG if a CTG is indicated in the antenatal period. If a computerised CTG is not available a traditional CTG should be used.*

Following Propess, Prostin or ARM, a traditional CTG should be used (see Intrapartum fetal heart rate monitoring).

Exceptions can be made on an individual basis by the obstetric consultant.

Key Points

- Outside of maternal dehydration IV fluids play no part in the management of abnormal antenatal CTG's
- If it is proving impossible to obtain a trace of interpretable quality after 10 minutes without an obvious reason → escalate
- If criteria is not met before 60 minutes but appears abnormal do not wait for 60 minutes → escalate and continue monitoring

Indications for an antenatal CTG

Maternal – pre-existing	Maternal – Gestational	Fetal
Cardiac Disease	GDM	Reduced fetal movements
Pulmonary Disease	Pre-eclampsia	IUGR
Renal Disease	PPROM	Infection
Thyroid Disease	Prolonged Rupture of Membranes ≥ 24 hours pre-labour unless delivery is imminent	Multiple pregnancy
Autoimmune Disease	Vaginal bleeding	Fetal arrhythmias
Raised BP	Abdominal Trauma	Oligohydramnios
Diabetes	Suspected pre-term labour	ECV

The list is not final, there may be other concerns that you will need to monitor the fetus for.

Documentation and CTG Storage

- Rationale for antenatal CTG documented in maternal notes.
- **Computerised CTG**- Enter Name, S number and Gestation, manually write maternal pulse on CTG. The CTG must be left to run to allow the breakdown to be printed.

It should be documented in the health record that the **computerised** criteria has been met or not met and the length of time it took to meet. The antenatal CTG stickers should not be used, the fetal heart rate baseline should be documented in the handheld records after every CTG.

Traditional (Non computerised CTG) - At the start of the CTG, use Start of CTG sticker. Check printing speed 1cm/min

The CTG should run for a minimum of 30 mins

At the end of the CTG Use the Antenatal CTG sticker to document findings

Antenatal CTG Proforma		University Hospitals of Leicester NHS Trust	
	Reassuring	Non-Reassuring	
Baseline rate (bpm)	110 - 160 Rate:	Less than 109	Rate:
		More than 161	Rate:
		Sinusoidal pattern for 10 minutes or more	
N.B Rising baseline rate even within normal range may be of concern if other non-reassuring features present.			
Variability (bpm)	5 bpm or more	Less than 5 bpm for more than 40 minutes	
Accelerations	Present	None for 40 minutes	
Decelerations	None	Unprovoked deceleration/s	
		Decelerations related to uterine tightenings (not in labour)	
Opinion	Normal CTG (All features reassuring)	Abnormal CTG (1 or more non reassuring feature)	
Maternal pulse:	Membranes ruptured: Y / N If yes, date and time:		
Liquor colour:	Gestation (wks):		
Reason for CTG:			
Action (An abnormal CTG requires prompt review by experienced obstetrician/senior midwife)			
Date:	Signature:		
Time:			
Print Name:	Designation:		

CTG check list (attach to start of CTG trace)		University Hospitals of Leicester NHS Trust	
Reason for CTG:			
Date:	Date set correctly on CTG? (tick)		
Time:	Time set correctly on CTG? (tick)		
Name:	Paper speed set to 1 cm per min (tick)		
Hospital Number:	Gestation:		
(or attach addressograph)	Maternal Pulse:		
	FH auscultated prior to CTG (rate):		

- The CTG trace should be filed in the CTG envelope as normal.

Action related to traditional Antenatal CTGs:

A **Normal** CTG may be discontinued following review.

An **Abnormal** CTG should continue and be reviewed, without delay, by an experienced Obstetrician. (ST4 or above) If there is going to be a delay – [see escalation pathway appendix 2](#)

Performing computerised CTG:

Start the CTG, turn 'analysis on'

Enter the gestational age in weeks and days.

Turn the printing on.

After 10 minutes if the **computerised CTG** criteria is met, this will be displayed on the bottom of the screen (with a tick). If you want to review press menu and then press "review". If you want to generate the report then stop the recording and press print (Do not turn off the CTG machine until it has completed printing).

If the **computerised CTG** criteria are not met then continue to record the CTG.

- **Applying the computerised CTG criteria:**

The computer software assesses the above mentioned dataset and creates a report. The first result is after 10 minutes and is updated every 2 mins up to max of 60 mins.

There are 2 possible outcomes:

- Criteria met
- Criteria not met

- **What to do when Criteria are met:**

This can be met after as little as 10 minutes (i.e. after the first analysis). It indicates a normal trace. The CTG can be stopped subject to visual assessment and clinical judgement. Do not rely on the analysis in isolation. It may not always identify unusual or pathological patterns that may be more obvious from visual interpretation, holistic assessment of, and knowledge of, the whole clinical scenario.

In some clinical scenarios such as the monitoring of severely growth restricted fetuses, analysis **will** need to continue for longer, **EVEN IF** the criteria are met. The STV value in these cases is only valid after 60 mins. This will be on an individual patient basis.

- **What to do when Criteria not met BEFORE 60 minutes:**

This simply indicates that the criteria have not **YET** been met and normality has not been demonstrated. There are many reasons why a trace may not meet the criteria for a while, including uncertain basal rate determination and fetal behavioural state (e.g. sleep state). Reasons for failure to meet the criteria are shown as reason codes. If there are **abnormal** features or concerns about **fetal** wellbeing, contact a senior obstetrician (ST4 or above) immediately as delivery may need to be facilitated sooner. Otherwise, continue the trace until the criteria are met.

- **What to do when Criteria are not met AT 60 minutes:**

In the context of the antenatal CTG test, this must be considered an "**Abnormal**" outcome and appropriate case review and action must be taken, based on the reasons for failure, visual trace review, and an holistic assessment of the pregnancy, in accordance with local / international guidelines & protocols. The review should be performed **ideally** by an ST6 /Consultant to plan further management. **If a ST6/Consultant is not available see [escalation pathway \(appendix 2\)](#)**. Do NOT act on the basis of the CTG analysis alone, as it is an aid to pregnancy management, not a diagnostic tool.

The reasons why the trace did not meet the criteria are highlighted as coded numbers alongside the **CRITERIA NOT MET** message.

Below are descriptions of each CRITERIA NOT MET CODES and may help to advise further management but THIS DOES NOT REPLACE AN INDIVIDUAL RISK ASSESSMENT AND CLINICAL REVIEW.

Dawes Redman® CRITERIA NOT MET codes:

1. Basal Heart Rate outside normal range (110 – 160)
2. Large decelerations
3. No episodes of high variation
4. No movements and fewer than 3 accelerations
5. Baseline fitting is uncertain
6. Short-term variation is less than 3ms
7. Possible error at end of the record
8. Deceleration at the end of the record
9. High-frequency sinusoidal rhythm
10. Suspected sinusoidal rhythm
11. Long-term variation in high episodes below acceptable level
12. No accelerations

Escalate as per appendix 2 and form 1

See appendix 1 for further information on computerised CTG and escalation required

Computerised CTG analysis may also indicate that a CTG is ‘pre-terminal’. This message appears on a second page after the initial criteria not met analysis. Where this message appears, this is an obstetric emergency and delivery of the baby should be immediately facilitated (usually via category 1 caesarean section).

3. Education and Training

Education training is complete at point of registration, no additional training requirements needed, updates in practice training introduced as required

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
The use of computerised CTG	Audit	Fetal monitoring Midwife	Yearly	Report

5. Supporting References (maximum of 3)

Department of Health (2019) Saving Babies Lives Care Bundle. NHS England

National Institute for Health and Care Excellence, (2008). Antenatal care for uncomplicated pregnancies. London: NICE. Updated 2019.

6. Key Words

Antenatal monitoring, computerised CTG,

CONTACT AND REVIEW DETAILS	
Guideline Lead (Name and Title) S Blackwell and Chandrima Roy	Executive Lead Chief Nurse
Details of Changes made during review: New guideline	

Computerised CTG

Computerised CTG is an objective analysis of CTG. It eliminates the problems associated with highly subjective interpretation based on visual interpretation and is reproducible and consistent. It uses the computerised numerical analysis of the CTG, which is derived from the world's largest CTG database linked to outcomes and is known as Dawes Redman CTG analysis. It works in a 2-stage process where it derives a dataset similar to the traditional interpretation process and then applies the Dawes Redman criteria to this dataset. The final clinical judgement should be based on the entire clinical assessment with computerised CTG forming a part of this holistic approach to pregnancy management.

The Dawes Redman criteria are derived from the following dataset:

- 1) **Signal Loss:** Percentage of the trace length for which there is no FHR data.
- 2) **Movements:** As per traditional technique based on movements perceived by the patient. This is not used in monitoring twin pregnancies as movements cannot be attributed to a particular fetus.
- 3) **Basal heart rate:** This is different from baseline heart rate and is calculated by the software. It may deviate significantly from the visual assessment of baseline heart rate particularly during periods of prolonged high or low rates.
- 4) **Contractions:** Are recorded as per the traditional technique.
- 5) **Accelerations:** Same as conventional CTG definition but are quantified and presented in 2 groups (amplitude >10bpm and amplitude >15bpm).
- 6) **Decelerations:** The number of decelerations is defined as per conventional CTG but additionally, they are quantified in terms of ">20 Lost Beats"- a measure of the depth and duration of the deceleration.
- 7) **Reactivity of fetal heart beat:** Fetal heart rate variation has been shown to be the most useful computerised CTG indicator of antepartum fetal well-being. Two normal sources of FHR variation are gestational maturity and episodic changes in fetal behavioural states after 28 weeks gestation. The system was designed to take into account the episodic changes in fetal heart rate and fetal movement's characteristic of sleep states. Even in the absence of acceleration in a normal fetus, there is at least one episode of high FHR variation from 28 weeks onwards.
 - **Long term variation (LTV)** is in the form of high and low episodes in minutes. Variation in the pulse interval or rate from the baseline gives a measure of LTV. Periods for which LTV or beat-to-beat variation is >32 milliseconds for five or six consecutive minutes are described as high episodes and when the LTV is low the period is described as low episodes.
 - **Short term variation (STV):** Is similar to baseline variability, and LTV, but measured over a much smaller interval of just 3.75s (typically 7 to 10 beats). A significant benefit is that it is independent of baseline rate. The mean STV increases as gestational age advances.
 - Overall the thresholds of abnormal STV are as below:
 - < 4ms: Low
 - < 3ms: Abnormal
 - < 2ms: Highly abnormal.

STV CANNOT be assessed visually from looking at the trace. It is NOT the same as beat-to-beat variability. It MUST NOT be used in isolation as an indicator of fetal condition – you can have normal STV with a severely compromised fetus. It is only significant as part of a full 60-minute analysis

USE OF COMPUTERISED CTG's (further information)

This provides an analysis system developed by Dawes and Redman (1985) which assesses various features of the CTG trace within a set criterion.

The analysis system programmed by Dawes and Redman assesses various features of the tracing, defining accelerations as a rise in baseline of 10 beats for 10 seconds, and assessing baseline variability as mean range. Mean range of variation is considered the most important index – if it is greater than 20 milliseconds it is normal

Features

Short term variability (STV)

It's similar to baseline variability, & LTV, but measured over a much smaller interval of just 3.75s (typically 7 to 10 beats)

It's based on the difference between average beat intervals in each 3.75s segment

A significant benefit is that it is independent of baseline rate

It **CANNOT** be assessed visually from looking at the trace (there isn't enough detail in the printed trace)

It is **NOT** the same as beat-to-beat variability

It **MUST NOT** be used in isolation as an indicator of fetal condition – you can have normal STV with a severely compromised fetus

It is only significant as part of a full 60-minute analysis

Results from two studies of compromised fetuses (Redman et al)

Predict when intervention is likely to become necessary

Thresholds for management (only valid when measured over the full 60 minutes):

- <4ms Low
- <3ms Abnormal
- <2ms Highly abnormal

STV (ms)	<2.6	2.6–3.0	>3.0
Gestation (weeks)	25–38	26–38	27–37
Metabolic acidaemia	10.3%	4.3%	2.7%
IUD	24.1%	4.3%	0.0%

Remember when interpreting Computerised CTG they are more sensitive than conventional CTG at predicting fetal acidemia.

However:

STV

Conventional fetal monitoring has no proven predictive value

STV proven to correlate highly with fetuses at risk of metabolic acidaemia and intra-uterine death

Use only when measured over a full 60 minute analysis. Low STV on analyses less than 60 minutes may simply reflect, for example, a period of normal fetal "sleep" state

Use only in the context of the full CTG analysis, not as a sole indicator of fetal wellbeing

LTV

High frequency sinusoidal FHR pattern associated with, but not reliable marker for, fetal anaemia

High frequency sinusoidal FHR pattern with low LTV highly predictive of fetal anaemia (100% sensitivity and specificity reported in one study based on Oxford database)

If there was a possible error at the end of recording (code7), then it is appropriate to repeat, however if criteria not met by 20 minutes a senior review is required.

Appendix 2

MAU/Ward Escalation policy for Abnormal CTG's

Abnormal CTG
Or **Computerised** criteria Not met

Full SBAR handover must be used to escalate concerns

If there are CTG concerns **BEFORE THE FULL HOUR** **computerised** analysis of the CTG, this should prompt a review earlier.

The patient needs to be physically reviewed by a Registrar who should be ST6 or above, and a plan made.

If there is only a ST4/5 in residence they should discuss the case / management with the consultant on call

08:00-17:00 – ST4 or above
08:30-1700 - Consultant available on LRI MAU***
13:00-17:00 - Consultant available LGH MAU
If MAU Cons not available contact ward or delivery suite Consultant

No medical review available, the midwife on MAU/ward should liaise with the co-ordinator, to facilitate prompt transfer of the woman to delivery suite.

If further escalation is required, escalate to the Maternity Bleep Holder

OUT OF HOURS

Registrar from delivery suite should be contacted (use form1 as an aid)

Delivery suite co-ordinator should be informed to help facilitate

Patient moved to delivery suite

Delivery suite unable to accommodate, the consultant on-call should be informed if before 10pm LRI/8pm LGH

If after 22:00 - no doctor, unable to review and delivery suite unable to accommodate with discussion with co-ordinator consultant on call should be contacted

Patient or staff safety compromised

Manager on call for Maternity to be contacted VIA switch board

Escalation (form1)

Why did you call?		
Staffing issue	Urgent obstetric review required	Covid related
Capacity issue	Transfer to delivery suite required	BSOTS-related
Obstetric review required	Urgent transfer to delivery suite required	Other
Numbers in MAU?	Women:	Staff: MW: MCA:

Who did you call?	Name	Outcome
Maternity Bleepholder		Awaiting Callback Yes/No <u>Plan</u>
Delivery Suite Co-ordinator		Awaiting Callback Yes/No <u>Plan</u>
Manager – Maternity/On-Call		Awaiting Callback Yes/No <u>Plan</u>
Obstetric SHO		Awaiting Callback Yes/No <u>Plan</u>
Obstetric Registrar Junior/Senior		Awaiting Callback Yes/No <u>Plan</u>
Obstetric Consultant		Awaiting Callback Yes/No <u>Plan</u>

Date:

Time:

Name of person escalating