QUEENSLAND COURTS

OFFICE OF THE STATE CORONER

NON INQUEST FINDINGS

CITATION:	**Investigation into the death of Baby A**
TITLE OF COURT:	Coroners Court
JURISDICTION:	Southport
FILE NO(s):	2008/604
DELIVERED ON:	9 December 2014
DELIVERED AT:	Southport
FINDINGS OF:	James McDougall, Coroner
CATCHWORDS:	Coroners: investigation, the inadequacy in assessing Baby A's welfare throughout the mother's labour
Counsel Assisting:	Rhiannon Helsen

Baby A died soon after his birth on 8 June 2008 at a Gold Coast private hospital. The cause of his death was found to be hypoxic-ischaemic encephalopathy due to meconium aspiration syndrome.

Sequence of events

Ante-natal care

Baby A's mother was 42 years of age when she fell pregnant with Baby A, her first child. She had previously had one miscarriage and two pregnancy terminations when she was 19 and 26 years of age.

From 20 weeks gestation, Dr S provided the mother with antenatal care. Dr S is a qualified Consultant Obstetrician and Gynaecologist with the qualifications FRANZCOG, FRCOG, MD. He has been a qualified Consultant since 1996 and has a specialist registration with the Medical Board of Australia.

The mother's ante-natal screenings were normal including the first trimester ultrasound, low risk for trisomy and normal second trimester fetal morphology scan. Her ante-natal blood tests were found to be unremarkable, being negative for Hepatitis B, syphilis and Rubella immune. Her blood group was O-negative and she received anti-D injections during her pregnancy.

According to Dr S, the father and mother initially considered booking their delivery at the Murwillumbah Hospital. However, they changed their mind in preference of a Gold Coast private hospital ('the Hospital'), particularly as the mother chose at 36 weeks gestation to have a 'water birth' (that is, to give birth to her child in water, such as in a bath or pool filled with water). Dr S notes that until then, the mother's antenatal course had been uneventful. The father and mother were said to have purchased the Hospital's information package for a water birth. It was at this stage that the father and mother presented Dr S with their birth plan, which stipulated that they wished to have a calm, natural, drug-free, water labour/delivery.

The father and mother indicated that they wished to use the birthing pool for labour and possibly during delivery. The mother wanted to be able to move freely during the labour and would prefer to have the baby monitored intermittently and externally, if necessary. It was acknowledged, however, that whilst the birth plan indicated their preferences, the father and mother were open and flexible to any medical intervention that may become necessary in the case of a medical emergency.

The mother claims that she participated in antenatal classes at the Hospital as well as in Byron Bay. However, Hospital records of antenatal class attendance show no reference to the father and mother attending any antenatal classes at the Hospital.

During the mother's 36 week antenatal check-up, Dr S found that her blood pressure was mildly above her basal level. She was advised to have daily blood pressure checks at her local chemist and to report if her blood pressure was 150/90 or above. Dr S ordered investigations relevant to pre-eclampsia, namely FBC/LFT's/U&Es/Urates. These tests were found to be normal aside from borderline urates. On this occasion, Dr S also counselled the father and mother at length about a water birth, explaining the difference between using warm water for analgesia during labour and actually delivering the baby underwater. Dr S informed them that a water birth was allowed in uncomplicated cases where the birth was normal and spontaneous. The mother's blood pressure check at home remained below 150/90.

At the mother's 37 week antenatal check-up, Dr S found that her blood pressure was increasing to 150-160/80 indicating she was developing pre-eclampsia. As a result, Dr S took the following actions:

- Ordered repeat blood tests. These were found to be normal except for the urates which were still borderline elevated.
- The mother was commenced on Labetatol 100 mg twice daily.
- The mother was ordered to continue having her blood pressure monitored daily. This remained below 150/90.
- An ultrasound for fetal growth and wellbeing was ordered. The result was found to be normal.
- Dr S informed the father and mother that a 'water birth' was contraindicated in her case as she was developing pre-eclampsia. Dr S provided the father and mother with reading material about the subject, namely the Hospital policy on water birth, the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) statement on water birth, and Cochrane's review on water birth.

On 2 June 2008, during the mother's antenatal check-up, Dr S found her blood pressure was 160/90. As such, she was admitted to the Hospital for rest, observations and further testing. At that stage, her pre-eclampsia was found to be mild to moderate in severity. Dr S increased her dose of Labetatol 100 mg to three times a day. The mother's blood pressure settled whilst she was in the Hospital and her blood tests were normal except for borderline raised urates.

The mother was discharged from the Hospital on 4 June 2008. She was ordered to continue to take Labetatol 100 mg three times a day and to check her blood pressure daily at home (and to report if it was above 150/90). The mother was also to have repeat blood tests and a check up conducted by the midwives at the Murwillumbah Maternity unit on 9 June 2008. There were no concerns for Baby A prior to his birth.

Events on 7th & 8th of June 2008

According to Dr S, a plan for induction of labour was intended for 9 June 2008 at 39 weeks of pregnancy due to the presence of pre-eclampsia. However, at 9:00 pm on 7 June 2008, the mother went into spontaneous labour and commenced having contractions every three minutes. The Hospital was contacted at around 9:30 pm and the mother was advised to attend. By this time, the mother claims the contractions were getting stronger and were coming every one and a half minutes. Her water broke whilst she was at home at around 10:30 pm. The mother claims there was something greenish when her waters broke. As they were aware of meconium, the father and mother took a sample of the discharge to show nursing staff at the Hospital.

At 11:30 pm that evening, the father and mother arrived at the Hospital. She was attended to by Midwife P, who recalls that the mother told her that her contractions had commenced at 9:00 pm and that her water had broken at 10:30 pm, which caused clear fluid to drain from her vagina as well as a vaginal brownish discharge. The partogram in the Hospital medical records indicates that the mother's contractions were three to five minutes apart and she was three centimetres dilated. The mother's liquor (amniotic fluid) was observed to be pink/blood stained. An entry in the patient progress records at 11:45 pm on 7 June 2008 by Midwife P states that "*contractions started approx 2100 hrs and SROM [spontaneous rupture of membranes] @ 2230 hrs. Clear fluid/brownish. OA: BP 184/91…pinkish fluid on pad. CTG commenced FHR: 118-155 bpm…3 cm dilated.*"

Midwife P palpated the mother's abdomen and noted that the baby was *"longitudinal lie, cephalic presentation, [head downwards] head 3/5$^{th\uparrow}$ brim [above the pelvic brim]? LOA [left occiput anterior] (baby's spine on the mother's left)".* She noted that the estimated date of confinement was 16 June 2008 and that the baby was 39 weeks of gestation. Midwife P also noted that the mother had a history of pregnancy-induced hypertension and was taking medication for this condition.

At approximately 11:45 pm, Midwife P commenced the admission cardiotocography ('CTG'), which was applied for around 20-25 minutes. During this time, she noted that the fetal heart rate varied between 118 to 155 beats per minute ('bpm'), which is within the normal range.

At 12:15 am on 8 June 2008, Midwife P contacted Dr S to inform him of the mother's admission. She advised him of her findings following her examination of the mother. Dr S claims, however, that he was not informed by Midwife P of an admission CTG. As a result of the mother's high blood pressure, Dr S ordered that an intravenous cannula ('IVC') be inserted and blood tests be undertaken to check her liver function. He also ordered that the mother's blood pressure be monitored regularly and that she be offered pethidine/epidural for pain relief. Dr S was then to be called in two hours time to be advised of the mother's progress. Midwife P subsequently inserted an IVC and took a blood test. She offered the mother pethidine and/or an epidural, which was refused. The mother indicated that she wished to go into the bath for pain relief and wanted to have a water birth. Midwife P told the mother that Dr S had stated that there were contra-indications for a water birth due to her pre-eclampsia, which is reflected in the medical progress notes.

In her statement to police, the mother acknowledged that Dr S had recommended that she not proceed with a water birth due to her pre-eclampsia. Nonetheless, the father and mother persisted with their birth plan.

At approximately 12:30 am, the mother got into the bath and continued to breathe on nitrous oxide for pain relief. Midwife P noted in the partogram that at this time, the mother's blood pressure was 159/91 and the fetal heart rate was 145 bpm. Midwife P used a Doppler machine (a hand-held ultrasound instrument) to monitor the fetal heart rate every 30 minutes for approximately one minute after each contraction whilst the mother was in the bath.

At 1:00 am, Midwife P recorded the fetal heart rate in the progress notes as being between 135-145 bpm.

At 1:30 am, whilst the mother was in the bath, Midwife P recorded the fetal heart rate as being 140 bpm. The mother's blood pressure was noted as being 150/84.

At 2:00 am, the mother indicated that she had the urge to push. Midwife P performed a vaginal exam and found the mother to be seven centimetres dilated. The baby's head was at 'station -2' (within the pelvis but not yet engaged) and the liquor was blood stained. The fetal heart rate at this time was recorded as being 140 bpm.

At 2:15 am, Midwife P telephoned Dr S again and advised him of the mother's progress. He confirmed that he would attend shortly.

Dr S arrived at the Hospital at around 2:30 am and took over responsibility for the mother's progress. According to Midwife P, Dr S reviewed the admission CTG scan. At this time, the mother was still in the bath and was using nitrous oxide as a means of pain relief. The fetal heart rate was recorded as being between 135 and 148 bpm.

Medical notes confirm that Dr S attended upon the mother continuously from 2:30 am onwards. Dr S claims he reminded the father and mother that her condition of pre-eclampsia was not best managed by a water birth and that an epidural would normally be

recommended, which would not only provide pain relief but also assist to stabilise the blood pressure and enable the labour to be monitored more effectively in a quiet and controlled manner. Regardless, the mother declined the offer of an epidural or pethidine for use as analgesia, as a means of controlling her pre-eclampsia or to allow for the standard monitoring of the fetal heart rate. As such, the fetal heart rate was monitored via a stethoscope whilst she was in the bath and during and after contractions with the Doppler machine. It was found that the fetal heart rate had a normal baseline and would accelerate during contractions before returning to baseline level.

In Dr S' opinion, the mother's labour did have some possible complications and risk factors due to her development of pre-eclampsia. Continuous electronic fetal monitoring is used for cases, such as the mother's, where there are some possible complications or risk factors. As such, these births are not appropriate cases for a water birth. Dr S maintains that he expressed this view to the father and mother during the antenatal discussions when the mother developed pre-eclampsia and also upon admission to the Hospital.

At 2:45 am, a vaginal examination was performed and found that the mother had progressed to full cervical dilation (nine centimetres); however, the fetal head had not progressively descended into the birth canal. Midwife P noted that no liquor was seen at this time.

At 3:00 am, a further vaginal examination was conducted. At Dr S' direction, Midwife P recorded in the progress notes that there had been no change. It should be noted that Dr S claims in his statement that Midwife P conducted the examinations for cervical dilation whilst the mother was in the birthing pool at 2:45 am, 3:00 am and 4:00 am, during which she was found to be nine centimetres dilated. The mother went to the bathroom, however, was unable to void. The fetal heart rate was recorded as being between 155 and 160 bpm.

At 3:30 am, the mother returned to the birthing pool. Midwife P noted that the fetal heart rate at this time was between 145 and 160 bpm.

At 3:45 am, Midwife P noted that the fetal heart rate was 135 bpm.

At around 4:00 am, the mother got out of the bath and was placed onto a bed to allow Dr S to conduct a vaginal examination. At Dr S' direction, Midwife P recorded in the progress notes that the mother was still nine centimetres dilated. The infant's head was found to be in the left occiput posterior ('LOP') position. A catheter was subsequently inserted by Dr S to allow the mother to empty her bladder. Midwife P conducted a urine analysis and noted in the chart that high levels of protein were found, which when coupled with high blood pressure would indicate pregnancy-induced hypertension. At this stage, the fetal heart rate was 120 bpm. Midwife P subsequently placed the CTG monitor on the mother. However, she had difficulty placing the maternal transducer straps on as the mother was moving around and was on her hands and knees on the bed. According to Midwife P, Dr S told her *'not to worry as we could hear the baby's heart beat via the CTG.'* The CTG remained in place for approximately one hour. During this time, the fetal heart rate was able to be heard via the CTG machine and also viewed on the monitor.

At 4:45 am, after a trial of pushing whilst at full cervical dilation, Dr S conducted a further vaginal examination where he found signs of cephalopelvic disproportion with suspected narrow pelvic outlet. At this stage, Dr S recommended that a caesarean section be conducted, to which the father and mother agreed. The indication for a caesarean section in this case was the failure to progress in the second stage of labour due to cephalopelvic disproportion, together with pre-eclampsia. As such, the category of caesarean section ordered was 'category two' ('maternal or fetal compromise but not immediately life threatening').

Dr S notes that the pattern of fetal heart rate in the second stage of labour was considered to be 'early decelerations' (escalate to 170 bpm) with recovery between contractions (back

down to 130-140 bpm), which Dr S states is common at full dilation due to fetal head compression in the birth canal. However, Dr S does acknowledge that the signal pickup and recording of the paper tracing was not satisfactory as the mother was making vigorous movements with contractions. During each of the vaginal examinations, no meconium was observed.

Midwife P subsequently prepared the mother for the caesarean section by inserting an in-dwelling catheter and shaving her pubic area. The fetal heart rate was recorded as being between 135 and 150 bpm at this time. Midwife P recorded in the patient progress notes that the recording of the fetal heart rate on the trace was not good as the mother was moving around the bed. Midwife P completed the emergency caesarean section of the clinical pathway document in preparation for the caesarean section.

According to notes made by Dr S in the patient progress record, the request for the caesarean section was made as a category two and notified as such to the Hospital Nursing Co-ordinator and the theatre. Nursing notes in the medical record indicate that at approximately 5:00 – 5:10 am, Dr S requested a nurse to organise theatre staff for a category two caesarean. Nurse T subsequently rang the Hospital Nursing Co-ordinator, Specialist Anaesthetist, Dr D, and Dr B to request their assistance. Dr D promptly travelled to the Hospital, which took approximately 20 minutes. At 5:40 am, approximately 10 minutes after the mother had been taken to the operating theatre, Nurse T contacted Paediatrician, Dr C to request his assistance.

Theatre Nurse To recalls that at approximately 5:00 am she was contacted by the Hospital Nursing Co-ordinator who advised her that there was a patient in labour who had failed to progress and as such a caesarean delivery was required. As a result of the telephone call, Nurse To drove to the Hospital, which took approximately 15 minutes. Fellow theatre Nurse B was also called to the Hospital that morning. Nurse B was to be the scrub nurse and Nurse To was to act as the circulating nurse.

Recovery Nurse Y was also called by the Hospital Nursing Co-ordinator at around 5:00 am on 8 June and requested to attend the Hospital as a caesarean section was to be performed. Nurse Y arrived at the Hospital at around 5:40 am and immediately attended the changing rooms in the theatre complex and put on her scrubs. She then proceeded to the recovery area where she recalls seeing the mother being wheeled from the pre-operative area in recovery into the theatre.

At 5:30 am, Midwife P noted in the partogram that the fetal heart rate was 145 bpm. In relation to the fetal heart rate, Dr S noted the following in the patient progress record, "*the signal pickup and recording on the paper trace was not satisfactory with additional difficulty due to patient movement during contractions. However, the FHR was listened to by both the midwife and myself. Also, FHR was ausculated by Doppler in the preoperative area before administration of spinal anaesthetic by Midwife Linda D and I was told it was normal at about 135 bpm."*

At around 5:30 am, the mother was transferred to the operating theatre and placed in the recovery area awaiting the attendance of the anaesthetist. Whilst in the recovery area, Midwife P used the Doppler machine to monitor the fetal heart rate, which was recorded as between 132 to 135 bpm.

According to the intraoperative report completed by Nurse To, the mother arrived at the operating theatre at 5:45 am and anaesthetic intervention (that is, the first time the anaesthetist, Dr D, attended upon the mother) commenced at 5:55 am. Dr D performed a pre-anaesthetic assessment of the mother in the pre-operative area. Following this assessment, Dr D recommended a spinal anaesthetic, which the mother agreed to. After establishing an IV cannula, Dr D performed a spinal block at the L3-4 level. According to Dr D' anaesthetic record, the spinal block was established at approximately 6:00 am and was

uneventful. The mother's blood pressure and pulse oximetry were monitored. Blood pressure was initially 120 systolic at 6:00 am and was henceforth controlled with an infusion of phenylephrine 10 mg at 100 ml of normal saline running at 25 ml/hour.

At 6:10 am, the fetal heart rate was recorded as being between 132 to 135 bpm.

The caesarean procedure was noted to commence at 6:20 am, which is when the mother was first brought into the operating theatre. The mother's blood pressure and pulse were stable throughout the procedure.

Baby A was born at 6:35 am on 8 June 2008 via caesarean. He was not breathing at the time of his birth and was covered in thick meconium. No evidence of placental abruption was found. He weighed 2800 grams. Midwife P noted that the baby's head was cone shaped with a lot of swelling and moulding.

After the umbilical cord was cut by Dr S, he passed Baby A to Midwife P who immediately transferred him to the resuscitator in the operating theatre. She commenced chest compressions and suctioned meconium from Baby A's mouth. Resuscitation was subsequently performed by Dr C with assistance from Dr D for a period of approximately 17 minutes, which included pharyngeal suctioning, intubation and ventilation and intravenous adrenaline and normal saline. After this time, a heart beat was detected. At no time, however, did Baby A start to breathe for himself. Apgar scores were noted to be zero at one minute, one at five minutes, one at 15 minutes and three at 20 minutes. An x-ray showed that the infant had opened his bowels before birth and that faeces had entered his lungs (meconium aspiration).

Baby A was subsequently moved to a special care nursery and placed on life support. At this time, he had no brain function. He was given intravenous dextrose and Vitamin K.

That morning, Dr C discussed Baby A's case with Dr K, the Director of a Neonatal Intensive Care Unit at another hospital. It was noted that at 90 minutes of age, there was no movement, no respiratory effort and his pupils were mid-sized and fixed with doll like movements. It was determined that meaningful survival was unlikely and that the chance of severe cerebral injury was very high. At 10:40 am, after consultation with the father and mother, the decision was subsequently made to cease life support. Baby A was declared deceased at approximately 11:10 am on 8 June 2008.

In Dr S' opinion, Baby A suffered from severe birth asphyxia, the signs of which were not identified in the course of labour. He subsequently died as a result of hypoxic-ischaemic encephalopathy.

Following Baby A's birth, the severity of the mother's pre-eclampsia condition worsened and she had to be admitted to the Intensive Care Unit.

At around 5:00 pm that day, police attended the Hospital in relation to Baby A's death. Police subsequently spoke to the father and also the medical staff involved in Baby A's birth. Medical records and the doctor's notes were obtained from the Hospital. Police checks were conducted on both parents and it was found that neither had any previous criminal or domestic violence history.

Dr S had a number of discussions with the father and mother following Baby A's death whilst the mother was still in hospital and also in July, September and December 2008.

In a statement provided for the purpose of the coronial investigation, Dr S expressed the view that with the benefit of hindsight, the management of the mother's labour could have been managed differently:

- The admission CTG should have been recognised as abnormal by Midwife P and notified to Dr S as such at the first telephone call after the mother's admission.

- The CTG should not have been discontinued as it was at 12:10 am, but should have been kept running throughout the mother's labour. This would have resulted in identifying signs of fetal hypoxia from the point of admission to the Hospital.

- Midwife P should not have provided the birthing pool to the mother in view of her obvious pre-eclampsia, the abnormal CTG and Dr S' advice that it was contraindicated in this case.

- The father should have accepted Dr S' advice that the water birth was not suitable in their case.

The father and mother's recollection of events

The mother claims that whilst she was in the water, the nurse continued to check to see how far she had dilated. The first examination showed that she was seven centimetres dilated and the next indicated she was already nine and a half centimetres. The mother recalls that at one stage, Dr S attended and conducted an examination. During this examination, the mother got out of the pool and was placed upon a bed. The fetal heart rate was checked at this time and it was the mother's understanding that everything was fine. She claims that at some stage, she believes an ultrasound of the baby was conducted to check its position. After this, the mother returned to the water. A short time later, the mother was asked to leave the water for a further examination, during which it was established that she was still nine and a half centimetres dilated. The mother claims that she felt as though the baby was stuck and she was ready for a caesarean, which she mentioned to Dr S. According to the mother, Dr S told her to wait another half an hour to see what happened. However, she claims Dr S took longer than half an hour to return. When he did, the mother was prepared for a caesarean, which did not take place for another few hours.

Statements provided by the father and mother to police following Baby A's death

On 8 June 2008, shortly after Baby A's death, the father participated in a field interview with Plain Clothes Senior Constable Pillinger whilst still at the Hospital. During the interview, the father provided his recollection of the events that had just transpired. The relevant information provided by the father during the course of the interview is as follows:

- At around 9:00 pm the previous evening, the mother started having contractions which were three minutes apart.

- They subsequently called the Hospital at around 9:30 pm. The Hospital told the mother to have a shower and see how she felt. If they were just as strong after a shower, the mother was to attend the Hospital.

- At 10:00 pm they rang the Hospital and were told to come in.

- Before they left, the mother went to the toilet and her water broke.

- They arrived at the Hospital at around 11:30 pm and were taken to a birth room for a water birth.

- Whilst the mother was in the water and going through contractions she didn't show any signs of high blood pressure.

- At some point, the doctor recommended that a caesarean would have to be considered to which the mother agreed.

- The mother had been on medication for high blood pressure for the last two weeks.

- The caesarean took some time as they had to call in specialist anaesthetists. There was nothing to suggest it was urgent.

- They had been monitoring the fetal heart beat all the way through and it seemed fine.

- The fetal pulse rate was okay whilst they were waiting in the pre-op area. At around 6:00 am the father left the mother and was called in to theatre at around 6:30 am. The staff weren't checking the fetal heart rate like they had been earlier.

- The fetal heart rate seemed to be intermittent sometimes when they were monitoring it, however, the father didn't say anything to the medical staff.

- Staff were all very respectful, apologetic and supportive.

- The only concern leading up to the birth related to the mother's pre-eclampsia.

- The father and mother had undertaken antenatal classes at the Hospital.

The mother provided a statement to police on 24 March 2009 some nine months after Baby A's death, recounting the series of events to the best of her recollection. In relation to the care provided by medical staff at the Hospital, it should be noted that the mother stated that "*I felt that I was treated well at the Hospital. The staff and everyone looked after me. The only thing that I wasn't happy about was how long it took to start the caesarean. Other than that I felt the standard of medical care was fine"*

Autopsy

An external and full internal examination was performed by Dr W on 10 June 2008. A number of histology and toxicology tests were also undertaken.

The external examination showed a baby boy with signs of recent medical therapy. There were no morphological features to suggest he suffered from any sort of syndrome.

The internal post mortem examination revealed thick green material in the airways consistent with the clinical history of meconium aspiration. The lungs were heavy. No structural abnormalities were found. The brain and spinal cord were examined by a neuropathologist. The brain showed agonal changes but the central nervous system was otherwise normal with no structural abnormalities. There were no pathological signs of hypoxic-ischaemic encephalopathy. Dr W notes that this is likely due to the short survival time following resuscitation, as several hours are required to pass for histological evidence of hypoxia to be visible.

The placenta was examined by a pathologist at QML Pathology. This examination revealed acute chorioamnionitis (infection of the fetal membranes). This would most likely have been the result of a bacterial infection ascending from the vagina.

Histological examination showed features of meconium aspiration and pneumonia.

Cytogenetic tests showed a normal male karyotype with no chromosomal abnormalities detected.

Toxicological tests were performed on the post-mortem blood and urine samples. No alcohol or drugs were detected.

Microbiological tests were performed on a number of post-mortem samples. A bacterium, *Staphylococcus,* was cultured from the blood sample. Scant numbers of another bacterium, *Enterococcus faecalis,* were cultured from the left lung and spleen samples. Dr notes that these samples may represent post-mortem contamination rather than true ante-mortem infection. No micro-organisms were identified in the samples from the brain, liver and right lung.

Metabolic screening showed features related to post-mortem sampling, but no significant abnormalities were detected. Specific tests were performed for mucopolysaccharides on the urine samples, however, the results were found to be in the normal range. As such, there were no findings to suggest that the infant had Hurler syndrome.

Dr W concluded that the cause of Baby A's death was hypoxic-ischaemic encephalopathy due to meconium aspiration syndrome. It is noted that meconium aspiration syndrome is a serious condition and would account for the fact that Baby A was not breathing at birth, which in turn lead to his hypoxic ischaemic encephalopathy. Acute chorioamnionitis and a failure to progress in labour were also considered to be important maternal conditions contributing to his death. Dr W notes that both of these conditions may have been factors that contributed to fetal distress and subsequent meconium aspiration.

Family Concerns

During the course of the coronial investigation, the father and mother raised a number of concerns regarding the care and treatment provided by medical staff, particularly Dr S and Midwife P. Whilst I do not propose to outline all the concerns raised, the father and mother essentially submitted that the clinical care provided during labour and delivery was inadequate. In particular, the father and mother expressed concern regarding the failure to continuously monitor the fetal heart rate, in light of the mother's high-risk pregnancy and the perceived delayed response by staff to the events that transpired during delivery.

I have considered all the concerns and matters raised by the father and mother during the course of the coronial investigation, when reaching my conclusions regarding Baby A's death.

Hospital policies and procedures in place at the time of Baby A's birth

For the purpose of the coronial investigation, the Director of Clinical Services at the Hospital provided a statement detailing the obstetric policies, pathways and forms in place at the time of Baby A's birth on 8 June 2008. In addition, the Director also provided details as to a number of new obstetric policies and procedures, which have since been implemented after June 2008.

Fetal Monitoring Policy

In November 2008, a Fetal Monitoring Policy was in place as specified in section three of the Birthing Unit Policy and Procedure Manual.

The Fetal Monitoring Policy in place at the time of Baby A's death provided as follows:

- High-risk patients will be identified and continuous electronic fetal monitoring will be performed throughout the intra-partum period. Continuous electronic fetal monitoring is to be performed for women who fit into any of the antenatal and intrapartum risk categories, including:

    - Abnormal Doppler artery velocimetry;
    - Abnormal antenatal CTG;
    - Prolonged pregnancy;
    - Multiple pregnancy;
    - Breech presentation;
    - Pre-eclampsia (current pregnancy);
    - Premature labour;
    - Epidural analgesia;
    - Meconium or blood stained liquor; and
    - Abnormal auscultation.

- Non-reassuring fetal heart rate patterns will be promptly detected and appropriate action will be taken.

- All observations and actions will be accurately documented on a continuing basis in the patient's medical record.

- Midwives will demonstrate competence in the interpretation of fetal surveillance monitoring and are required to participate in regular training programs prescribed by the Hospital.

By memorandum dated 14 November 2008, all midwifery staff were advised of proposed changes to the policy and the current fetal monitoring policy requirements were reinforced. Midwives were notified that all patients admitting for assessment of labour or in labour must have a 20 minute CTG attended on admission. The baseline CTG must be recorded for 20 minutes or until the trace is reactive – up to 60 minutes. Reactive was defined as two accelerations within 20 minutes. Two midwives were required to check and sign the admission CTG.

In May 2009, the Hospital's Fetal Monitoring Policy was replaced by the Fetal Monitoring Intrapartum Policy, which was developed and implemented by the private health service provider (PHSP) who owns and operates the Hospital as well as a number of other health care facilities across Australia. This policy, combined with the PHSP's Labour First Stage Policy, replaced the Admission Assessment and Management of the Labour First Stage Policy, which had been in place between December 2008 and May 2009.

The Fetal Monitoring Intrapartum Policy now requires an admission CTG be recorded and continued until a normal trace is identified.

The following relevant additional changes were also included in the Fetal Monitoring Intrapartum Policy:

- Admission CTG must be assessed and signed by two midwives or one Accredited Practitioner and a Midwife.

- Two additional intrapartum risk factors were added, namely an active first stage of labour greater than 12 hours and active second stage (i.e. pushing) greater than 1 hour.

- A requirement that electronic fetal monitoring should be undertaken for a minimum of 15 minutes at least every two hours, and should only be discontinued if the CTG is normal.

- In the event of a high risk pregnancy (this is a pregnancy with ante partum and intrapartum risk factors identified), a requirement for continuous CTG monitoring to be undertaken and signed by two midwives every two hours.

- Midwives must attend RANZCOG training every three years after their initial training.

Labour – First Stage

At the time of Baby A's birth, the Assessment and Management of the First Stage of Labour Policy was in effect having been implemented in June 2004. The aim of the policy was to ensure accurate assessment and documentation would be provided to all obstetric patients at pre-admission (by telephone), on admission and throughout the first stage of labour. Results of assessment will be documented in the medical record and be communicated to the multi-disciplinary team. Upon admission, a number of assessment and management actions are to be undertaken, including:

- Discuss birth plans.

- Perform baseline observations, which include: temperature, pulse and blood pressure, admission fetal heart rate and assessment of contractions – 10 minute duration CTG unless non-reassuring trace, when fetal monitoring policy is followed. Also examination of liquor and any vaginal discharge.

- Notify the Visiting Medical Practitioner of the admission and the baseline assessment, in accordance with standing orders.

- Perform a vaginal examination when clinically indicated and subject to Visiting Medical Practitioner standing orders.

- Document clinical assessment fully in the medical records.

In relation to ongoing assessment and management, the policy provided that documentation of the progress during labour was to be made on the partogram only when the first stage of labour had commenced and not during the latent phase.

With respect to the observations to be performed, half hourly fetal heart monitoring as well as the maternal pulse was required to be undertaken. Temperature and blood pressure was required to be taken two-hourly.

In late November 2008, a revision of the Assessment and Management of First Stage of Labour Policy was undertaken and the policy was renamed Admission, Assessment and Management of the First Stage of Labour. The relevant changes to the policy were the increase in the admission CTG from 10 minutes to 20 minutes and a requirement for the admission CTG to be checked by another midwife.

The Admission, Assessment and Management of the First Stage of Labour policy remained in place from December 2008 until the roll-out of the PHSP's updated Labour First Stage Policy in May 2009. The relevant changes introduced by the Labour First Stage Policy included:

- Definitions for the latent first stage of labour and established first stage of labour.

- A requirement for the midwife to assess the mother's risk status in the pre-admission telephone assessment.

- Clarification as to when an Accredited Practitioner ('AP') must be notified.

Labour – Second Stage

At the time of Baby A's birth, the policy in effect in relation to the second stage of labour was the Assessment and Management of the Second Stage of Labour Policy. The purpose of the policy was to ensure that the second stage of labour was defined and managed in a safe and appropriate manner to minimise the risk to the mother and the child. The second stage of labour was defined by the policy as 'the stage of expulsion, lasting from full dilation of the cervix to the complete birth of the child'.

The policy notes that if the mother's condition is satisfactory, the baby's condition is satisfactory and there is evidence that progress is occurring with descent of the presenting part, there are no grounds for intervention.

In relation to observations to be undertaken during the second stage of labour, the following are to be measured:

- Uterine contractions: strength, length and frequency should be assessed continuously by observations of maternal responses and uterine palpation.

- Descent, rotation and flexation: if there is a delay in progress despite regular contractions and active maternal pushing a vaginal examination is indicated to assess the station of the presenting part. The obstetrician must be contacted if not present and informed of findings. A vaginal assessment of progress is usually undertaken after one hour of active pushing of a primigravida and after thirty minutes of active pushing of a multigravida or sooner in the case of maternal exhaustion, or in the presence of non reassuring fetal heart rate. The need for an assessment is dependent upon whether there are obvious signs of progress present.

- Fetal condition: liquor is to be assessed to ascertain the colour and amount. Thick meconium liquor is an ominous sign and must be reported to the obstetrician immediately. Intermittent auscultation of the fetal heart using the Doppler must be performed and recorded at least every five minutes in the absence of active pushing and after each contraction with active pushing. Continuous external fetal monitoring must be used if there is evidence on auscultation of baseline less than 110 bpm or greater than 160 bpm, if there is evidence on auscultation of any decelerations or if any intrapartum risk factors develop.

- Maternal observations: maternal pulse rate to be taken half hourly and blood pressure every hour.

This policy remained in place until the introduction of the PHSP's Labour Second Stage Policy. The following relevant amendments made to the new policy include:

- The inclusion of clear definitions of passive second stage and onset of the active second stage.

- Details of the frequency of observations for both the passive and active stages of labour.

- Clarification concerning the acceptable duration for the second stage of labour.

- Direction as to when an AP must be notified/contacted.
- The introduction of the Birth Record.
- The recording of five-minute auscultation of the fetal heart rate on the second stage of labour sheet of the Birth Record.

Escalation of Management of First and Second Stage of Labour

This policy was implemented in its final form in September 2009 to ensure the timely escalation of concerns or issues regarding labour management.

The Fetal Monitoring Intrapartum Policy was reviewed in May 2009 and details the assessment of fetal compromise, confirming what is normal and not normal. The policy clarifies the baseline standard in accordance with RANZCOG. This policy also details when the obstetrician must be notified.

The Obstetric Notification in Birth Suite Policy, which was implemented in July 2010, also details when obstetricians are to be called.

Complications of Pregnancy - Hypertension

The Complications of Pregnancy – Hypertension Policy was introduced in February 2005. Pre-eclampsia was defined in the policy as follows:

- *Mild pre-eclampsia:* onset of mild hypertension (140 systolic and or 90 diastolic) after the 20 week of gestation with proteinuria (greater or equal to 300 mg/24 hour collection) uncomplicated by neurologic symptoms or criteria for the diagnosis of severe pre-eclampsia.
- *Severe pre-eclampsia:* this is diagnosed when the blood pressure is greater or equal to 170 mm Hg systolic and/or 110 mm Hg diastolic, and also in women who have mild pre-eclampsia who also have either severe proteinuria (greater or equal to five grams in a 24 hour specimen), Oliguria, central nervous system dysfunction, thrombocytopenia, liver disease, severe epigastic and right upper quadrant pain or intrauterine growth restriction.

In the case of severe pre-eclampsia, the policy dictates that continuous fetal monitoring is required to take place.

In June 2009, the policy was reviewed and updated. The changes included removing reference and information regarding Magnesium Sulphate Infusion. The management of Magnesium Sulphate Infusion became a separate policy.

In June 2009, the Complications of Pregnancy – Hypertension – Magnesium Sulphate Infusion Policy was reviewed and included in the Intensive Care Policy Manual. The reason for this was that at the Hospital's obstetric and perinatal meeting on 13 May 2009 it was agreed that all patients requiring a magnesium sulphate infusion should be managed in the Intensive Care Unit with full haemodynamic monitoring.

Water Immersion during labour for Hydrotherapy Birth

The Water Immersion during Labour for Hydrotherapy Birth Policy was first introduced in June 2004 and reviewed in June 2006.

The policy provides that women may birth into water, under the care of a consenting obstetrician, assisted by a midwife who has completed the water birth competency, unless

there are factors which preclude such a birth method. The factors cited as precluding the use of warm water immersion during labour include:

- Lack of experience and comfort of the care giver.
- Any fetal distress.
- Maternal infection.
- Conditions where pure tap water cannot be provided.
- Abnormal blood loss.
- Client with an epidural in situ.
- Ante-intrapartum bleeding.

The factors cited as precluding birth in water include:

- Where the doctor does not support birth into water.
- Abnormal evolution of labour.
- Meconium staining of the liquor.
- Any non-reassuring fetal heart rate.
- An active pushing period of greater than one hour without progress.

The policy states that the obstetrician is responsible for informing clients of factors precluding water birth and the management of second stage labour.

In relation to the monitoring of the fetus, the policy provided that the use of aqua Dopplers enables the monitoring of the fetus as necessary with minimal disturbance to the mother. The fetus should be monitored with attention to second stage. Planned birth into water is contraindicated if there is fetal distress or meconium liquor present.

With respect to avoiding problems, if there is any suspicion of fetal distress, the mother should be asked to leave the tub to avoid the possibility of water inhalation. If meconium staining of the liquor amnii is present, the mother should be asked to leave the tub.

This policy was reviewed by the Hospital's Policy and Document Control Committee on 2 March 2011. There is no further information provided as to the current policy in effect.

Birth Record

In October 2008, the Unit Manager of the Birthing Unit introduced the Trial Birth Record as part of the policy review update. Prior to this the birth partogram was the birth record. The Trial Birth Record was implemented on a permanent basis in May 2009. The Birth Record is a fully integrated record, which allows both the obstetrician and the midwifery staff to document their care of the patient. The Birth Record allows for every aspect of the delivery to be recorded in one document.

The Birth Record was recently refined by a group of obstetric professionals from a wide range of PHSP hospitals. In December 2010, minor changes were made to the Birth Record. As a result, the fluid balance chart page has been removed and is a separate document and a page titled pre-labour observation chart has been added.

Booking In – Antenatal Clinical Pathway

This pathway was updated in July 2009 and October 2010 as part of the routine review of pathways. Relevantly, the following key changes were made:

- Education – pain management options for labour were added.
- A requirement for the patient to be informed of the need and frequency of CTG monitoring during labour.
- Provision to include pain management options and epidural signed information stickers.
- Information regarding birth plans and the need for possible interventions.

In November 2008, the education pathway was titled 'Education Pathway For Pre-Admission Care'. This pathway was reviewed and updated in July 2009 as part of the routine review pathways. The revised pathway is now titled 'Education Pathway For 34 Week Interview/Pre-Admission Care'. The relevant key changes made were:

- The history has been expanded to cover complications such as excessive swelling of the face, hands and feet should be checked. Headaches, pain, visual disturbances, fever should be reported.
- Mothers are advised to phone if they have any concerns during pregnancy.
- The education section focuses on mothers being made aware of some of the risk based factors that preclude the use of water in labour and for birth.
- The need for CTG monitoring is explained by the midwife.
- Following the interview the expectant parents are now required to sign the pathway.

In January 2011, the Education Pathway for 34 Week Interview/Pre-Admission Care was further revised to include a page specifically relating to Birth Plan discussions which clearly explains the reasons for interventions. Following the interview, any expectant parents who have a birth plan that does not align with the Hospital's policies or guidelines are now required to sign the birth plan document to confirm they understand the information provided.

Cardiotocograph Request/Reporting Form

In May 2009, the Cardiotocograph Request/Reporting Form was finalised along with the Birth Record (as detailed previously). An additional Labour Cardiotocograph Form was also introduced in the form of an envelope, which allows for the storage of the recorded CTG's and there is a space on the front of the envelope for two midwives to sign and give a summary of the CTG recording.

Caesarean Section Policies

The Caesarean Section – Priority One Extremely Urgent Policy and Caesarean Section – Priority Two Urgent Policy were introduced in June 2004 and reviewed in July 2008 and October 2008. The only change made to the policies was the process of transferring the mother and baby from the theatre to the birth suite.

The policy in place at the time of Baby A's birth in relation to priority two caesarean sections stipulated that a priority two (aim for less than 40 minutes) applied in cases where there was moderate ante-partum haemorrhage, non reassuring CTG, maternal seizure or eclampsia or an unsuccessful assisted birth.

In relation to the midwife's responsibilities after-hours (Monday to Sunday 3:30 pm to 7:00 pm), the policy stipulates the following:

- The midwife/doctor informs the parents of a need for a caesarean section.
- The midwife informs the Hospital Nursing Coordinator ('HNC') and the paediatrician of the need for a priority two caesarean.
- The HNC calls in the "on call" theatre staff.
- HNC makes contact or goes to 3A to arrange or provide support as needed.
- Directs the wards person to open recovery area and to assist transfer of mother to theatre on the birth suite bed.
- Second midwife goes to the emergency theatre and begins setting out the caesarean pack and obtains the emergency drugs from the cupboard.
- VMO or HNC, if requested, contact the anaesthetist "on call" by mobile phone.
- VMO or HNC, if requested, contact the surgical assistant.
- HNC directs the float to assist or calls in staff as needed.
- HNC contacts pathology for urgent blood collection if appropriate.
- Proceed with Priority 2 caesarean and second midwife returns to 3A and prepare special care nursery.

The PHSP has recently distributed to all of its obstetric units a new Caesarean Section – Emergency: Categorisation of Urgency Policy. The purpose of the policy is to provide a standardised classification system regarding when an emergency caesarean birth is required. This policy was reviewed and endorsed on 9 February 2010. The policy has four categories which are in line with RANZCOG guidelines:

- Category One – Urgent threat to the life of the woman or fetus.
- Category Two – Maternal or fetal compromise but not immediately life threatening.
- Category Three – Needing earlier than planned delivery but without currently evident maternal or fetal compromise.
- Category Four – At a time acceptable to both the woman and the caesarean section team.

The classification will be decided by the obstetrician in liaison with the midwife in charge and then communicated with the relevant staff.

Antenatal classes

Antenatal classes have also been restructured to include a more balanced view of a normal and abnormal labour and also when intervention may be required. This review was undertaken in conjunction with the obstetric/paediatric visiting medical officers and the Hospital midwives who conduct the class. A new 'Childbirth and Parenting Program' Booklet was written to incorporate a balanced view of labour and the potential for unexpected outcomes.

In 2010, the antenatal educator at the Hospital, Ms S, worked with the midwives who present the class to update them on the new format of the classes and to assist with their presentation of antenatal classes and documentation requirements. Midwives are now required to sign off to confirm that they have covered each area of the teaching plan during the antenatal class. The new format of antenatal classes commenced in January 2011.

Professional Development and Training

A database is kept by the Hospital's Obstetric Educator which summaries the competencies completed by each midwife in all areas.

Midwives are required to complete a CTG competency assessment annually. This competency has been in place since 2005. The competency covers preparation of the patient, performance of the CTG, documenting the results and an explanation of the results to the mother. The competency is subsequently assessed.

In July 2008, a visiting professor from South Australia conducted a day workshop for the Hospital midwives on CTG monitoring and its significance. Following the workshop, midwifery staff were required to complete the online Electronic Fetal Monitoring Master tutor activities and by February 2009 all midwives had completed the online assessment.

In November 2009, 43 out of 46 midwives and all four accredited obstetricians from the Hospital attended an interactive one day workshop through the RANZCOG education program. Education in relation to fetal assessment and the intra-partum risk factor of meconium or blood stained liquor was provided. The workshop included an assessment component.

In relation to ongoing education, abnormal CTG's are reviewed and discussed at a case presentation on a monthly basis. These educational activities are organised by the Obstetric Educator and are attended by the midwives. Wherever possible, obstetricians are involved in these case reviews. Throughout 2009, these case presentations were conducted informally but since January 2010, the process is now documented and recorded.

In May 2010, the PHSP introduced additional CTG training which is linked to K2 Medical Systems Fetal Monitoring training.

In relation to documentation, monthly audits are conducted by the Hospital to determine compliance with policy requirements. Each month, obstetric medical records are audited and the results of these audits are provided to midwifery staff at departmental meetings to provide feedback to the midwives in relation to any issues identified in the audit. From January 2009, the obstetric documentation audit tool was expanded to ensure auditing of all documentation.

In order to enhance the knowledge of midwives regarding the importance of accurate documentation, an education session was provided in November 2009 and on 2 March 2011 by the PHSP's legal counsel.

The Hospital has also expanded the external courses now available to midwifery staff to include obstetric emergency courses.

Investigation by Hospital into Baby A's death

Adverse Patient Outcome

At the time of Baby A's birth, the Hospital had an Adverse Patient Outcome ('APO') program and an associated policy in place. An APO was defined as '*an unplanned event that results in, or has the potential to result in, injury or damage. It is unrelated to the natural course of the illness and differs from the expected outcome of patient management, e.g. expected complications*'. The purpose of an APO is to yield learning improvements that will enhance the safety and effectiveness of the patient care provided by the Hospital.

The APO conducted following Baby A's death was reviewed by Dr H (medical quality representative on the Medical Advisory Committee) and Dr T who in June 2008 was the Chair of the Obstetric and Perinatal Committee. The recommendation from the review of this adverse event was that the incident should be referred to the PHSP's clinical governance and legal units for external review. As such, the matter was referred for external review by an interstate consultant obstetrician, Dr E.

Dr E subsequently reviewed the antenatal care, labour and delivery of the mother and detailed his findings in a report dated 11 September 2008. In relation to the first CTG conducted on 7 June 2008 commencing at 11:41 pm, Dr E notes that that whilst the tracing is not terribly clear, there is certainly a significant deceleration to 90 bpm at 11:45 pm. The CTG also shows a reduced beat of less than five. He also notes that it is sometimes difficult to tell whether the baseline is 150 with decelerations down to 130 and 120 after contractions or a low baseline of 120 with accelerations up to 160. Dr E interprets this as the former with late decelerations. He categorises the trace as non-reassuring and not reactive.

With respect to the second CTG commenced at 4:20 am on 8 June 2008, Dr E notes that the trace was also difficult to assess because of the loss of contact. Nonetheless, there were clear signs of loss of beat to beat and significant decelerations down to 70 bpm. The trace from 4:38 am to 4:56 am shows a significant bradycardia between 50 and 100. The baseline picked up from then until the trace was discontinued at 5:16 am. However, there were significant decelerations down to 60.

In Dr E' opinion, the mother had developed pregnancy induced hypertension at 38 weeks. At that time, her uric acid was 0.37 and she had significant proteinuria. Elevated or rising levels of uric acid indicate a worsening of pre-eclampsia. This, together with the fact that Labetalol had been used to control blood pressure, suggests that the mother had a significant hypertensive disease of pregnancy. Dr E suggests that an alternate management, in spite of the mother's birth plan, would have been either induction of labour or even an elective caesarean section.

Dr E notes that the admission CTG was interpreted as reactive, despite the following being apparent:

- Deceleration down to 90, not related to a contraction.
- Lack of beat to beat variation, less than five.
- Either a baseline of 150/160 with significant decelerations or possible lower baseline with acceleration.

In Dr E' opinion, Dr S should have realised that the CTG was certainly not reactive when he attended upon the mother at 2:30 am. This coupled with her hypertension on admission, significant proteinuria and a uric acid, which had increased significantly, should, at least, have prompted staff to remove the patient from the bath and recommence the CTG not

withstanding her 'birth wish list'. Dr E acknowledges, however, that it can be difficult to compromise with patients who have fixed ideas on their birth plan.

Dr E also notes that there was a delay of about an hour from the time the decision to perform a caesarean and arrival in the operating theatre. He suggests that this caesarean should have been a priority one, which is required to be performed within 30 minutes (fetal distress).

As a result of the findings of the external review, a peer review meeting was held with Dr S, Dr H, Dr T and the Director of Clinical Services on 16 October 2008. The purpose of this meeting was to discuss Dr S's clinical management of the mother's labour and delivery of Baby A.

During this meeting, Dr E's report was reviewed. Dr S confirmed that the mother had presented him with a birth plan at 36 weeks requesting a water birth. When asked about the feedback provided to the mother about a water birth, Dr S stated that it was the mother's choice to stay in the water and that she had declined to get out of the bath. It was noted that management of pre-eclampsia would normally indicate that continuing with the plan for a water birth should not have proceeded.

Discussion was also had in relation to the admission CTG and whether it was abnormal. Dr T expressed the view that Dr S should have reviewed the admission CTG when he arrived. Dr S agreed that he would do this in the future. It was suggested that Dr S participate in further CTG training, however, he stated that he had only recently undertaken a course with RANZCOG.

Dr S stated that he had not planned to deliver the baby early. Dr T and Dr H indicated that given the presence of a number of risk factors, it would have been more appropriate to deliver the child early. Dr T and Dr H questioned whether the father and mother were aware of all of the risks. It was also suggested that Dr S review current clinical management of pre-eclampsia and consider consulting a second obstetrician in future regarding the best practice.

Dr S confirmed that he had met with the father and mother in August and again in December to discuss the birth. He indicated that he had provided them with a full explanation as to what had occurred.

The areas of advice provided to Dr S were as follows:

- Lessons in CTG interpretation.
- Management of pre-eclampsia was not ideal and Dr S agreed to consult with colleagues regarding pre-eclampsia management in the future.
- In relation to the management of labour, it was noted that a possible induction in day light should have been considered.

PHSP - Online Incident Reporting Program

The PHSP also has an Online Incident Reporting Program. Managers and staff can enter clinical and other hospital incidents directly into the program and these are then escalated depending upon the risk rating either by the Director of Clinical Services, the Risk Manager or the Chief Executive Officer. This program also allows for a direct reporting of incidents to the PHSP's Clinical Governance Unit. A hard copy of the incident reporting form is also on file to allow staff who do not have computer skills to complete an incident report. Incidents are risk rated one to four and the policy clearly defines the escalation of incidents with a rating of one or two.

An incident report was generated in relation to Baby A's death.

Supplementary information from the Hospital

On 9 September 2013, a further statement was requested from the Director of Clinical Services seeking clarification of a number of matters, namely:

(a) Provide details as to the updated policy of the water immersion during labour for hydrotherapy birth. Detail the current policy and outline the changes to the policy, explaining the reasons why.

(b) What information was provided at the time of Baby A's birth (June 2008) during the antenatal classes performed at the Hospital?

(c) To the Hospital's knowledge, please provide details as to the training Midwife P had received prior to Baby A's birth in relation to CTG monitoring and use of the Doppler device. What, if any, further training/actions were undertaken by the Hospital following this incident in relation to the administration and interpretation of CTGs and also use of the Doppler device?

(d) Given Dr E's findings, was a review subsequently undertaken with Midwife P in relation to the matter? If so, please detail the review undertaken and any subsequent remedies actioned. If not, please provide an explanation as to why.

On 23 October 2013, the Director of Clinical Services provided a further statement in response to the matters outlined above:

(a) *Water immersion policy:* The *Water Warm Immersion in Labour/Birth Policy* underwent review in June 2011 and again in March 2012. This review was conducted to ensure that the updated policy was consistent with the Queensland Maternity and Neonatal Clinical Guideline. The updated policy outlines the maternal and fetal risk factors that preclude the use of warm water immersions during labour and/or birth. A detailed clinical practice table is now included at pages three and four to ensure that midwifery staff have a readily available reference to the Hospital requirements for permitting warm water immersions during labour and birth. The Birth Record identified antepartum and intrapartum risk factors that link with the *Warm Water Immersion in Labour/Birth Policy*. This record was introduced as a trial in October 2008. In particular, the Birth Record clarifies for visiting medical officers and midwives when continuous fetal monitoring is required. For example, the antepartum risk factors listed on the form confirm that pre-eclampsia is a maternal risk factor that requires continuous fetal monitoring by way of CTG. Water immersion is precluded for any situation that requires continuous fetal monitoring via CTG.

   The changes made to the *Warm Water Immersion in Labour/Birth Policy* and the associated amendments to the Birth Record were made to ensure that the practices endorsed at the Hospital are consistent with the PHSP's health care policies nationally and the relevant guidelines of RANZCOG.

(b) *Antenatal information as at June 2008:* At this time, antenatal classes were conducted over five weeks comprising of one session per week of two hours duration. An array of topics are covered during these sessions, including general hospital information, understanding the process of labour and ways to manage change, the role of the obstetrician and interventions and getting to know your baby.

   Since Baby A's death, a comprehensive review of the antenatal information provided to parents has been undertaken, which was detailed in the Director of Clinical Services' previous statement. The changes made, particularly since 2010, have

focused on providing balanced and comprehensive factual information to parents about pregnancy and the birthing process with an extended opportunity for them to ask questions. The current program is also provided over a five week period with sessions of two hours in duration. Alternatively, parents can opt for a weekend course. The current program covers an array of topics, including pregnancy advice and coming to hospital, labour, management of pain and unexpected outcomes, breastfeeding and parenting. Considerable time is now allocated to discussing the interventions that may be required during birth. At the 34 week interview between the parents and a member of the midwifery staff, an "education pathway" has been established which clearly outlines education and safety relating to CTG monitoring for expecting parents. The education pathway lists antepartum risk factors, including pre-eclampsia, as one of the reasons for continuous fetal monitoring and expected mothers are asked to sign off on their understanding of the Hospital's requirements. There is also a specific page summarising "birth plans" which explains why interventions may be required even when a mother has a preferred birth plan.

(c) *Training details for Midwife P:* The maternity unit has core clinical competencies, which are in compliance with RANZCOG expectations, which are completed annually by midwifery staff. Midwife P commenced working at the Hospital on 3 January 2007. She provided evidence at this time of previous CTG education that was completed in August 2006. Given how recent this training was, and to align with the annual training timetable scheduled by the Hospital, further RANZCOG education was not undertaken by Midwife P until February 2008. At this time, she completed competencies in an array of topics, including external CTG, newborn resuscitation, neonatal apnoeic and bradycardiac management and water immersion/water birth. On 15 June 2008, Hospital records indicate that Midwife P confirmed she had read and understood various hospital policies relating to fetal monitoring and various other labour and birth related policies.

On 26 June 2008, Midwife P underwent a routine annual performance review with the Nurse Unit Manager of the Obstetric Unit. During this review, she indicated that she wished to attend a further course to enable her to become an educator for conducting antenatal classes.

On 18 July 2008, following discussions between the Director of Clinical Services and the Nurse Unit Manager in relation to the circumstances surrounding Baby A's birth, Midwife P attended a CTG Workshop.

On 27 February 2009, Midwife P completed an online tutoring in external fetal monitoring.

The annual competency assessments were attended and completed by Midwife P in May 2009, to align with the annual training timetable scheduled by the Hospital. On 6 November 2009, she also attended a fetal surveillance education program conducted by Mr Mark Beaves. Midwife P ceased her employment with the Hospital on 8 August 2010.

(d) *Dr E' review:* Dr E' report confirmed his opinion that the CTG tracing recorded at 11:41 pm following the admission of the mother on 7 June 2008, was non-reassuring and not reactive. Prior to the review being completed by Dr E, the Nurse Unit Manager and the Director of Clinical Services had already met with Midwife P to discuss the events of the mother's labour and delivery and further CTG training and education was arranged and attended promptly. The Director of Clinical Services notes that during her meeting with Midwife P she was of the opinion that the admission CTG was "ok".

Calibration and maintenance of CTG monitoring equipment at the Hospital

The CTG equipment utilised by the Hospital at the time of Baby A's birth was comprised of a US transducer (ultrasound used for measuring fetal heart rate) and a TOCO transducer (strain gauge used for measuring the contraction strength and timing). These elements are universal across all CTG fetal monitoring devices. US and TOCO technology are present in both telemetry and non-telemetry fetal monitoring equipment. This equipment is of a reputable standard and is used throughout the world in both public and private hospitals.

By the nature of the technology, US sensors are highly directional and must be correctly placed against the mother's abdomen to be able to sense and monitor the fetal heart rate. It is also vital that an acoustic gel be used to ensure transmission of the signal. The standard method of ensuring the adequate monitoring of the fetal heart rate is through the use of a belt/strap arrangement to position the US sensor. Although the US sensor can sometimes slip out of position (and thus not pick up an accurate fetal heart rate), the strap is used to minimise the amount of displacement.

The US transducer is also directional and must be correctly placed to ensure an accurate reading of the fetal heart rate. Often due to fetal movement, it is common for the US transducer to have to be repositioned during the course of labour. While the introduction of telemetry based fetal monitoring equipment has allowed for greater freedom of movement for the mother during labour, this technology has increased the difficulty in accurate positioning of the US transducer. With the greater freedom of movement for the mother there is a tendency for the sensor to move out of the correct position, which causes the CTG to lose the fetal heart rate. If the US transducer is not picking up a good signal, if the sensor moves out of place or the unit is simply not in use, no data will be available.

The use of full disclosure recording of fetal monitoring (by way of SD recording devices), whilst technically possible, is not currently included into fetal monitors as a paper printout must be produced and kept as part of the medical record. Centralised monitoring systems with full disclosure, whilst available, are not commonly used in Australian hospitals.

For the 12 months prior to Baby A's birth, the maintenance and calibration of the fetal monitoring equipment used at the Hospital was undertaken by a biomedical engineering company (BEC).

The BEC performed functional and safety testing and necessary servicing of the fetal monitor (Philips M1350B, serial number 3650G08700) ('the machine') used during Baby A's delivery and for the 12 month period up to 8 June 2008. Service history of the machine confirms:

- A safety/functional test was carried out on 29 November 2007 which confirmed that there were no problems with the machine.

- Repair works were carried out on 18 February 2008 due to a flickering screen. At this time, the machine was checked over and a loose power cord was found. The power cord was refitted and the machine subsequently operated quickly. The overall performance of the machine was also checked which was satisfactory.

- Repair works were carried out on 14 May 2008 due to the maternal pulse not working correctly. The probe and lead were tested for any breaks and were found to be satisfactory.

This fetal monitor was installed in January 2002.

The BEC carried out an Electrical Safety and Essential Performance Parameter Test of the machine on 29 November 2007. This test is performed every 12 months to ensure the

machine is operating correctly and is accurately recording the fetal heart rate and uterine contractions. Testing is carried out by a trained biomedical engineer or technician. All tests carried out on the machine on this occasion confirmed that there was no technical fault or maintenance issue with the machine at the time of the inspection.

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists Guidelines

Categorisation of urgency for caesarean section (C-Obs 14) – in place in 2008

The RANZCOG Guidelines in place at the time of Baby A's birth in relation to the categorisation of urgency for caesarean sections recommend that there is a four-grade classification system for emergency caesarean sections. These are:

- **RANZCOG Category 1:** Urgent threat to the life of a woman or a fetus.
- **RANZCOG Category 2:** Maternal or fetal compromise but not immediately life threatening.
- **RANZCOG Category 3:** Needing earlier than planned delivery but without currently evidence maternal or fetal compromise.
- **RANZCOG Category 4:** At a time acceptable to both the woman and the caesarean section team, understanding that this can be affected by a number of factors.

The RANZCOG Guidelines recommend that there should be no specific time attached to the various types of caesarean sections. Each case is to be managed according to the clinical evidence of urgency, with every singe case being considered on its merits. Judgement on the appropriateness of decision to delivery intervals should be made on the basis of the information available to the clinician making the decision for a caesarean section before delivery and not on the condition of the baby at birth nor on the time required to access a functional and staffed operating theatre.

The RANZCOG Guidelines also stipulate that all maternity services conducting deliveries should be staffed and equipped to perform a caesarean section promptly within the guidelines.

C-Obs 24: Warm water immersion during Labour and Birth – endorsed after Baby A's birth (current)

The RANZCOG Guidelines regarding water immersion note that practitioner's views on water immersion for labour and birth tend to be polarised. There are very clear differences in the level and nature of maternal and fetal risk that may be ascribed to "water immersion during labour" when compared to the consequence of giving birth whilst immersed in water. It is noted that there is much less support in the medical community for water birth in comparison to water immersion in labour and many of the hazards of water immersion during labour are the consequence of unintended water birth.

It is generally accepted that lying in warm water does promote a sense of relaxation. However, whether labouring immersed in water results in a reduction of pain or the requirement for pharmacological analgesia, is less clear.

The potential adverse consequences of water immersion in labour are noted as follows:

- Neonatal sepsis, maternal sepsis: contamination of the water with enteric bacteria is inevitable and cases of neonatal and maternal sepsis can logically be expected.

- Unplanned delivery in water: a proportion of women will deliver in water, despite prior intent to do otherwise, due to the rapid progress of the second stage of labour.

In relation to the management of problems created by water immersion in labour, it is noted that continuous electronic fetal monitoring is only possible using telemetry, which is not often available and therefore fetal surveillance is limited to intermittent auscultation, usually with a hand-held Doppler device. Progress of labour is also difficult to ascertain as vaginal examination necessitates the cessation of water immersion in order to maintain appropriate antisepsis. There is no quality evidence attesting to the safety of vaginal examination whilst immersed in water. It is noted that the need to interrupt water immersion for vaginal examination may potentially lead to less adherence to institutional protocols about labour progress.

The RANZCOG Guidelines also acknowledge that obstetric emergencies cannot be managed appropriately with a patient in a birthing pool.

It is noted that there is a paucity of quality scientific evidence and safety data regarding the benefits and risks of a birth in water. Complications that have been reported to occur in the setting of water birth include drowning, near drowning, respiratory problems, cord avulsion, and waterborne infections. In addition, management of some obstetric and neonatal emergencies cannot be completed adequately whilst a woman is immersed in water. For these reasons, the RANZCOG Guidelines conclude that planned birth in water cannot currently be favoured over conventional birth.

Nevertheless, where appropriate facilities exist, women who make an informed choice to deliver in water, acknowledging the difficulties in administering life saving treatment and accepting the possible increased risk of adverse maternal or neonatal outcome, should be supported in their decision-making and given every opportunity to do so in best practice facilities attended by appropriately trained staff.

Expert Report – Consultant Obstetrician, Dr M

On 12 August 2011, Consultant Obstetrician Dr M was requested to provide an expert opinion in relation to this matter. Specifically, Dr M was asked to address the following matters:

I. The appropriateness of a water birth;

II. Parental insistence of a water birth and the Hospital allowing it in those situations, as well as its relationship to the prolonged second stage of labour;

III. Complications of mother;

IV. Any other causes of death;

V. Assessment of fetal heart rate monitoring, equipment used (quality, age, maintenance) and medical documentation;

VI. Your opinion as to the appropriateness of the treatment provided to Baby A by the Hospital; and

VII. Any other issues you may wish to comment on regarding the care of Baby A.

After considering the material provided, Dr M identified a number of issues associated with the care provided to the mother during her labour and delivery.

Notations in the medical records

Dr M notes that the overall documentation in the medical records is lacking in some details, particularly:

- There is no medical referral from the obstetrician in the chart.
- The vaginal examination times are different in the patient progress notes and the partogram.
- The original CTG is faded and very difficult to interpret and is not a continuous CTG but merely an intermittent record of the fetal heart rate throughout the labour.
- The QML urine protein creatinine ratio taken during the admission to the ward in January was clearly abnormal and the result has been filed in the chart without any evidence that it has been seen by medical staff.

Liquor assessment

Dr M notes that there was no comment on the colour of the liquor in the partogram aside from two recordings of blood stained liquor. For the last four and half hours of the labour, there was no documentation or comment on the liquor colour.

Dr M notes that there may have been no liquor draining as the head was jammed in the pelvis. It is possible for the fetus to pass meconium in-utero and this is not evident to the attending midwife or obstetrician as the fetal head acts as a plug preventing amniotic fluid and meconium from draining per vaginum.

Dr M states that it is especially important to check and note the colour of the fluid when a mother is using the bath for analgesia, as the presence of meconium is a contraindication to water immersion in labour. If meconium was noticed, this is an indication for continuous monitoring with a CTG.

Contractions

Dr M is of the opinion that the mother's contractions were poorly recorded on the partogram. It is not clear whether the contractions were 2:10 or 3:10 and therefore whether they were adequate to achieve a vaginal birth.

Blood pressure

Dr M is of the view that the mother's blood pressure was clearly abnormal, however, wasn't being monitored or treated appropriately. The last recorded blood pressure reading in the notes was 180/80 at 5:00 am, following which delivery didn't occur for another 90 minutes. Dr M is of the view that this abnormal reading warranted closer monitoring.

Dr M notes that in her opinion, the mother had severe pre-eclampsia on admission with her level of proteniuria and her high blood pressure of 180/91. In support of this claim, Dr M cites PHSP document DS-1-(g), *'Complications of Pregnancy'*, which states that severe pre-

eclampsia is diagnosed when blood pressure is greater or equal to 170mmhg systolic and/or 110mmhg diastolic. Furthermore, the diagnosis should also be considered in women who have severe proteinuria, greater than or equal to three of proteinuria on dipstick. The mother had both of these and was therefore a high risk labour. Dr M notes that the risks of high blood pressure in labour are bleeding, placental abruption, coagulopathy and stroke.

Dr M notes that there were six recordings of blood pressure during the mother's labour, which spanned some six hours. Each of the readings were abnormal as they were above 140/90.

Temperature

Dr M notes that there are only two recordings of temperature on the partogram despite the policy to have more frequent observations during labour, especially when water immersion is being used.

CTG trace

Dr M notes that there are two CTG's in the original medical notes:

(a) CTG number 88023-88026 – dated 3 June 2008. This CTG was taken during the mother's admission for investigation of her high blood pressure. The CTG was run for 30 minutes and shows a normal baseline of 130 bpm with accelerations and no decelerations. Dr M notes that the CTG trace has faded considerably and is difficult to read.

(b) CTG number 88218-88229 - Dr M notes that this CTG trace is very faded and is very difficult to interpret due to the poor quality. The trace appears to commence at 11:44 pm on 7th June 2008 and finishes at 5:20 am on 8th June 2008. The CTG, however, was not recorded continuously as the trace represented 110 minutes only of the six and half hours of labour. Dr M notes that there are several sections where it is not possible to make any comment as the trace is so faded. There are also other sections where there is presumed loss of contact with the maternal pulse rate being picked up at 80 bpm. Dr M is of the view that this CTG trace represented small snapshots of the fetal heart rate throughout the labour. Whilst the trace is very faded, Dr M is of the view that the fetal heart rate pattern appeared to be one of a baseline approaching 160 bpm with variable decelerations to 120-130 bpm. The rest of the trace is so faded that it is difficult to make any further comment.

Dr M notes the concerns raised by the father and mother about the fetal heart rate, where both claim that they heard the heart rate slow down when the mother was on the bed being examined. They also expressed concern that they believed the fetal heart rate was high when the mother was in the birthing pool. In response, Dr M notes that if the fetal heart rate was abnormal on auscultation intermittently with the Doppler ultrasound probe, this is an indication that a CTG trace should be performed continuously.

Dr M expresses concern that there was no record of the fetal heart rate between 5:30 am and 6:35 am despite this being a high risk pregnancy.

At the time of Baby A's birth, Dr M notes that the RANZCOG CTG Guidelines were in effect and well known to all maternity hospitals in Australia. In accordance with these guidelines, Dr M notes that in this case there were three indications for a continuous CTG to be conducted throughout the labour, namely:

(i) The antenatal diagnosis of preeclampsia.

(ii) The abnormal Doppler CTG (as reported by the father).

(iii) Liquor volume. There is no record of any liquor draining since 2:00 am. There was either no liquor seen or it wasn't looked for or noted. If there was any meconium noted this would have also been an indication for a continuous CTG.

Dr M notes that wireless monitoring could have been conducted, which would have enabled the mother to mobilise and not be restricted to the bed.

Dr M also expressed the view that the slow progress in labour between 2:30 am and 5:00 am with an occiput posterior position in the presence of high maternal blood pressure was also an indication to monitor the labour more closely with a CTG.

Water birth appropriateness

Dr M notes that whilst there is no state-wide policy in relation to water births in Queensland, there are RANZCOG guidelines and an internal policy at the Hospital.

In the mother's case, Dr M is of the view that there were at least two contraindications to having a water birth:

(c) Due to antenatal diagnosis of severe pre-eclampsia, the mother needed to have her blood pressure monitored especially as it was abnormally high on admission. In Dr M' opinion, this should have been explained and enforced by staff and precluded being in the water as it is not possible to monitor the mother's condition as well in the water. Moreover, there are risks to the mother with high blood pressure and the bath is not an appropriate place to be should the mother experience any complications from the high blood pressure, such as eclampsia or bleeding.

(d) When the fetal heart rate was abnormal on intermittent auscultation, a CTG should have been applied and the CTG should have been left on continuously. It is possible to wirelessly monitor the fetal heart rate allowing the mother to be mobile on the birthing ball out of the bath and using nitrous oxide. It is not possible to perform a continuous CTG in the bathing pool.

(e) If any meconium was present this would have been a further contraindication to being in the water.

(f) If a temperature developed in labour this would have also been a contraindication.

Dr M is also of the view that the mother's delivery was complicated as the fetal head was impacted in the pelvis with an arm prolapsing through uterine incision. Dr M states that the fetal head would need to be pushed up out of the pelvis to enable the baby to be turned into the breech position and delivered by breech extraction. Dr M notes that whilst the progress notes indicate that the delivery was easy, in her view, the situation described is not one of an easy delivery. Dr M opines that the delivery may have further contributed to Baby A passing meconium and aspirating meconium.

Weight at birth

Baby A weighed 2.8 kg at the time of his birth. Dr M notes that pre-eclampsia causes slowing of the fetal growth in utero and reduced liquor volume. The placenta can show signs of reduced utero-placental perfusion and this can cause fetal distress in utero during the pregnancy or during labour. With each uterine contraction there can be increased pressure on the umbilical cord reducing the umbilical artery blood flow causing the fetus to become hypoxic and acidotic. Dr M notes that this stress on the fetus can result in the passage of meconium. If the fetal head is jammed in the pelvis the meconium may not be evident until after the fetal head is born as the head acts as a plug preventing the fluid from escaping.

Meconium aspiration

Dr M notes that meconium can be passed in utero antenatally and up to 33% of all babies at term pass meconium prior to birth. Meconium passage results from increased peristalsis and relaxation of the anal sphincter due to increased vaginal outflow. Normal healthy babies and those experiencing utero stress can pass meconium. If the liquor volume is reduced the meconium can become quite thick and is highly irritating if inhaled into the fetal lungs. The liquor volume can be reduced with high blood pressure and this can be associated with small babies.

Risk factors that may cause stress to an infant before birth include:

- Decreased oxygen to the fetus in utero;
- Difficult delivery or a long labour; and
- High blood pressure antenatally.

Dr M notes that the mother had severe pre-eclampsia, which is a risk factor for meconium aspiration. When the mother arrived at the Hospital on 7 June 2008, it was noted that the liquor was clear (brownish) and on the partogram it is recorded as pink. If meconium is passed prior to the onset of labour, the liquor is usually noted to be green/yellow or yellow/brown in colour. Fresh meconium is green and old meconium passed some days or weeks before is yellow/brown in colour. Dr M notes that it is possible that the brownish colour was old meconium although this wasn't commented on further in the nursing or medical notes.

Acute chorioamnioinitis – placenta histology

Dr M notes that there is no placenta histology from QML in the medical records. At autopsy, however, the QML histology showed evidence of chorioamnioinitis (inflammation of the fetal membranes), which is most likely due to bacteria ascending from the vagina. This can occur during labour. This is why, in Dr M' opinion, it is important to monitor the maternal temperature regularly in labour for signs of infection and to treat with IV antibiotics if the temperature rises above 38 degrees.

Dr M also states that when the mother has pre-eclampsia, there can also be evidence of utero placental insufficiency in the placenta on histological examination. Baby A weighed 2.8.kg at birth, which is at the small end of the normal range being the tenth percentile. Dr M opines that it is possible that there may have been some degree of chronic compromise in the utero-placental circulation causing Baby A to be smaller than average.

Policy failures

Having considered the relevant policies in effect at the time of Baby A's birth, Dr M notes the following compliance failures:

(g) ***DS-2-(f): Admission Assessment and Management of the First Stage of Labour, states***:

- An admission CTG should be performed and signed by two midwives (not done in this case).
- Second hourly temperatures (no temperature done in this case after 2:00 am)
- Half hourly PV loss notes colour of amniotic fluid if present (not done after 2:00 am)
- CTG should be performed if the fetal heart rate is abnormal on auscultation.

N.B: This policy was NOT in effect at the time of Baby A's birth and was only introduced in May 2009.

(h) DS-1-(g): Complications of pregnancy – hypertension

- Severe pre-eclampsia is diagnosed when the blood pressure is equal to or greater than 170mmhg systolic and/or 110mmhg diastolic.
- The mother's blood pressure on admission was 184/91, which was clearly abnormal. Dr M is of the view that in the very least, her blood pressure should have been checked again in half an hour. One hour later her blood pressure was recorded as 159/91 and thereafter three further high readings of 171/83, 182/84 and 174/82 at 2:00 am, 2:30 am and 3:30 am. The last recorded blood pressure prior to delivery was 180/80.

(i) DS-1-(a) Fetal Monitoring (current in 2008 and obsolete in 2009)

- A CTG is indicated if the mother has preeclampsia. Dr M notes that in the mother's case this wasn't done continuously, merely intermittently throughout the labour. Unfortunately, the quality of the CTG recording is very poor as it has faded since 2008 and by 2012 was virtually uninterpretable.

Dr M' opinion

In Dr M' view, the mother's pregnancy was high risk as she was 42 years of age with high blood pressure and diagnosed severe pre-eclampsia.

Dr M agrees that it was appropriate for Dr S to have admitted the mother to Hospital for assessment, investigation and likely delivery on 7 June 2008. She is of the view that Dr S's antenatal management of the mother, including the decision to prescribe Labetalol and to conduct an ultrasound scan to monitor the fetal growth, was appropriate. Dr M acknowledges that it is likely that Dr S would have likely induced the mother if she had not gone into labour spontaneously on 7 June 2008.

Dr M notes that it is best practice to continuously monitor the fetal heart rate by CTG throughout labour.

In Dr M's view, water immersion wasn't appropriate during the mother's labour as there was an indication for continuous fetal heart rate monitoring with a continuous CTG. She believes that a CTG should have been recommended to the father and mother and been applied continuously, which could have been done wirelessly to allow the patient to mobilise.

Dr M is of the view that there was an inappropriately long delay in getting to theatre and performing the caesarean section. Dr M states that it is unclear from the medical notes why it took one and half hours to arrange the caesarean section. During this time, there was no appropriate monitoring of the fetal heart rate for the last hour of labour. Dr M opines that as there was no appropriate monitoring, the caesarean section was categorised as a Category Two, which indicates a non-life threatening fetal or maternal condition. The mother had pre-eclampsia and if the CTG was on for the duration of the labour, it is most likely that it would have showed a pathological trace, which would have necessitated a more urgent or Category One caesarean section.

Dr M notes that the fetal scalp Ph showed evidence of hypoxia and acidosis. The autopsy findings didn't confirm this in Baby A's brain as he died so soon after birth and the pathological changes in the brain take some time to develop. Dr M is of the view that had Baby A survived, he would likely have suffered from severe hypoxic encephalopathy (severe cerebral palsy).

Dr M is of the view that it is most likely that the hypoxic and ischaemic injury happened in the last few hours of the labour. In Dr M' opinion, as the labour was not monitored appropriately, the attending midwives and obstetrician were unaware of the true fetal condition. Dr M expresses the view that it is likely if a CTG had been applied, there would have been signs of an increasingly hypoxic intrauterine environment with a rising baseline and decelerations of the fetal heart rate with contractions. There was also some evidence of ascending chorioamnionitis in the histology of the placenta which may have contributed to the death.

In Dr M's opinion, it is most likely that Baby A died from acute hypoxic encephalopathy resulting from meconium aspiration in utero, which is likely to have occurred during labour. As the liquor was recorded as being clear at the beginning of labour, it is most likely that Baby A passed meconium and aspirated the meconium into his lungs during the course of labour.

Dr M notes that review of the placental histology by a prenatal pathologist may be helpful to ascertain the timing of the passage of meconium and review of the ultrasound scan.

Dr S and Midwife P' responses to Dr M' report

Dr S' response

After considering Dr M' report, Dr S provided a further statement, dated 21 March 2013.

In relation to issues raised by Dr M, Dr S made the following relevant comments:

- The ultrasound scan taken at 36 weeks (taken on 27 May 2008) was not in the medical chart but rather in Dr S' practice notes. The report shows amniotic fluid volume at the lower end of normal, normal umbilical artery Doppler and estimated fetal weight of 2,992 grams, which does not reflect fetal growth retardation.

- Dr M notes that it is likely that Dr S would have induced the mother had she not gone into spontaneous labour on 7 June 2008. Dr S states that in his practice notes, he indicated that he was considering an induction of labour, which is also reflected in the Hospital records.

- As to whether the mother had moderate or severe pre-eclampsia, Dr S is of the view that her condition during her antenatal course could be described as 'mild-moderate' by reference to Queensland Health clinical guidelines on Hypertensive Disease in Pregnancy (a copy of which is annexed to his statement). Dr S agrees, however, that when the mother was admitted in

labour her condition was such as to meet the criteria for severe pre-eclampsia. He notes that blood pressure is usually exacerbated by the stress of labour, and in the mother's case, it fluctuated between mild and severe. The admission blood pressure was recorded by Midwife P at 11:45 pm as 184/91, and then at 2:00 am as 150/84. The recordings on the partogram ranged between 150 to 184 systolic and 82-97 diastolic, and after the caesarean section were recorded at 8:40 am as 144/77.

- Dr S describes his recollection of the environment in the labour room where the mother was admitted. He notes that it is a large room with a large birthing pool on one side of it and a labour bed on the other side. When Dr S arrived to attend to the mother, the lights were dimmed, which would not have helped identify the passage of meconium in the pool of water. Also the mother was reacting vigorously to labour pains when she was in the water, and after coming out of the pool she had exacerbated anxiety that her labour and delivery were not progressing as "naturally" as she had hoped, which also increased her reactions to contractions and made monitoring difficult. This was also recorded by Midwife P in her notes in the medical records at 5:00 am.

- Dr S agrees that standard continuous CTG monitoring of the fetal heart rate was indicated in this case and would have resulted in earlier identification of fetal hypoxia in labour and therefore earlier delivery of Baby A.

- Contrary to Midwife P' entry on the CTG tracing stating 'seen by Dr S @ 230', Dr S claims he was not made aware of any abnormality of the fetal heart rate before his arrival to attend to the mother at 2:30 am and did not see the admission CTG. He notes that Midwife P reported that the fetal heart rate on admission to be 'commenced FHR, 118-155 Reactive'. At 1:00 am, she also recorded 'FHR 145-135'.

- Dr S maintains that vaginal examinations were performed by Midwife P at 2:45 am and 3:00 am to assess the progress of labour as the mother felt the urge to push and cervical dilation was found unchanged at nine centimetres. At about 4:00 am, the mother agreed to come out of the pool when she realised that her labour was not progressing to a smooth delivery. Dr S recorded vaginal examinations performed by himself at 4:15 am and 4:45 am, the findings of which indicated obstructed labour. Dr S recorded in the patient file that no meconium was observed during his vaginal examinations. No meconium was reported by Midwife P on the mother's admission nor while she was in the birthing pool.

- Dr S notes that, as described in his previous statement, the fetal heart rate was monitored, once the mother had exited the birthing pool, by using an external transducer of the CTG machine. Dr S' assessment at the time was that the fetal heart rate demonstrated early decelerations caused by head compression and impaction in the pelvis with adequate recovery in between contractions and without rising tachycardia. There was some difficulty in obtaining a good signal and the machine recording on the paper strip was poor, with the mother reacting vigorously to labour pains.

- In relation to the reasoning for ordering a Category Two caesarean section, Dr S refers to the information provided in his previous statement. He notes that the decision was made at 5:00 am. Whilst preparations were being made for the caesarean section, the fetal heart rate was listened to by Midwife P and was recorded at 6:10 am as being between 132 and 135. Dr S maintains that he was not made aware of any further abnormality or

deterioration such as fetal tachycardia or prolonged decelerations. Otherwise, he maintains that he would have re-categorised it as a Category One caesarean section.

- Dr S agrees that Baby A suffered intrapartum hypoxia as documented by the cord blood gases. The CTG performed by Midwife P was not recognised as abnormal on admission. Had he been advised of abnormality in the fetal heart rate on admission, Dr S maintains that he would have advised standard continuous CTG monitoring. Dr S states that he had already advised that immersion in the birthing pool was "contra-indicated" in the mother's case.

- Dr S notes that it is common practice for a midwife to send a CTG by facsimile to his home for evaluation if any deviation from normality was suspected. Furthermore, Midwife P may have sought the assistance of a more senior midwife about the admission CTG. Dr S maintains that Midwife P made no mention to him of the admission CTG at any stage until after Baby A was born.

- In relation to the caesarean section delivery, Dr S notes that because Baby A had no muscle tone, once the head was impacted out of the pelvis, it floated up in the uterine cavity as if the baby became folded on itself. The practical solution was to then perform a breach extraction. The lack of real muscle tone explains why Dr S notes it was an "easy" breach extraction.

- At the time of delivery, Baby A was not making any spontaneous breathing effort. Dr S is of the belief that meconium aspiration is likely to have occurred in the uterus at a time prior to caesarean delivery.

- Dr S notes that histological examination of the placenta reported acute chorioamnionitis. The mother had post caesarean sepsis in her abdomen that required laparotomy despite antibiotic prophylaxis in the caesarean section. Dr S notes that she did not have prolonged rupture of the membranes and her vaginal swab at 36 weeks was negative for GBS bacteria. However, the placental acute chorioamnionitis may indicate that Baby A also suffered from sepsis that contributed to his death. Dr S submits that it is arguable that this may be linked to immersion in water and having vaginal examinations performed under water.

Midwife P' response

After considering Dr M's report, Midwife P provided a further statement dated 28 February 2013. Her responses to the issues raised by Dr M are as follows.

Vaginal examinations

In relation to the vaginal examinations conducted, Midwife P notes that she is unable to reconcile the times nominated by Dr M in her report. She confirms that vaginal examinations were conducted at the following times:

- 11:30 pm – vaginal examination performed by Midwife P at which time the mother was three centimetres dilated.

- 2:00 am – vaginal examination performed by Midwife P at which time the mother was seven centimetres dilated.

- 2:45 am – vaginal examination performed by Dr S who told Midwife P that the mother cervix was nine centimetres dilated.

- 3:00 am – vaginal examination performed by Dr S who advised Midwife P that the mother was nine centimetres dilated.

- 4:00 am – vaginal examination performed by Dr S who advised Midwife P that there was no change.

Midwife P also recalls that she was present when Dr S performed a further vaginal examination when the mother was either in the operating theatre or in the operating theatre waiting area. She recalls that Dr S told her that there was no change. She estimates that this likely occurred between 5:30 am and 6:10 am.

Liquor colour

Midwife P clarifies that the note she made in the medical records' patient progress notes at 11:45 pm which stated *'clear fluid/brownish'* was to record something the mother had told her and not something she had observed.

Midwife P confirms that she did not observe any brownish vaginal discharge at any stage during her care of the mother. She did not observe any meconium at all throughout the mother's labour.

In response to Dr M's suggestion that there was no comment on the liquor colour on the partogram, Midwife P highlights that she recorded the following liquor colour at the time of the vaginal examinations:

- At 11:30 pm, Midwife P noted that the liquor was blood stained.

- At 2:00 am, Midwife P noted that the liquor was blood stained.

- At 2:45 am, Midwife P noted that no liquor was observed to have been seen by Dr S. As such, Midwife P has marked the relevant column on the partogram with a horizontal line.

- At 3:00 am, no liquor was reported to have been seen by Dr S and as such Midwife P has marked the relevant column on the partogram with a horizontal line.

- At 4:00 am, Midwife P did not record whether any liquor was observed by Dr S.

- Midwife P does not recall whether or not the presence of liquor was mentioned at the time of Dr S' vaginal examination in the theatre area between 5:30 am and 6:10 am, however, her usual practice would be to make a note of any findings reported to her.

Contractions

In response to Dr M' question as to whether the mother's contractions were sufficient to achieve a vaginal delivery, Midwife P recalls that the mother's contractions were consistently strong and occurring at a rate of three every 10 minutes from the time of her admission and throughout her labour. In her experience, strong contractions, such as those experienced by the mother, were adequate to achieve vaginal delivery.

Blood pressure observations

Midwife P queries Dr M' suggestion that the last recorded blood pressure reading for the mother was 180/80 at 5:00 am. She notes that the mother's blood pressure was being monitored because it was high at the time of her admission. The systolic blood pressure was at times observed to be above 170, however, after the reading at 1:00 am, the diastolic measurement settled and remained below 90.

According to the notes made by Midwife P in the partogram, progress notes and the pre-operative checklist, the mother's blood pressure readings were as follows:

- 11:30 pm – 184/91
- 12:30 am – 159/91
- 1:30 am – 150/84
- 2:00 am – 171/83
- 2:30 am – 182/84
- 3:30 am – 174/82
- 5:30 am – 164/81

Midwife P notes that she was not observing the mother's blood pressure in isolation. She claims she was constantly monitoring her for the development of any other clinical signs that might impact on the health and well being of either the mother or the infant, such as blurred vision, headaches, a pounding pulse or heart palpitations. None of these clinical signs were observed.

CTG and monitoring of the fetal heart rate

Midwife P states that at no time during the mother's labour was she concerned about the fetal heart rate. The CTG taken on admission continued for a duration of 20 to 25 minutes and appeared to be normal and reactive.

Midwife P does not recall any discussion with the father and mother, as repeated by Dr M in her report, to the effect that the fetal heart rate came almost to a stop during the admission CTG. Midwife P does not recall the fetal heart rate coming almost to a stop at any stage during the labour.

Midwife P notes that if there were any audible fluctuations in the fetal heart rate, her practice would have been to reassure the parents that it is normal for the fetal heart rate to fluctuate to some extent, particularly during contractions, between the range of 110 to 160 bpm.

Midwife P does not recall observing any abnormality with the fetal heart rate, including on auscultation when the mother was in the bath. She does recall having a conversation with the father and mother about the fetal heart rate sounding a bit high with the Doppler machine whilst the mother was in the bath. She recalls reassuring them that it should come down again, which it did. Midwife P is of the belief that this conversation was in relation to an observation that the fetal heart rate was 160 bpm, which could have taken place during her observations taken at 3:00 am or 3:30 am. To the best of her recollection, the readings of 160 bpm were fleeting and occurred during contractions.

Midwife P notes that is her usual practice to raise a concern with Dr S if she observed any fetal tachycardia, particularly if it was persistent. In this case, Midwife P did not observe any fetal tachycardia during the mother's labour.

By way of clarification, Midwife P made the following recordings of her observations of the fetal heart rate throughout the labour:

- 11:30 pm – 145 bpm

- 11:45 pm – 118 to 155 bpm
- 12:30 am – 145 bpm
- 1:00 am – 145 to 135 bpm
- 1:30 am – 140 bpm
- 2:00 am – 135 to 140 bpm
- 2:15 am – 145 bpm
- 2:30 am – 135 to 148 bpm
- 3:00 am – 155 to 160 bpm
- 3:15 am – 125 bpm
- 3:30 am – 145 to 160 bpm
- 3:45 am – 135 bpm
- 4:00 am – 120 bpm
- 4:30 am – 145 bpm
- 5:00 am – 135 to 155 bpm
- Shortly after 5:00 am – marked FHR as within the normal range
- 5:30 am – 145 bpm
- 6:10 am – 132 to 135 bpm

Midwife P notes that the CTG was reapplied to the mother at 4:00 am, and although she experienced difficulty attaching the maternal transducer straps, she could hear the fetal heart rate at all times. The fetal heart rate was also continuously displayed on the monitor and she recalls that it was, at all times, within normal limits for the duration of the CTG.

Midwife P also claims that to the best of her recollection, she monitored the fetal heart rate with the Doppler more often than is recorded in the patient records after the mother was taken to the theatre waiting area. She claims this was probably because she didn't always have immediate access to the patient chart due to the involvement with other staff in preparing the mother for the caesarean section. Midwife P did not have any concerns with the fetal heart rate at this time. She does recall Dr S popping out on at least one occasion to ask whether the fetal heart rate was okay, to which she confirmed that it was.

Temperature

Midwife P notes that the mother's temperature was observed to be within the normal range at 11:30 pm (36.9 degrees), at 2:00 am (36.7 degrees) and again at 5:30 am (36.7 degrees).

Further statements provided by Dr S and Midwife P

Supplementary statement of Midwife P

On 9 September 2013, Midwife P was requested to provide a further statement for the purposes of the coronial investigation, specifically addressing the following matters:

(a) Details as to the training she was provided prior to Baby A's birth, particularly in relation to the interpretation of CTG monitoring and use of the Doppler device. She was also requested to provide details of further training provided following Baby A's death, particularly in relation to the interpretation of admission CTG's.

(b) Was there any discussion with the father and mother at any time during the labour about the difference between CTG monitoring as compared to the Doppler device, including the advantages and disadvantages of both?

(c) Did Dr S inform you at anytime that he was of the opinion that there was an obstructed labour?

A further statement was subsequently provided on 25 October 2013 and relevantly stated as follows:

Details of training prior to 8 June 2008:

- On 13 August 2006, Midwife P completed the Fetal Surveillance Education Program provided by RANZCOG.

- After commencing employment with the Hospital Midwife P completed all the relevant compulsory annual competency assessments required. In particular, on 1 February 2008, Midwife P relevantly completed competencies in fetal assessment external CTG, newborn resuscitation, neonatal apnoeic and bradycardic management, neonatal pulse oximeter application and monitoring and water immersion/water birth.

Details of training after 8 June 2008:

- On 26 June 2008, Midwife P underwent a routine annual performance review with the Nurse Unit Manager of the Obstetric Unit, during which she indicated that she wished to attend a course by the National Association of Childbirth Education in order to obtain formal qualifications to become an educator for conducting antenatal courses.

- On 18 July 2008, Midwife P attended a CTG workshop.

- On 27 February 2009, Midwife P completed an online tutorial in external fetal monitoring.

- On 28 May 2009, Midwife P successfully completed the Hospital competency assessments in a number of areas, including Fetal Assessment – External Cardiotocography, Neonatal Pulse Oximeter Application and Monitoring, Water Immersion Leading to Birth, Newborn Resuscitation and Basic Life Support.

- Prior to Midwife P' departure from the Hospital in early August 2010 she continued to undertake further training, which included a Fetal Surveillance Education Program on 6 November 2009, Obstetric Emergency Skills Workshop on 17 December 2009, Care of the Critically Ill Obstetric Patient Seminar on 20 July 2010 and Fetal Monitoring Training System on 3 August 2010.

- Midwife P is presently employed at another hospital as a full time nurse. She has maintained her annual midwifery and registered nursing competencies and has attended various internal and external courses on a number of topics.

Details of conversations with the father and mother:

Given the lapse in time, Midwife P does not now recall any specific discussions with the father and mother about the differences between CTG monitoring compared to Doppler monitoring. She does recall, however, that the mother was insistent that she wanted to labour in the bath. Midwife P believes she would have explained to the mother that they were unable to continuously monitor the fetal heart rate by using the CTG once she entered the bath and would need to monitor the fetal heart rate regularly using the Doppler device.

Details of conversations with Dr S:

Midwife P does not recall Dr S informing her at any time that he believed the mother's labour was obstructed.

Supplementary statement of Dr S

On 9 September 2013, Dr S was requested to provide a further statement specifically addressing the following matters:

(a) Provide details as to conversations you had with the father and mother about what happened to Baby A, whilst the mother was still in hospital and then again in July, September and December 2008. Notes and records of these conversations should be annexed to this statement.

(b) Please provide further details as to why you are of the view that the admission CTG for the mother was abnormal? What about the CTG made it abnormal?

(c) Please provide an update as to the actions you undertook to address the concerns raised by Dr E in his external review and which were subsequently discussed during the meeting with Hospital management in October 2008?

(d) Given the poor description of the fetal heart rate upon admission by Midwife P, as per your statement dated 21 March 2013, please provide an explanation as to why you did not make further enquiries to ascertain the baseline, variability and whether there were accelerations and decelerations?

(e) You state that you performed two vaginal examinations at 4:15 and 4:45 am, the findings of which indicated an obstructed labour? Please explain why it was necessary to conduct a further vaginal examination when the first indicated an obstructive labour? Wouldn't this initial finding warrant further action to be undertaken?

Dr S subsequently provided a further statement on 12 November 2013, which relevantly stated as follows:

(a) *Details as to conversations with the father and mother:* Dr S states that he cannot remember the details of the conversations he had with the father and mother about what happened to Baby A whilst the mother was still in hospital and then again in July, September and December 2008. He relies upon his practice notes and the notes contained in the Hospital's records. He does recall, however, in a general sense that the conversations with the father and mother concerned the cause of Baby A's death, the obstructed labour, the unsuitability of a water birth, the condition of pre-eclampsia and its worsening into HELLP syndrome after delivery, the adnominal sepsis that followed and the laparotomy treatment thereof and the potential for future fertility and delivery. Dr S recalls that on one occasion, the mother brought a copy of the autopsy report which they read together and discussed.

(b) *Admission CTG:* Dr S states that the admission CTG had no clear baseline fetal heart rate although it could be suggested that it was running at around 150-160, and showed most probably recurrent variable decelerations that could be described as complex variable decelerations. He acknowledges that the CTG could have been described at the time as abnormal or non-reassuring and the required course of action would be to continue it for further clarification, and notify the managing obstetrician for further assessment.

(c) *Dr E' concerns:* Dr S states that he was aware that the Hospital had arranged for this matter to be reviewed by an external doctor, however, claims that he was not asked to provide any input into the review or provided with a copy of the final report. Dr S states that he was only provided with a copy of Dr E' report by the Coroner's office. In relation to the minutes taken at the meeting in October 2008, Dr S notes that:

- He has attended CTG educational workshops on several occasions before and after Baby A's death. He also continued to participate in periodic CTG review meetings in many hospitals he has worked and continues to do so in his current hospital.

- Dr S maintains that he has appropriately managed innumerable cases of pre-eclampsia before and after the mother's case in many obstetric hospitals. He notes that in this case, the prominent feature was not just the pre-eclampsia but the mother's strong desire to follow her own plans for a so called 'natural' delivery and water birth against medical advice. On the occasions that he encounters such an attitude in the face of his advice, it is his practice to refer the case to the department where he works for discussion and consensus management or to offer the patient to transfer her care to a second obstetrician. However, Dr S notes that in private practice these options are limited and in this case, it was not logistically possible to offer the mother a second obstetrician's opinion on the night of her admission when she insisted on a water birth contrary to his advice.

In relation to Dr E's report, Dr S notes the following:

- It does not address the failure of Midwife P to identify the admission CTG was abnormal or non-reassuring, when she reported the fetal heart rate as normal.

- It does not address the error of Midwife P of discontinuing the admission CTG, which would have required continual monitoring to clarify the fetal condition.

- It does not address Midwife P's failure to notify Dr S of the admission CTG at all, or of any deviation from normality in the fetal heart rate.

- It does not address the action of Midwife P in preparing and providing the birthing pool to the mother despite the midwife recording in the notes of Dr S' advice that a water birth was contraindicated.

- It does not address the wrong notation entered by Midwife P on the admission CTG that it was seen by Dr S at 2:30 am, which he notified to the Nursing Unit Manager on 14 June 2008.

- It does not consider documentation in the Hospital's records dated 4 June 2008, of his plan to induce labour.

- It does not given sufficient weight to the refusal of the mother to accept medical advice that water birth was not suitable and plainly contraindicated.

(d) *Fetal heart rate:* Dr S maintains that he was informed by Midwife P that the fetal heart rate was normal and as such he did not ask her about aspects of abnormality.

(e) *Obstructed Labour:* Dr S states that obstructed labour is diagnosed by confirming the lack of progress over a reasonable time interval. Obstructed labour was not diagnosed at the examination times at 4:15 am, but after he detected no advancement in the labour process at the second examination time 4:45 am.

Expert report by Consultant Obstetrician, Professor H

On 5 February 2014, a further expert report was sought from Specialist Obstetrician and Gynaecologist, Professor H.

On 27 April 2014, Professor H provided his expert report addressing an array of matters.

In general comments regarding the events that precipitated Baby A's birth, Professor H relevantly noted the following:

- In relation to the admission CTG conducted on 7/8 June 2008 for approximately 40 minutes, Professor H notes that it was not normal or reassuring. The heart rate is seen to vary between 118 and 160 beats per minute and contains either large accelerations from a relatively low baseline or large decelerations from a high baseline. In the current paradigm of fetal heart rate reporting, Professor H would classify the CTG as suspicious and would have expected the CTG to be continued until a decision had been made about the fetal welfare. He would have expected Dr S to be told that the CTG was not normal.

- Urine testing for the presence of protein, despite the mother's known presentation of pre-eclampsia, was not conducted until 4:00 am on 8 June 2008, despite the reasonably compelling case that could have been made for such testing to have been conducted within a relatively short timeframe after admission as a priority.

- During the time the mother was in the bath after a decision was made to perform a caesarean section, Professor H notes that fetal heart rate monitoring occurred by auscultation at times and by CTG at others. Monitoring was difficult. He notes that there is a very poor quality section between 4:30 and 4:50 am, which is highly suspicious of significant fetal compromise, with a recorded heart rate below 100 beats per minute in significant sections. At 5:10 am, the heart rate is between 140-150 beats per minute with at least one deceleration to approximately 70 beats per minute. Whilst Professor H acknowledges that the abnormally low heart rate may be artefact (e.g. the maternal heart rate rather than the fetal heart rate) further steps should have been taken to definitively ascertain the fetal welfare status. In the absence of such steps to obtain a definitive assessment of the fetal status there should have been significant concern regarding the welfare of the baby at the time.

In relation to the specific questions to be addressed, Professor H stated as follows:

(a) ***Antenatal care and pre-eclampsia:***

- **Was Dr S' antenatal care and treatment provided to the mother adequate and appropriate?**

  Prior to 36 weeks gestation, when the development of high blood pressure, proteinuria and raised uric acid and alkaline phosphatise levels began, Professor H did not find any fault with Dr S' care of the mother. He does, however, believe that Dr S' notes regarding the discussion of the water birth option and the need for booking at the Hospital are inadequate.

- **Given the mother's circumstances, should she have been considered to be a high-risk pregnancy?**

  Professor H notes that there are a number of risk scoring systems in use, including the one that he developed in the 1990's for use in rural and remote facilities, but which is applicable everywhere. This is the only Australian system which has been published in a peer-reviewed fashion with an evidential basis.

  Using this system, the mother would have had a risk score of five (moderate risk) at her first visit, continuing until 37 weeks gestation. After 37 weeks when significant hypertension developed, with some measurements exceeding 160 mm Hg systolic pressure, a further four points added would make her reassessed risk score nine, which is indicative of a high risk pregnancy.

  Professor H notes that moderate and high scores of themselves do not dictate exact management but do certainly warn of the need to have significant concern for the welfare of the mother and her baby.

- **How would you describe her condition of pre-eclampsia (moderate/severe)?**

  At 37 weeks gestation, Professor H describes the mother's condition of pre-eclampsia as moderate, bordering on severe, with the presence of increasing blood pressure, proteinuria and rising uric acid and alkaline phosphatese levels.

  By 38 weeks, the continuation of blood pressures of the level of 160/90 with significant proteinuria and raised uric acid and alkaline phosphatese levels despite hypotensive medication places the pre-eclampsia into the severe range.

- **Was management of the mother's pre-eclampsia reasonable and appropriate during pregnancy and labour?**

  Professor H notes that the only cure for pre-eclampsia is delivery of the placenta, which implies delivery of the baby. Where moderate to severe pre-eclampsia is present with a mature pregnancy (37 weeks or more) the "main stream" view is that delivery of the baby is appropriate with careful monitoring of maternal and fetal welfare during that process. The reasons for this view are:

  - Moderate to severe pre-eclampsia can fulminate to a severe disease process without warning, with significant morbidity and morbidity risks to the mother; and

  - The fetus is at significant risk of the effects of placental insufficiency, including intrauterine death and/or hypoxia, and progressing further in the pregnancy does not offer any extra benefit to the baby.

  This view that expediting delivery of the baby after 37 weeks in the presence of significant pre-eclampsia is found in section 9 and 9.1 of the Queensland Maternity and Neonatal Clinical Guidelines Program entitled, *'Hypertensive Disorders of Pregnancy'.* This clinical guideline was first published in 2010,

however, it encapsulates the expert views regarding appropriate management of pregnancy complicated by pre-eclampsia in 2008.

A similar concept can be found in the National Institute for Health and Clinical Excellence Guideline for Hypertension in Pregnancy, which was originally published in 2006.

- **Should the mother have been considered for induction earlier? If so, should induction have taken place during the day when there would be more ready access to the surgical theatre?**

  Given Professor H' response to the above question, he is of the view that the mother should have been counselled that delivery at 37 weeks gestation was the most appropriate option for care, and that the options of induction of labour with careful and continuous electronic fetal heart rate monitoring and elective caesarean section should have been proposed. Awaiting spontaneous labour and considering birthing in a pool without continuous fetal heart rate monitoring should have been noted as inappropriate options for care.

(b) ***Following admission on 7 June 2008***

- **Was the trace CTG upon admission normal/abnormal?**

  Professor H notes that the 40 minutes of CTG tracing as copied in the medical records is of poor quality. As stated above, this CTG is not normal/reassuring and contains large accelerations from a relatively low baseline or large decelerations from a high baseline. He would classify this CTG as suspicious and would have expected the CTG to be continued until a decision was made about the fetal welfare.

- **Was the response to the admission CTG trace by Midwife P appropriate?**

  Professor H would have expected that Dr S would have been told that the CTG was not normal. It is unclear from the medical record and the subsequent statements provided by Midwife P, about what she told Dr S. An entry in the notes at 11:45 pm on 7 June 2008 by Midwife P states *'CTG commenced FHR 118-155 bpm reactive'.* Professor H' interpretation of this note is that Midwife P believed that the CTG was not concerning.

- **Is it common/best practice for an obstetrician to examine an admission CTG? Is it acceptable for an obstetrician to rely upon the interpretation of a CTG scan by a midwife rather than examining it themselves? And if relying upon an assessment by a midwife, what information should the obstetrician expect to be conveyed?**

  Professor H states that though relatively widely used, there has not been any clear evidence that admission CTGs offer a benefit in predicting fetal outcome in labour. At best, an admission CTG offers an assessment which may identify the unrecognised 'at risk' fetus in a low risk pregnancy (section 4.1 RANZCOG Intrapartum Fetal Surveillance Clinical Guideline). In section 6 of this guideline it is suggested that 'continuous electronic fetal monitoring should be recommended when either risk factors for fetal compromise have been detected antenatally, are detected at the onset of labour or develop during labour'.

In Professor H' view, relying on an admission CTG to predict fetal welfare is unwise, without intending to continuously monitor the fetal heart rate until the birth of the baby. If Dr S intended to rely on the admission CTG he should have visualised the trace himself.

In the event that Dr S relied on an assessment by a midwife, he should have had knowledge of that midwife's experience with CTG interpretation, and he should have expected to have been given a clear description of the fact that the CTG was not normal due to the heart rate varying widely between 118 and 160 beats per minute and contained large accelerations and decelerations, which could not be assessed for significance within this CTG trace.

- **Was the fetal heart rate monitoring conducted during labour adequate and/or in accordance with existing best practice?**

  Best practice for fetal heart rate monitoring in labour in the setting of moderate to severe pre-eclampsia and advanced maternal age should have been continuous electronic fetal heart rate monitoring throughout labour. In the event that there was difficultly gaining adequate trace by an externally placed ultra-sound based heart rate pickup, application of a CTG electrode directly to the fetal scalp would be an option. In the event that there is still uncertainty regarding fetal welfare, a fetal blood sample could be obtained from the fetal scalp to measure fetal acid-base status as a surrogate for fetal oxygenation status.

(c) ***Water Birth***

- **Given the mother's antenatal history, was a water birth appropriate?**

  Professor H is of the view that water birth was not appropriate because adequate continuous fetal rate monitoring is not possible in that setting and there is a risk of the development of severe complications of pre-eclampsia, including eclampsia with fitting and unconsciousness, which cannot be safely managed in a water bath.

- **Given the father and mother were counselled against a water birth by Dr S is there anything Hospital staff (such as the midwife) or the obstetrician could have done to prevent such a birthing procedure given it was the father and mother's chosen means of delivery?**

  Professor H states that the hospital staff were in an invidious position if the father and mother made such a demand. The appropriate response, in his opinion, would have been to delay availability of the prepared birthing pool whilst seeking Dr S' attendance to discuss the matter face-to-face.

- **Given the father and mother's insistence on a water birth was the monitoring of the fetal heart rate at the intervals recorded appropriate?**

  Professor H is of the view that the baby should have had its fetal heart monitored continuously and anything less than that was inappropriate. All guidelines regarding intermittent auscultation of the fetal heart rate as a means of monitoring fetal welfare are only applicable to low risk pregnancies.

- **Also, should there have been some additional consent sought from the father and mother in relation to the continuation of the water birth, given it was against the advice of the midwife and the obstetrician?**

There is no clear rule about such a concept, however, all parties would have been wise to clearly document their discussions with the father and mother regarding the pros and cons of their decision to not accept specialist obstetric advice.

(d) ***Caesarean section***

- **Was the categorisation of the caesarean section by Dr S as a category two appropriate in the circumstances? Please explain the reasons for your view.**

  Professor H is of the view that in the context of the decision to proceed to caesarean section at 5:00 am and the knowledge Dr S did/didn't have regarding fetal welfare, a decision that the request for a theatre access was Priority Two was not unreasonable, given the Hospital's policy *'Caesarean Section – Priority Two Urgent'* states that this policy aims for a commencement within 40 minutes of the decision being made. In reality, however, the decision-to-birth interval was 90 minutes.

  However, Professor H notes that the information Dr S had was quite inadequate due to a lack of continuous fetal heart rate monitoring, and in retrospect clearly indicates that this should have been a Priority One request.

  Professor H suggests strongly that a more effective assessment of fetal welfare on admission in labour may well have prompted a Priority One request at the time.

- **What was the appropriate timeframe for Baby A to have been delivered in?**

  In Professor H' opinion, given the poorly recorded CTG at 5:10 am, which is highly suspicious of poor fetal welfare (baseline in the range of 140-150 beats per minute with at least one deceleration down to 70 beats per minute), he believes the request should have been for a Priority One (as soon as possible).

- **Dr S notified the HNC that the mother required a caesarean section at 5:00 am. The mother arrived at the recovery room awaiting consultation with the anaesthetist at 5:40 am and was given an epidural at 5:55 am. Baby A was delivered at 6:35 am. Was the time between when the decision was made to conduct a caesarean and the operation being carried out reasonable? Did the timeframe in this case comply with the Hospital policy in effect?**

  As stated previously, the decision-to-birth interval was 90 minutes, which was not consistent with the Hospital policy. In a public hospital maternity specialist service this period of time would be considered to be unacceptable. Professor H notes that he cannot comment on behalf of a private hospital, such as the Hospital, which does not have theatre and anaesthetic staff on site or on close 'proximate call' 24 hours a day.

  Professor H does note that the statement provided by Dr D indicates that he provided a spinal anaesthetic, not an epidural anaesthetic, which is quicker to administer.

- **Was the fetal heart rate monitoring conducted by Midwife P after the decision for a caesarean section to be conducted adequate?**

  Professor H states that whilst providing continuous electronic fetal heart rate monitoring can be challenging at times whilst in the process of moving a patient from the birth suite to an operating theatre, that should have occurred in this case. Once awaiting anaesthetic intervention, electronic fetal heart rate monitoring should have been continued.

  Intermittent auscultation of the fetal heart rate was inadequate in this situation, but the notes and statements from Dr S and Midwife P suggest strongly that they did not realise that Baby A was severely distressed.

(e) ***Autopsy***

- **During the internal post-mortem conducted by Pathologist, Dr W, she found thick green material in the airways consistent with the clinical history of meconium aspiration. The lungs were also found to be heavy. If possible please provide comment on this finding, particularly in relation to the clinical findings which would normally be seen when this occurs?**

  Professor H notes that the presence of meconium inhaled into the lungs in this manner suggests strongly that it has occurred in utero for a significant period prior to birth, and represents evidence of a reasonably long period (not possible to quantify the length of the period) of fetal hypoxia/acidosis (i.e. fetal distress). A healthy fetus in late pregnancy undertakes only shallow breathing movements in utero. A distressed fetus tends to take much larger gasping inhalation activity.

  It is incongruous that thick meconium was seen when the uterus was opened and yet the only other suggestion of possible meconium staining of the amniotic fluid (a suggestive sign concerning fetal welfare) was the admission statement of the mother describing loss of '*clear fluid, brownish*'. Professor H accepts that the baby's head being impacted into the pelvic brim may have blocked the loss of meconium stained amniotic fluid.

(f) ***Care and treatment provided***

- **Provide comment on the adequacy of care and treatment provided by the Hospital during the mother's labour and delivery?**

  Professor H is of the view that the process of assessing the baby's welfare was inadequate. He finds it hard to be sure from the notes what information was passed to Dr S after the admission CTG, but there are sufficient concerning items on the inadequate CTGs to indicate that all involved health professionals should have been concerned about the welfare of the baby.

  It would appear that there was at least tacit support from the birth suite staff (Midwife P and others) to assist the mother into the birthing pool, despite Dr S' statements that this was inappropriate. Monitoring of the baby's heart rate in the birthing pool was inadequate and this should have been corrected (potentially by removing the mother from the birthing pool).

  Professor H notes that the hospital notes are grossly inadequate in that there is little to indicate the discussions that occurred with the mother regarding the

pros and cons of using a birthing pool in this clinical setting, the standard of fetal monitoring required, and the severity of the pre-eclampsia and its potential risks.

- **Do you agree with the findings of Consultant Obstetrician, Dr E, who reviewed the antenatal care, labour and delivery provided to the mother at the request of the Hospital?**

  Professor H does not have any fundamental disagreements with Dr E' report, though he does have a stronger belief that the mother's pregnancy should have been electively ended with either induction of labour or elective caesarean section at 37 weeks, preferably all happening in daylight hours with options for intervention being quickly and efficiently available.

- **In your opinion, did the care provided by any staff at the Hospital fall below the expected standard of care to be provided?**

  Professor H is of the view that the initial admission assessment of the fetal welfare was inadequate, as were the notes regarding what information was passed to Dr S. It is inappropriate that a urine sample was not tested for protein for four hours after admission in the setting of moderate to severe pre-eclampsia.

  Furthermore, ongoing fetal heart rate assessment in labour was well below the expected standard of care in the setting of moderate to severe pre-eclampsia. The alacrity with which a category two caesarean section was performed did not meet the Hospital's policy guidance.

- **In you opinion, did the staff members involved in the mother's labour comply with the Hospital policy that existed at the time?**

  Professor H is of the view that the policy '*Fetal Monitoring'* was not adhered to:

  - it required continuous fetal heart rate monitoring in high risk labours;
  - it required non-reassuring heart rate patterns to be promptly detected and 'appropriate action' to be taken

  The policy *'Complications of Pregnancy – Hypertension'* clearly describes assessing the degree of proteinuria in assessing the severity of pre-eclampsia, but this was not done for four hours. The section sub-headed *'Management of Severe Pre-eclampsia'* mandates continuous fetal heart rate monitoring, which did not occur, and urine testing for protein. Seizure prophylaxis with magnesium sulphate is mooted, but does not appear to have been considered until after birth.

- **Were the policies in effect at the Hospital at the time of Baby A's birth adequate?**

  The policies in place at the time were adequate, in Professor H's opinion, however, he notes that there is evidence that they were not followed.

(g) ***Dr S' statements***

- **In a statement provided by Dr S for the purpose of the coronial investigation, he expresses the view that, with the benefit of hindsight,**

the management of the mother's labour could have been managed differently. Please comment on each of the matters proposed by Dr S and whether they were reasonable in the circumstances?

In Professor H' opinion, Dr S' expectation that he be notified immediately of the abnormal admission CTG is quite appropriate. Nonetheless, it was also his responsibility to review that admission CTG when he first attended.

Professor H agrees that the CTG should have been continued. Ultimately, it is Dr S' responsibility to ensure adequate monitoring of fetal welfare.

Professor H also agrees that the mother should not have been assisted into the birthing pool, and that Midwife P and other hospital staff should have immediately sought direct in-person intervention by Dr S in this regard.

Whilst Professor H agrees that the father and mother should have accepted Dr S' advice that use of the birthing pool was inappropriate in this clinical setting, there is very little evidence of the content of discussions between the father and mother and Dr S, in terms of the reasons that he gave and the pros and cons of following his advice. This is, potentially, a matter of the father and mother exercising their right to make an informed decision, but there is no evidence about the nature and content of such discussions.

(h) ***Medical Notes***

- **Were the notes made in the medical records sufficient and in accordance with best medical practice?**

  Professor H is of the view that there is inadequate information recorded by Dr S in his private notes, and by Dr S and Midwife P in the Hospital's medical records regarding the nature of discussions with the father and mother regarding the severity of the pre-eclampsia and its appropriate management, the importance of continuous fetal welfare assessment, and the inability to provide adequate care in a birthing pool within the clinical setting.

(i) ***Further Testing***

- **In your opinion, should further histological tests be conducted (if possible) of the placental membranes by a prenatal pathologist in order to determine how long the meconium had been present?**

  The Pathologist, Dr W and Professor H are of the view that the chorioamnionitis does not represent a non-infective inflammation secondary to the prolonged presence of meconium in the amniotic fluid and hence adjacent to the placenta and membranes. Hence, Professor H does not believe that such further testing would be helpful.

- **Are there any further tests or enquiries, which you believe should be conducted to assist the Coroner in this investigation?**

  Professor H is of the view that there are no further tests or enquiries which would assist the Coroner's investigation.

(j) ***Dr M' report***

- **Having considered all the material, do you agree with the criticisms raised by Dr M? Why/why not?**

  Professor H agrees with the conclusions reached by Dr M numbered one to seven in her report, namely:

  - The mother had severe pre-eclampsia and this was a high risk pregnancy in view of her age and blood pressure.

  - The mother was inappropriately monitored during her labour (both infrequent observations and lack of a continuous CTG for the duration of her labour).

  - Immersion in the bath was inappropriate in view of the severe pre-eclampsia.

  - There was an unacceptable delay in getting to theatre once the decision had been made to perform a Caesarean section at 5:00 am.

  - There was no documented monitoring of the fetal condition for the last hour of the labour between 5:30 and 6:30 am.

  - The CTG in the Hospital record is very difficult to interpret as it has faded considerably and only records the fetal heart rate for 110 minutes of the six and a half hour period the mother was in the labour ward.

  - It is likely that if a continuous CTG was done that it would have been pathological and should have alerted the attending midwife and obstetrician to deliver earlier.

  In relation to conclusion eight reached by Dr M, that is, that it is most likely that Baby A died from acute hypoxic encephalopathy resulting from meconium aspiration in utero, which is likely to have occurred during the labour, Professor H notes that hypoxic-ischaemic encephalopathy does not occur as a result of meconium aspiration. Rather, it occurs as a result of intrauterine fetal asphyxia, and fetal asphyxia often leads to meconium aspiration. While it is possible that the fetal asphyxia occurred during labour, it is equally possible that it was developing prior to labour as a result of the pre-eclampsia.

  Professor H agrees with Dr M' conclusion nine, which is that it is most likely that Baby A passed meconium and aspirated the meconium into his lungs during the course of the labour.

  In relation to conclusion 10, Professor H doubts the veracity of the conclusion that histological examination of the placental membranes by a prenatal pathologist could give some indication as to how long the meconium had been present. Professor H notes that there are times when membranes are stained with meconium, however, he was more interested in whether or not the chorioamnionitis represented a sterile inflammation in response to meconium.

  Professor H agrees with Dr M' conclusion 11, which finds that Baby A weighed 2.8 kilograms on the tenth percentile for gestational age. As such, there may have been some degree of chronic utero-placental insufficiency due to the high blood pressure noted from 33 weeks. An ultrasound scan at

36 weeks may have confirmed the small estimated fetal weight and possibly reduced amniotic fluid volume as well as abnormal umbilical artery and middle cerebral Doppler waveforms.

In relation to conclusion 12, that is, that there was evidence of ascending chorioamnionitis in the histology of the placenta, which may have contributed to the death, Professor H is of the view that chorioamnionitis is usually due to ascending infection. Its presence in the mother's case is an enigma in Professor H' opinion. At no time was the mother febrile, which would be expected in the presence of an intrauterine infection.

Conclusion

Baby A died shortly after birth on 8 June 2008 at the Hospital as a result of hypoxic-ischaemic encephalopathy due to meconium aspiration syndrome.

The central issue in this case is the inadequacy in assessing Baby A's welfare throughout the mother's labour, particularly the failure to continuously monitor the fetal heart rate, even though there was indication that such practice was necessary given this was a high risk pregnancy and the suspicious admission CTG. From the findings of the review conducted by the Hospital, as well as Dr M's and Professor H' expert reports, it is clear that the admission CTG was abnormal and not within the normal range as thought by Midwife P. Professor H notes that he would have expected Dr S to be told that the CTG was not normal. That being the case, I am of the view that Dr S, as the mother's treating obstetrician, should have examined the admission CTG at 2:30 am when he arrived at the Hospital and assumed control of the mother's labour. Dr S has somewhat acknowledged his failing in this area during the review conducted by the Hospital and in the statement he provided for the coronial investigation. Midwife P says that Dr S examined the admission CTG. This is a very significant discrepancy. Obviously, continuous CTG monitoring of the fetal heart rate could not be done whilst the mother was in the birthing pool during labour. According to Dr S, the father and mother were aware of the risks associated with a water birth and he had attempted to counsel them against this component of their birthing plan during antenatal appointments and also when he arrived at the Hospital. Whilst this may be the case, his notes regarding discussions had with the father and mother about a water birth were clearly inadequate. Midwife P also communicated Dr S' view about the use of the birthing pool in labour and during birth when the mother was admitted. From the statements of Dr S and Midwife P, as well as the statement provided to police by the mother and the field interview with the father, it seems clear that the father and mother were fairly insistent about complying with their birth plan, despite the advice provided by Dr S on a number of occasions before and during birth. As such, the actions of the father and mother, which were contrary to medical advice, undoubtedly contributed in some part to the tragic events that subsequently transpired.

It is clear that the mother's condition of pre-eclampsia at 37 weeks gestation was moderate, bordering on severe. By 38 weeks, this had developed into a severe case. Accordingly, Professor H is of the view that she should have been counselled to deliver at 37 weeks gestation. Given the mother's severe condition, it seems evident that when she did present in spontaneous labour, continuous fetal heart rate monitoring should have been engaged in throughout the duration of the labour. Anything less than this was clearly inappropriate taking into account the surrounding circumstances.

Whilst there are some minor discrepancies in relation to who undertook certain actions during the mother's labour (primarily between the obstetrician and midwife), the sequence of events and timeline, as outlined in each of the staff's statements, is largely consistent.

Based upon the material obtained during the coronial investigation, I am satisfied that the changes to the policies in place at the Hospital since Baby A's death have adequately

rectified the clinical concerns arising in this matter, particularly the requirement that two midwives sign the admission CTG. The review conducted by the Hospital clearly identified issues associated with the care and treatment provided during the mother's labour, heavily scrutinizing Dr S' conduct. Ultimately, it was acknowledged that a number of issues had arisen, which needed to be addressed by way of amendment to various obstetric policies that are now in effect. In my opinion, the subsequent adoption and inclusion of the PHSP's policies has adequately remedied the shortcomings of the policies in place at the time of Baby A's birth, and will help to prevent similar deaths from happening in the future.

Having considered the circumstances surrounding Baby A's death and the concerns and criticisms raised by Dr M and Professor H in their respective expert reports, I have decided to refer this matter to the newly established Office of the Health Ombudsman ('OHO') for its consideration and appropriate action. As was stated by Professor H in his report, the process of assessing Baby A's welfare was inadequate and there were signs that clearly indicated that his wellbeing was in doubt. The OHO has a clear mandate and specialist resources for promoting professional, safe and competent practice by health practitioners and protecting the health and safety of the public, and would be an appropriate entity for reviewing this matter to determine whether any other action is warranted.

Lastly, I note that a draft of these findings was provided to Baby A's parents pursuant to section 46A(2) of the *Coroners Act 2003*, which requires that I consult with and have regard to the views of Baby A's family prior to publishing my findings. In response, Baby A's parents raised a number of concerns regarding the events leading up to Baby A's death and management of the labour and Baby A's birth, as well as care provided to Baby A's mother following his birth. On my review of these concerns, I did not identify any information that I considered should cause me to amend my findings as to how Baby A died. I do, however, consider it appropriate to provide OHO with a copy of these concerns, such that they can be taken into account as part of any further review of or investigation into the health services provided to Baby A and his mother.

James McDougall
Coroner
Southport
9 December 2014