QUEENSLAND COURTS

CORONERS COURT OF QUEENSLAND

FINDINGS OF INVESTIGATION

CITATION:	Non-inquest findings into the death of Baby C
TITLE OF COURT:	Coroners Court
JURISDICTION:	Cairns
DATE:	26 August 2020
FILE NO(s):	2014/1797
FINDINGS OF:	Northern Coroner, Nerida Wilson
CATCHWORDS:	Meconium aspiration syndrome (MAS); persistent pulmonary hypertension; induction of labour(iOL); tracheal suctioning; special care baby unit; newborn emergency transfer service (NETS) delay; nitric oxide therapy (iNO); fetal monitoring after EDD.

Contents

Introduction

1. Baby C was born at 6:33am on 13 December 2012 at Cairns Hospital to parents Ms B and Mr B.

2. Baby C was declared deceased at 00:50 hours on 14 December 2012. He was aged 18 hours and 13 minutes at the time of his death.

3. Baby C's mother Ms B identifies as an Aboriginal and Torres Strait Islander woman.

4. Baby C was delivered at full term plus 9 days.

5. At birth Baby C was covered in thick meconium, staining his skin, nails and umbilical cord. He had a significant amount of meconium on his lungs and was not able to breathe on his own. He was transferred to the Special Care Baby Unit and deteriorated whilst awaiting transfer to the Townsville Hospital. He died before transfer, in the early hours of the morning on 14 December 2012, from meconium aspiration syndrome complicated by persistent pulmonary hypertension.

Reportable death

6. Baby C's death was not reported to the Coroner by the Cairns Hospital.

Concerns

7. In 2013, during several meetings with the Cairns and Hinterland Hospital and Health Service (CHHHS), Ms B raised concerns in relation to the care of her pregnancy and Baby C's neonatal care.

8. In April 2014 Ms B engaged lawyers to write to the Office of State Coroner raising a number of concerns about the circumstances surrounding Baby C's birth, particularly a failure by the hospital to properly identify and treat meconium aspiration syndrome in a sufficiently timely manner so as to prevent his death.

9. The then Northern Coroner requested information from the Cairns and Townsville Hospitals and commenced a coronial Investigation into the death of Baby C.

10. Ms B raised concerns in relation to the circumstances surrounding Baby C's death including:

    - That she was denied an early induction when requested;
    - A lack of Fetal heart monitoring prior to her admission to give birth, even though Baby C had recorded a high Fetal heart rate during check-up, and Ms B did not feel well;
    - The delay by Cairns Hospital to escalate Baby C's post birth care to the Townsville Hospital;
    - The delayed arrival of the Townsville Neonatal Emergency Transfer Service ('NETS') teams with the necessary respiratory equipment;

- Cairns Hospital, Special Care Baby Unit ('SCBU') was not then stocked with nitric oxide to administer to Baby C; and
- A lack of communication between treating staff and the parents about Baby C's deterioration and management and no indication as to the severity of their baby's condition.

Background

11. By way of background, Ms B has delivered three previous children, born 6 September 2005, 24 April 2009 and 4 December 2011 all without complications. Her second child was induced at 10 days past the due date with no complications.

12. Gestational age assessment based on an ultrasound performed on 4 May 2012 [9 weeks] provided Baby C's estimated due date ('EDD') as 4 December 2012 but based on periods and cycle, EDD was calculated as 26 November 2012. However, on 3 occasions the size was said to be 1 week ahead of calculated dates.

13. Ms B was assessed on 21 June 2012 by a Registered Nurse/Senior Midwife at the Cairns Hospital Antenatal Clinic. She was 16 + 2 weeks gestation at the time.

14. On 10 July 2012 Dr A, Consultant Obstetrician and Gynaecologist, requested an obstetric ultrasound.

15. On 17 July 2012 then 20 weeks, Ms B was reviewed by Dr W, Principal House Officer at the Cairns Hospital. She was noted to be well and low risk. An EDD, based on ultrasound record, was 4 December 2012. There were no issues with the observations of the mother, or the Fetal heart rate. Ms B attended each scheduled appointment with no concerns save for low iron where she was required to take iron supplements.

Full term

16. On 4 December 2012, then 40 weeks, Ms B was attended by a Registered Midwife. Ms B was having groin pains and was taking iron supplements. Observations indicated the Fetal heart rate was 142 beats per minute (bpm).

Full term + 6 days

17. On 10 December 2012, full term + 6 days, Ms B was further reviewed by Dr A at the Cairns Hospital. Ms B requested to be induced at this time. She was advised that the Cairns Hospital recommended induction after 10 days of the estimated due date, unless there was a 'definite indication'.

18. Dr A booked induction of labour (IOL) for 14 December 2012 with no further appointments for either a midwife or obstetrician required in the interim. During observations at this time the Fetal heart rate was recorded in the 160s, but no further Fetal surveillance was undertaken. (The hospital record is also unclear as to whether this record was at a peak of contraction or sustained).

19. Ms B left the clinic appointment that day without the hard copy of her pregnancy record for Baby C. Instead, she had been inadvertently provided with the records relating to a previous pregnancy and was told that the correct record would be provided to her at her labour. Ms B has since indicated that if she had the correct record in hand, she would have noted the high Fetal heart rate and requested a further review.

20. I have since reviewed records and meeting notes from various doctors involved in this matter and there is consensus that if the Fetal heart rate was sustained at 160bpm on 10 December 2012, then further testing including a CTG would have been warranted.

21. On 12 December 2012 Ms B experienced Braxton Hicks contractions lasting 10 minutes, feeling unwell and with cramping. She went to bed and awoke at 5:00am on 13 December 2012 with frequent contractions.

Baby C is born

22. At about 6:15am Ms B arrived in the birth-suite of Cairns Hospital in advanced labour with contractions every 2-3 minutes. Registered Midwife ('RM') Ashworth and RM Doran were in attendance. The Fetal heart rate was 140bpm. At 6:30am Ms B's cervix was noted to have fully dilated. Her membranes ruptured and produced thick meconium stained liquor but normal volume of liquor. RM Doran attempted to contact the Paediatrician initially receiving no answer and then contacting via the switch board.

23. At 6:32am Baby C's Fetal heart rate was 140 beats per minute.

24. Baby C was born at 6:33am.

25. The progress notes indicate:

> *Mother arrived in birth suite and delivered within 5 minutes. Term baby, thick meconium at birth. Baby cried at birth and then had thick meconium coming out of nose and mouth. Suctioned cords under direct vision. Thick meconium aspirated. Baby pale with shallow breathing, brought to nursery – sats 88-90 % on 100 % o2. Baby intubated. Explained to mother child on ventilator. Cord – dark green stained. Blood gas pH – 7.013; pCO2 – 67.7; bE – (-14); baby given a bolus of normal saline – 35 mls and commenced on IV antibiotics. O/E Baby poor perfusion; shallow breathing; femoral pulses – respiratory distress; meconium aspiration – commence sedation; morphine, midazolam, repeat CXR.*

26. The Principal House Officer, Dr S, Paediatrics, was in attendance at birth.

27. A statement was obtained from Dr S outlining her involvement with Baby C's care and treatment. She stated upon Baby C being delivered he was covered in meconium with some falling to the floor.

28. Ms B stated that Baby C was placed on her chest and he had a green substance over him, but she didn't know what it was. When she asked what it was and what was happening,

she was told to concentrate on herself and the delivery of the placenta. Baby C was placed by a midwife on the resuscitation table where he cried.

29. Baby C had meconium coming out of his mouth and nose and Dr S suctioned his nose and cords under direct vision using a larynges scope. Mr B states that he noticed Dr S was massaging Baby C's stomach and that a RM showed him a jar with approximately 20 ml – 40 ml of meconium that had been taken out of his lungs. At this time Baby C was pale in colour, had shallow breathing and a heart rate of 60 beats per minute. A mask was placed over his mouth, ensuring an adequate seal and positive pressure ventilation ('PPV') was provided via the neopuff with oxygen at 30%. Baby C's first Apgar score was 4.

30. Dr S monitored Baby C's vital signs for the next 4 minutes, noting his heart rate was still below 100 beats per minute. The oxygen was gradually increased to 100%. At 5 minutes Baby C's Apgar score was 5. Over the next 5 minutes Baby C had improved slightly with an Apgar score of 7 at 10 minutes. Dr S considered that he wasn't active and vigorous and transferred him to the Special Care Nursey ('SCN') for ongoing resuscitation. Directions were given for nurses to prepare for intubation and ventilation of Baby C, as well as to set up for IV cannulation for fluids. Once Baby C had arrived Dr S continued with 100% oxygen (at 88-90% saturation). Baby C's heart rate was 100 beats per minute. Dr S then intubated Baby C and suctioned the meconium via endotracheal tube ('ETT').

31. Dr S stated:

> *I then continued to provide PPV via the neopuff and looked for chest wall movement. I saw there was good chest wall movement. The nursing staff secured the ETT tube. At the same time I placed the stethoscope on the baby's chest to listen for Air Entry (AE). There was AE in the lungs bilaterally after intubation. At 0710 the baby was commenced on ventilation Synchronised Intermittent Positive Pressure Ventilation at pressure of 20/6 and 100% oxygen.*
>
> *One of the nurses did a heel prick at the time of commencing ventilation to check the baby's blood gases. While waiting for the blood gas results, I inserted a cannula into the baby and took bloods, for a full blood count and a blood culture. I reviewed the blood gases, pH7.013, pC02 67. 7, and Be (-14), and noted that the baby had a respiratory acidosis as well as a metabolic acidosis.*
>
> *To treat the metabolic acidosis I then instructed the nurses to give the baby a bolus of normal saline. The nursing staff gave the baby a bolus of normal saline - 30 mls, and IV maintenance fluids were continued with 10% Dextrose. I requested that the nursing staff do a capillary blood gas half an hour after the administration of the normal saline.*

32. Baby C was administered intravenous antibiotics and a chest x-ray was ordered, indicting pneumothorax, patchy ground glass indicative of meconium aspiration. A nasogastric tube was inserted. Dr S further examined Baby C noting he still had poor perfusion, the femoral pulses were present, the chest air entry was equal bilaterally, he had dual heart sounds with no murmurs, his abdomen soft bowel sounds were present and the umbilical cord was dark green, stained at birth which may indicate he had been distressed in utero.

33. At that time Dr B, Consultant Paediatrician was called as the on-call consultant. The plan was to add morphine and midazolam (to commence sedation) and order a repeat x-ray. A repeat blood gas was done at 8:05am showing an improvement in Baby C's metabolic and respiratory acidosis.

34. Dr S spoke with Ms B advising that Baby C had been commenced on ventilation, medication and IV fluids as he needed support to breathe.

Care of Baby C in the Special Care Nursery – Dr T

35. Dr B, Consultant Paediatrician, along with Dr A, Paediatrician, took over the care of Baby C from that point.

36. Dr A provided a statement to the Northern Coroner regarding Baby C's condition.

37. Two chest x-rays showed widespread patchy opacification throughout. Those images were consistent with a differential diagnosis of meconium aspiration syndrome or sepsis. There was also a small air leak (pneumothorax) around the right lung evident on the x-ray. The blood gas test showed Baby C was not clearing carbon dioxide effectively.

38. Dr A stated that it was clear to her that Baby C was unwell. The differential diagnosis was sepsis, which Dr A assumed was why Dr S had prescribed antibiotics. Dr A considered the care options available to Baby C at Cairns and Townsville and along with Dr B agreed that prior to considering transfer to The Townsville Hospital (a level 6 hospital) Baby C required clearance of carbon dioxide and improvement of his acidosis. In her statement Dr A noted:

> *Transferring a baby who requires 100% oxygen and high ventilator support and who is unstable is inherently risky. It is standard practice to stabilise the baby prior to transfer. The decision as to when to undertake such a transfer is a clinical one based upon a clinical risk analysis.*
>
> *Townsville hospital is a level 6 nursery and Cairns Hospital is a level 5. Townsville hospital nursery is able to provide two things which Cairns cannot provide. High frequency oscillatory ventilation and inhaled nitric oxide therapy. High frequency oscillatory ventilation and inhaled nitric oxide therapy. High frequency oscillatory ventilation is recommended as a "rescue therapy" in situations where conventional ventilation is not successful in managing a baby who requires assisted ventilation. It is not recommended as first line treatment. Nitric oxide is used to relax the blood vessels in the lungs and is only effective when ventilatory support is optimised to remove carbon dioxide. In order for nitric oxide to provide relief of pulmonary hypertension, other factors must be optimised such as ventilatory support to remove carbon dioxide.*

39. At 8:05am a further test of Baby C's blood gas test showed that the acid level had improved. Also the bolus of fluid plus the time frame had reduced the lactic acid in the blood helping the PH to improve. However there was still too much acid because the carbon dioxide level was still too high.

40. At approximately 8:20am Baby C's parents were advised that they were trying to find a way to extract the meconium from Baby C's lungs and that he was stable, Dr A told them that it was the most meconium they had seen in a long time. At that time did not give the parents any indication that the condition was life threatening (the mother has since indicated that she and the baby's father should have been given an indication of the dire situation).

41. A partial dose of Surfactant was given to Baby C at 8:30am in an attempt to assist the alveoli (air sacs in the lung) to stay open in order to absorb oxygen and get rid of carbon dioxide. There was no noticeable improvement after the first dose and Dr A decided to not give the other partial dose as the risk outweighed the potential benefit.

42. Given the blood test results the ventilator settings were changed to pressure support ventilation ('PSV') as well as other changes. Dr A organised for an arterial umbilical catheter to be inserted and an umbilical venous catheter. An x-ray at 9:23 am confirmed that the umbilical lines were in the appropriate position.

43. A blood gas test showed an improvement at 9:06am.

44. At approximately 10:00am Baby C's parents left the SCBU not knowing the seriousness of the condition. Mr B decided he would go home because Ms B needed to rest and Mr B wanted to help Ms B's mother who was looking after their other children.

45. A repeat blood gas was done at 10:43am and showed an ongoing improvement. Baby C remained stable. Dr A stated:

> *He still required 100% oxygen but his blood oxygen level was improving, saturation levels were in the low 90s. Nevertheless, the ventilation was still not optimal to reduce the pressure in the blood vessels to the lungs (reduce the pulmonary hypertension). Sometimes the best way to manage a baby is to leave them to rest, which is what I decided to continue to do as things were improving. This allowed time for the alveoli to continue to open up with a combination of pressure ('PEEP') and surfactant. I therefore organised for a repeat blood gas test to be performed an hour later.*

Comment made by mid-wife

46. At approximately 11:00am Ms B asked the birth suite midwife if she could take Baby C some milk and the midwife allowed her to do so. Ms B states that the midwife questioned her about her labour and asked her if she had any pain prior to her calling the hospital. Ms B said that she had some minor cramping but not labour pains. The midwife replied by saying words to the effect of "you were more than likely in labour last night and you should have come in" she went on to say that Ms B was "probably in denial and did not want to believe she was in labour". Mrs B states that this comment devastated her and felt like the midwife was attempting to apportion blame onto her. At no point while Ms B was in this room did anyone notify her of the seriousness of Baby C's condition.

47. The Cairns Hospital has since acknowledged the inappropriateness of this comment and issued a written apology to Ms B.

Baby C's further care and treatment

48. Dr A was called to amend settings on the ventilator shortly before completing another blood gas test at 12:52pm. Results showed an improvement with pH increased to 7.322 (nearly within normal range) and the C02 at 37.SmmHg (within normal range).

49. At about 1:00pm Dr B returned to the SCN and discussed Baby C's condition with Dr A. Dr B performed an echocardiogram to determine the pressure in Baby C's lungs finding only pulmonary hypertension was present.

50. Although Baby C was stable and his ventilation had improved, it was not as much as both Doctors would have liked and a decision to discuss the case with the on-call Townsville neonatal consultant was made. Baby C had also improved such that he was well enough to be safely transferred.

51. Dr Y, the Consultant Neonatologist in the Neonatal Intensive Care Unit was happy with the management thus far and recommended that the PEEP (setting on the ventilator) be reduced further to 6 and that dobutamine be commenced. Dr A was not privy to whether there were any discussions to transfer Baby C to Townsville at that stage.

52. Dr A left Baby C in the care of Dr B after amending the ventilator settings, returning at 3:30pm to see how Baby C was faring (at her own discretion, she was not called back). Dr A was told the Townsville NETS team would arrive between 7:30pm and 8:00pm. The blood gas test had been performed at 2:48 pm showed deterioration in the ventilation. Dr A was aware that the ventilator pressures had been reduced, presumably after consultation again with a Townsville neonatologist.

53. At 3:35pm a blood gas test was worse again. Baby C's oxygen level in his blood was falling and the saturation level had dropped to 74%. A chest x-ray at 3:43pm showed fluid in Baby C's right lung, suggesting Baby C had pleural effusion.

54. Dr A contacted a neonatologist in Townsville and was given advice to administer a second dose of surfactant and dexamethasone. Dr A increased the ventilator settings again. There was a slow increase in Baby C's oxygen levels reaching an increase of 80% on 100% oxygen before 5:30pm. The ventilator settings were changed further, however Dr A was not able to recall the details of this.

55. A social worker spoke to the parents at this time.

56. The plan was for Dr A to return to the hospital after an appointment, to care for Baby C until the Townsville retrieval team arrived, notwithstanding she was rostered off. Dr B continued the care in Dr A's brief absence.

57. Dr A returned at 5:34pm and Baby C's oxygen levels were 77%. A blood gas test was performed at 5:34pm with results showing more acid with an increasing carbon dioxide level showing the ventilation was inadequate.

58. At about 6:27pm as Dr A stood beside Baby C's bed, his oxygen level fell rapidly to 48% despite 100% inspired oxygen. Dr A suspected either a pneumothorax or pleural effusion. Dr A inserted a butterfly needle connected to a three way tap and syringe into the right side of Baby C's chest and aspirated 20ml of brown fluid and a small amount of air. A blood gas test at this time indicated that the ventilator was still not successfully removing carbon dioxide and the blood acid was accumulating. Baby C's lungs would have been compressed by the pleural fluid, and as such Dr A increased the ventilator pressures. Despite this, Baby C's blood oxygen level remained between 40% and 50%. Dr A believed that the sudden reduction in oxygen level caused by the pleural effusion would have also worsened the pulmonary hypertension. A chest x-ray showed a large pneumothorax outside the right lung causing compression of it. There was also a small amount of fluid outside the left lung. Dr A inserted a chest drain urgently and administered adrenaline.

59. Baby C's blood pressure increased, and the oxygen saturation level increased to 92% suggesting the pulmonary hypertension was a major contributory factor to poor oxygenation. Dr A administered another dose of adrenaline and Baby C's blood pressure rose to 75mmHG and his oxygen levels to 100%. Over the next hour Dr A increased the adrenaline infusion rate in order to attempt a blood pressure of greater than 73mmHg but despite this there was no improvement in the oxygen saturation.

60. A chest drain was inserted under Dr A's supervision and was evident on a chest x-ray at 8:00pm. This x-ray indicated the pneumothorax was smaller but still present.

61. Dr A reported that:

> *Baby C was in a very serious condition. I was at Baby C's bedside during this time and was monitoring him, considering the possible differential diagnoses, organising and supervising his care and maintaining contact with the neonatologist in Townsville.*

Arrival of the retrieval team from Townsville Hospital (Newborn Emergency Transport Service - NETS)

62. At about 8:50pm the Townsville NETS team arrived at the special care nursery at Cairns, some 5 hours and 20 minutes after receiving the request. Dr K, Registrar, Neonatal Intensive Care, Townsville Hospital was the medical officer assigned to the retrieval team.

63. By that time Baby C was pale, blue with an oxygen level of 30-40%. Dr A reports he was extremely unwell.

64. Dr K withdrew the chest drain and increased the PEEP on the ventilator. Dr K made contact with Dr Y in Townsville who suggested a trial of nitric oxide, which was administered. This did not cause any improvement in Baby C's oxygen level. Two further blood gas tests were performed during this time.

65. Dr K and Dr Y (who in turn spoke with Dr G, the director of the Townsville Neonatal Unit) reached the conclusion there was no further treatment that could be offered and transfer to Townsville Hospital would be fruitless for Baby C.

66. At about 10:30pm Dr A and Dr K spoke to Baby C's parents explaining there was nothing further that could be done.

67. Baby C's oxygen levels continued to fall. Both parents elected to discontinue ventilator and inotropic support and the ETT was removed and IV therapy ceased. Baby C was cuddled by his parents and passed away at 00:50. He was 18 hours and 17 minutes of age. He remained with his parents overnight in the parent's room attached to SCBU and his parents were provided with a memory box.

Expert Report – Professor Tudehope

68. In light of the concerns regarding the clinical management of both Ms B and Baby C, the Coroner requested an expert opinion from Professor David Tudehope.

69. Professor Tudehope, at the time of writing his report in 2014, was a Professorial Researcher at the Mater Research Institute-UQ and a Professor in Paediatrics and Child Health at the University of Queensland whilst also being a visiting medical officer in neonatology at the Mater Mother's Hospital where he was a Consultant Neonatologist and the Director of the Division of Neonatology from 1977 until 2008.

70. Professor Tudehope described the characteristics of meconium aspiration syndrome:

> *Meconium aspiration syndrome (MAS) is an important cause of respiratory distress in the term infant, with a local incidence of around 1.5 per 1000 live births. The prelude to MAS is the passage of meconium at or prior to delivery, a circumstance encountered in 10-20% of all deliveries at term especially breech and Fetal distress and more frequently post term. Meconium staining of liquor may be mild, moderate or heavy [usually with oligo-hydramnios]. Aspiration into the lungs usually occurs within a few breaths of birth. Once spontaneous respirations occur, meconium migrates into distal alveoli. The response of an infant >37 weeks gestation to Fetal hypoxic stress is to stimulate colonic activity and Fetal gasping, and if meconium is present in proximal airway it will be aspirated deep into respiratory tract. Once respiration begins postnatally, distal migration of the meconium into small airways occurs. Meconium-stained amniotic fluid (MSAF) is rarely seen at preterm delivery; its presence raises the possibility of Fetal infection (particularly listeria). Once in the lung, meconium quickly migrates down the tracheobronchial tree inducing a complex lung disease including:*
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> - *large and small airway obstruction*
> - *chemical pneumonitis*
> - *proteinaceous alveolar oedema*
> - *surfactant dysfunction or inactivation*

71. Professor Tudehope outlined the incidence of MAS is directly related to gestational age:

> *[T]he overall incidence of MAS was reduced from approximately 4-5% of babies born through meconium stained liquor [5-6/1000 live births] in term and post term births to 1.5 per 1000 in Australia over the past 2 decades. This reduction has been attributed*

to a ten-fold reduction in post term deliveries and effective preventive management of babies born through meconium stained liquor.

72. He was of the view that Baby C passed meconium in utero some hours or even days before birth. The time of aspiration into lungs was not able to be determined with certainty.

Major Contributing factors

73. Professor Tudehope reported there were 6 major contributing factors relevant to Baby C's death:

1. Failure to induce labour at T + 4 days as requested by mother
2. Failure to monitor Fetus after EDD with CTG, ultrasound and Doppler flow studies.
3. Failure to intubate a non-vigorous baby for tracheal suctioning of meconium at birth, placing baby on mother's chest straight after birth
4. Delay in contacting the Townsville Hospital (TTH) NETS for retrieval of Baby C until 9 hours of age
5. A further delay of 5.4 hours before arrival of NETS team in SCBU [14.4 hours of age]
6. The trial of iNO therapy at 16 hours of age when Baby C had already collapsed with pH of 6.87, pO2 of 11 and O2 saturation of 5% was far too late to have any reasonable chance of success.

Failure to induce labour at term + 4 days and failure to monitor Fetus

74. Professor Tudehope reported:

The Queensland Maternity and Neonatal Clinical Guidelines Program [QMNCG] developed state-wide guidelines for induction of labour in September 2011 which were revised in January 2014. Induction of labour [IoL] at 41 weeks is supported by fewer perinatal deaths, a lower risk of MAS with no significant difference in rate of Caesarean Section compared with expectant management. In particular IoL at 41 weeks lowers risk of MAS to 0.9% compared with 3.3% for expectant management. Most women prefer IoL at 41 weeks over serial antenatal monitoring. The guideline states that waiting to 42 weeks is not recommended but the exact timing of IoL depends on the woman's preferences and local circumstances.

75. Ms B was reviewed by an Obstetrician at 40 + 6 weeks and she requested to be induced. She was told that it was Cairns Hospital policy to wait for EDD + 10 days. Instead a sweep and stretch of the membranes occurred. The decision to carry this out was a matter for the obstetrician however Professor Tudehope did note (although within the guidelines) recent advances in ethical principles in the practice of perinatal medicine would suggest that patient autonomy over-rides the other principles.

76. A Fetal Heart Rate in the 160s (at the time of Ms B's last appointment preinduction) should have led to further assessment of Fetal wellbeing.

Failure to intubate a non-vigorous baby for tracheal suctioning of meconium at birth

77. Professor Tudehope reported that:

> *Baby C cried straight away but had depressed respirations with large amounts of meconium coming out of mouth and nose. His pharynx was suctioned under laryngoscopic vision down to the vocal cords but he was NOT intubated for tracheal suctioning. This approach did not conform to the global standards taught in the NRP course and outlined by ILCOR and NICE. These standards of practice have evolved over 40 years since the sentinel paper of Gregory et al in 1974.6*
> *…*
> *"The assessment of a baby born through meconium stained liquor and algorithm from NRP Textbook, 6th Edition 2011 are the standards for clinical practice. No standard has ever recommended direct suctioning of trachea under laryngoscopic vision without intubation. A specially designed meconium aspirator is inserted between adaptor of ETT and suction tubing.*

Delay in contacting TTH NETS for retrieval

78. The call to Townsville NETS was not made until 3:30pm when Baby C was 9 hours old. Professor Tudehope reported that the delay was due to the assessment by Paediatricians Dr A and Dr B's assessment of the MAS not being severe as it appeared that he stabilised with treatment (assessed by clinical pulse oximetry of O2 saturations of > 80% on SIPPV/PSV, rate 60-70, pressures 30/5-8cm H2O and 100% oxygen).

79. Professor Tudehope stated:

> *In my opinion there was clear evidence as early as 2 hours of age that this case of MAS was severe with hypoxaemia refractory to conventional ventilation and likely to involve advanced care such as sophisticated echocardiography, HFOV, iNO and pressor agents for systemic hypotension. Even as early as 2 hours of age there was evidence of severe MAS on chest radiograph and right to left shunting as determined by pre and post ductal O2 saturations.*

Delay in NETS arrival

80. The call for TTH NETS retrieval was made at 3:30 pm. The ambulance arrived at the TTH at 6:20 pm and left for the airport at 6:30 pm arriving at Cairns SCBU at 8:50 pm some 5 hours and 20 minutes after receiving the request. The delay was explained as to the unavailability of the Royal Flying Doctors Service Plane and a change of shift of staff. Although it wasn't clear how urgent the request for retrieval was, Professor Tudehope considered this to be an inordinate delay given Baby C was critical. Use of iNO at 16 hours of age When TTH NETS arrived at Cairns Hospital SCBU, Baby C was in a critical condition with a pH6.87, pCO2 106, pO2 11, O2 saturation 40%, Bicarb 20 and BE-14. Professor Tudehope stated:

> *[T]here was no chance that iNO was going to be successful as a last ditch attempt to salvage Baby C. Had the call for retrieval been made at 0833hrs and retrieval team arrived at SCBU at CBH at 1133 hrs [5 hours of age] when gases were pH7.32, pCO2*

38, pO2 38, O2 saturation 67%, Bicarb 20 and BE-6 a trial of iNO and attention to systemic BP might have stabilised Baby C sufficiently to transport him safely to TTH.

81. Professor Tudehope was cognisant that iNO therapy could not be administered by Cairns Hospital as the special care nursery sits as a level 5 within the clinical service capability framework and as such cannot offer inhaled nitric oxide.

Missed opportunities

82. Professor Tudehope was of the view that there were missed opportunities for primary prevention after Ms B's EDD (induction and intensive monitoring of Fetal wellbeing) and secondary prevention (ETT suctioning of the trachea immediately after birth). Clinical staff did not appreciate the severity of MAS of Baby C and missed an opportunity to retrieve him earlier. A further contributing factor was the delay in arrival of NETS at Cairns Hospital.

83. Professor Tudehope commented in relation to Australian data on MAS:

These data suggest to me that had Baby C been born in a tertiary Perinatal Centre he almost certainly would not have died. Having said that there was no antenatal or intrapartum indication for him to have been born in a tertiary centre. Out born babies with MAS who are transferred by a retrieval team to a tertiary centre have higher mortality and long term disability rates than inborn babies with MAS.

Response by the Cairns Hospital

84. The Coroner provided the issues raised by Professor Tudehope to Dr A and Dr S. The Cairns and Hinterland Hospital and Health Service ('CHHHS') had also met with Baby C's parents in an attempt to answer their concerns. Dr M, the Clinical Director of Paediatrics, and Dr S, the Clinical Director of Obstetrics and Gynaecology, conducted a clinical care review and a maternal and perinatal mortality review. In summary, the CHHHS considered the care and treatment afforded to Ms B and to Baby C was appropriate and consistent with the then current State-wide Guidelines and CHHHS procedure.

Failure to induce labour at T + 4 days as requested by mother

85. At the conclusion of the perinatal mortality review by CHHHS it was noted that nothing could or should have been done differently to manage Ms B's pregnancy nor delivery on 13 December 2012.

86. The hospital notes do not record that Ms B had requested an induction although it was accepted that she did so by the hospital. It was also accepted that Ms B was given the wrong record (a record from her previous pregnancy) when she asked for it. She was told that she need not come in for the correct record as it would be there for her labour.

87. CHHHS outlined their position as follows:

'The Queensland Maternity and Neonatal Clinical Guidelines, Induction, Prolonged Pregnancy for women with uncomplicated pregnancies, recommended induction between 41 and 42 weeks. Ms B's due date was based on the ultrasound taken on 4 May 2012. An ultrasound done between 710 weeks gestation to determine due date has statistically a 95% accuracy rate. 10 December 2012, 6 days after the estimated delivery date. The Obstetric Department does restrict inductions requests with no medical reason. Social induction is only done in exceptional circumstances and is not without risks. A decision to progress to an induction is carefully approached especially when the pregnancy is considered to be normal, low risk and there is no compromise to mother or baby. The risks associated with an induction must be weighed against the benefits. As there was no clinical indication to warrant an induction, it was appropriate for the obstetrician to perform a 'strip and stretch' an alternative to induce labour without drugs. This is associated with fewer effects than using drugs to induce labour.

An induction is designed to prevent stillbirth. It is not designed to prevent meconium aspiration. There is no test to detect meconium aspiration and it is very difficult to pinpoint meconium aspiration prior to delivery as an ultrasound and the blood flow through the cord does not detect meconium presence.

***An incident occurred within the last week of pregnancy caused Baby C to poo** [sic], resulting in meconium aspiration. Clinical staff have not been able to determine what caused the event, however it could have been due to a change in his blood pressure (decrease) resulting in a stroke. They can only speculate on what occurred.'*

Failure to monitor Fetus after EDD with CTG, ultrasound and Doppler flow studies

88. The director of Paediatrics, advised Baby C's parents that if Baby C's Fetal heart rate was persistently above 160bpm it would indicate stress for some reason. Dr A, did not record whether the Fetal heart rate of 160bpm was sustained or accelerated. Dr A was no longer employed by the hospital and the hospital was not able to clarify this issue.

89. The Fetal heart rate normal baseline is between 110-160bpm with normal baseline variability at 5-25 bpm between contractions. If the attending Obstetrician was concerned, it would have been reasonable to perform a cardiotocography (CTG). However, there are no documented clinical findings to indicate a sustained abnormal Fetal heart rate or pattern that would warrant CTG.

90. CHHHS referred to the State-wide Queensland Clinical Guidelines: Maternity and Neonatal Clinical Guideline: Intrapartum Fetal surveillance which was the current guideline at the time of this matter. It provides that the risk factors that increase the risk of Fetal compromise require intrapartum CTG during the antenatal period, conditions with respect to "Prolonged pregnancy greater than or equal to 42 weeks". Further, reference to the CHHHS Procedure "Management of Prolonged Pregnancy" current at the time of this matter, applied to pregnancies of more than 41 weeks.

91. In addition to the above, the Chair of the Maternal and Perinatal Mortality review advises:

Monitoring postdates is not really prescribed by RANZCOG Guidelines.

92. Dr H advised that even if an ultrasound was conducted it would have only showed Baby C's size not whether there was meconium present as blood flow through the cord also wouldn't detect meconium.

Failure to intubate a non-vigorous baby for tracheal suctioning of meconium at birth

93. Dr S was asked directly whether ETT suctioning of trachea in a non-vigorous baby with a heart rate of less than 100, poor respiratory effort, and hypertonia at 1 minute of age, and 5 minutes, was used, to which she responded:

> *The baby cried and was suctioned prior to the first APGAR reading being taken at 1 minute. Thereafter, ETT suctioning of the baby occurred in SCN as set out above.*

94. There was little or no additional information provided on this point.

Delay in contacting TTH NETS for retrieval of Baby C until 9 hours of age

95. Dr A stated that the extent of the meconium aspiration was recognized as soon as Baby C was born. Baby C's condition then improved slowly for the first 6 hours of life. Dr A said:
> *His respiratory acidosis was managed with appropriate ventilator support. However, his pulmonary hypertension was not improving, and a decision was made to request a transfer to Townsville Hospital for ongoing management with inhaled nitric oxide and possibly HFOV.*

96. The decision to request to transfer to Townsville Hospital at 1:30pm was done in conjunction with advice from consultant neonatologist from Townsville Hospital about the management of Baby C.

97. Dr M advised Baby C's parents that in retrospect Dr A and Dr B should have contacted the TTH neonatal team in Townsville sooner. However they didn't because although Baby C was ill, his condition had been stabilized and it was felt that he would improve.

The trial of iNO therapy

98. As a level 5 clinical service capability framework (CSCF) special care nursery it is not within the CSCF of the Cairns Hospital to offer inhaled nitric oxide.

99. There have been requests for CHHHS to be upgraded to a level 6 facility. Dr M was of the opinion that if nitric oxide was available, it wouldn't have made a difference as Baby C's meconium aspiration was too severe, evident by Baby C's stained nails, the meconium had been present for long periods.

Other issues

100. CHHHS have since also responded to the issues of management and information between the treating team and parents Mr B and Ms B. These included the lack of

information about the deterioration of Baby C, how that information was delivered and inappropriate comments from a special care nurse that Ms B should have come into hospital sooner.

Expert Report – Dr David Cartwright

101. In light of the hospitals response, a further expert opinion was sought by me from Dr David Cartwright to form part of the coronial investigation.

102. Dr Cartwright is a Pre-Eminent staff specialist, Neonatologist, at the Royal Brisbane and Women's Hospital and Sunshine Coast University Hospital. He is also an Associate Professor at the University of Queensland Department of Paediatrics and Child Health. His medical practice has been entirely involved with the care of newborn babies since 1979 and was the Director of Neonatology at the Royal Brisbane and Women's Hospital from 1988 until June 2017.

103. Dr Cartwright addressed five points in relation to this matter and they are outlined as follows.

1. The decision making process around induction of labour

104. Dr Cartwright notes that this is primarily an obstetric question, and has been answered in the perinatal mortality review. As a neonatologist, he is aware of many obstetric practices, (and their guidelines). He opined that the decision to induce labour at 'T+10' (41 weeks and 3 days) if not in labour after the membrane sweep undertaken at T+6 is quite consistent with current guidelines, and those in place at the time, and in his experience is also quite consistent with current obstetric practice.

2. The nature and extent of Fetal monitoring after the Estimated Day of Delivery (EDD)

105. Baby C was born at 41 weeks 2 days. To this extent he disagreed with Professor Tudehope's statement that 'Failure to monitor Fetus after EDD with CTG, ultrasound and Doppler flow studies', was an error on behalf of Cairns Hospital, and referred to the guideline that such monitoring would be recommended after 42 weeks, not after EDD.

106. Associate Professor Kimble (I refer to her report below) on this point, also says that the current recommended guidelines indicate progression to twice weekly monitoring would occur at 42 weeks (which Ms B was not).

3. The decision not to intubate immediately at birth

107. Dr Cartwright stated that there is no doubt that guidelines current at the time of Baby C's birth recommended intubation at birth for suction of meconium for all non-vigorous babies, but Dr Cartwright further noted that they also emphasised that it should occur before the first breath, important because that breath takes meconium present in the trachea and places it further down the airway where it is no longer accessible to suctioning using an endotracheal tube. Dr Cartwright explained that the teaching slide

on this from 'Neoresus', the neonatal resuscitation program taught in Queensland Health Hospitals since 2013, states:

'*Meconium during birth with a depressed infant Intubation should only be performed:*

- *Immediately after birth*
- *If an experienced practitioner and all needed equipment are readily available.*
- *Before the onset of breathing and crying and in infants with decreased muscle tone.*
- *It should not be done if the infant is vigorous and breathing or crying.*'

108. Dr Cartwright explained that:

Baby C, had breathed - he must have, because he cried at birth. He was otherwise not vigorous. The registrar present seems to have been an experienced operator – she later sedated and intubated him without need for assistance. ***He really was a baby who didn't fall into the totally non-vigorous, non-breathing category, nor the vigorous and crying category. I am quite certain that I personally would have intubated and suctioned for meconium, then reintubated him to give the positive pressure breaths needed, but I cannot be totally critical of someone who didn't****. It should not ever be thought that the problems of meconium aspiration can all be overcome by suctioning the trachea at birth. The difficulty in management comes from the associated pulmonary hypertension much more than the presence of meconium, and resuscitation must always take precedence over intubation for meconium suction. Meconium aspiration without pulmonary hypertension is not difficult to manage; pulmonary hypertension without meconium aspiration is difficult to manage.*

It is of interest that opinion on this has altered somewhat since that time, such that current ANZCOR (Australian and New Zealand Council on Resuscitation) guidelines, dated January 2016, state 'For babies who are not vigorous (not breathing or crying, low muscle tone) the available evidence does not support or refute the value of routine endotracheal suctioning in preventing MAS ' and 'ANZCOR suggests that there is insufficient published human evidence to suggest routine tracheal intubation for suctioning of meconium (CoSTR 2015).7 Potential benefits of removing meconium from the trachea need to be weighed against what is likely to be an urgent need for other resuscitation maneuvers. ***Emphasis should be made on initiating ventilation rapidly in non-breathing or ineffectively breathing infants****. That does not say that it should never be done, just that it is not as mandatory as was once taught.*

109. Dr Cartwright stated that he agreed with Professor Tudehope that:

No standard has ever recommended direct suctioning of trachea under laryngoscopic vision without intubation.

4. The timing of the decision to contact the Townsville Hospital to request retrieval of Baby C

110. Dr Cartwright was firmly of the view that this should have happened much earlier, probably around 08:00.

He explained that:

At that stage, Baby C was assessed as having meconium aspiration syndrome with pulmonary hypertension (later confirmed on cardiac echo), was intubated and ventilated with quite high pressures, and required 100% oxygen to achieve only marginal saturations measured by pulse oximetry. There is no information regarding the siting of the oximeter probe, but one assumes, from the recorded observations and concomitant blood gases from a post-ductal site, that it was probably in a pre-ductal position, on the right hand or wrist. In all of the recorded observations between 07:30 and 24:00, there are only 2 saturations above 95% - the very first, at 07:30, and another at 19:00 which is so out of keeping with the ones before and after, and with blood gas at 18:37 that it seems to be an aberration. That is indicative of very severe pathology in someone receiving 100% oxygen.

Cairns Hospital operates as a Level 5 neonatal unit. The criteria for that in the Clinical Services Capability Framework include 'manages expected short-term mechanical ventilation (i.e. 48-72 hours) in consultation with a Level 6 service'. If that consultation had occurred early in the course of Baby C's ventilation, an experienced neonatologist would have quickly discerned that this was a serious situation not likely to be short-term and likely to require further escalation of management, and would I believe have recommended retrieval to a Level 6 centre.

I agree entirely with Professor Tudehope's statement 'Had the call for retrieval been made at 0833hrs and retrieval team arrived at SCBU at CBH at 1133 hrs [5 hours of age] when gases were pH7.32, pCO2 38, pO2 38, O2 saturation 67%, Bicarb 20 and BE-6 a trial of iNO and attention to systemic BP might have stabilised Baby C sufficiently to transport him safely to TTH.' (Note that oxygen saturation of 67% is as recorded on the blood gas, from the iStat machine, which I suspect is a calculated value using adult haemoglobin characteristics – the oximeter saturations at the time were in the low 90s). I think there is every reason to believe that institution of iNO (nitric oxide) ***therapy at the time late morning when blood gases were reasonable would have been successful in achieving better oxygenation and quite possibly allowing some weaning of ventilator pressures that might have decreased the chance of the later occurrence of pneumothorax, and would have allowed safe transfer to Townsville, and most likely survival.*** *There is a need for ongoing stabilisation, but that should be after requesting advice from the Level 6 Service, not instead of seeking that advice.* ***Had the call to Townsville been made earlier in the day, it is highly likely that the later delays in transport aircraft availability would not have occurred****. My experience with making calls in the mid-afternoon in south-east Queensland is that there is commonly a delay relating to pilot fatigue provisions, and the need to wait for a new aircraft crew to come on duty (we seem to still be unsure of the exact reason for the delay in this instance).*

Use of iNO therapy at 16 hours

111. Dr Cartwright did not think that the timing of 16 hours was the critical factor to consider in this matter as it is rather the virtually moribund state of Baby C at that time that would make there to be little likelihood of success of using iNO. Dr Cartwright could

understand why it was tried, as a virtual ‘last ditch effort’, but the chances of success are negligible in such a severely acidotic and hypoxic baby.

112. Dr Cartwright pointed out that earlier in the day, when the Baby C’s pH was almost normal, and the pCO2 also close to normal, that he would rate the chance of success of using nitric oxide as very high. Dr Cartwright did not agree with the assertion that the meconium aspiration syndrome was ‘too severe’ (per the parental interview record).

Dr Cartwright’s conclusion

113. Dr Cartwright concluded:

> *Overall, my view of Baby C’s management leads me to conclude that the one thing most likely to have made a difference to his course, and perhaps outcome, was the late referral to The Townsville Hospital neonatal unit and retrieval service.*

Associate Professor Rebecca Kimble expert report

114. So as to better understand the risk factors for meconium aspiration I requested an expert report from Associate Professor Rebecca Kimble.

115. Dr Kimble’s qualifications are as follows:
- MBBS, FRANZCOG, GAICD, Grad Cert IV Training & Assessment
- Medical Lead, Quality Improvement
- Patient Safety and Quality Improvement Service, Department of Health (Qld)
- Director State-wide Paediatric & Adolescent Gynaecology Services
- Chair, State-wide Maternity and Neonatal Clinical Network
- Director Queensland Clinical Guidelines
- Pre-Eminent Staff Specialist Obstetrics and Gynaecology
- Royal Brisbane & Women's Hospital and Queensland Children's Hospital University of Queensland, Faculty of Medicine.

116. The questions I posed to Dr Kimble via a Form 25 and her response to each is as follows:
1. What are the risk factors for 'meconium aspiration';
2. Can meconium aspiration be detected prior to birth;
3. Recent statistics on the prevalence of 'meconium aspiration'; and
4. Any further observations that may assist the coronial investigation with reference to available material (to be provided)

1) Risk Factors for Meconium Aspiration (Syndrome MAS)

Current literature on risk factors for meconium aspiration is based on retrospective studies, of which there are few from Maternity Services where intrapartum Fetal surveillance is available. The incidence of MAS in the developed world is low and seems to be

decreasing. Risk of MAS is significantly greater in the presence of Fetal distress and low Apgar score, as well as Pacific Islander and Indigenous Australian ethnicity.

The observed risk factors in studies suggest 'compared with healthy neonates with Meconium Stained Amniotic Fluid, those with Meconium Aspiration Syndrome (MAS) had a higher rate of no reassuring Fetal heart rate tracing, thick meconium in amniotic fluid, and Apgar score </= 5 at 5 minutes'.

All deaths and long- term morbidity occurred in babies with abnormal cardiotocographs, or in unmonitored babies.

Factors that have been associated with an increased risk for MAS are heavy meconium-stained amniotic fluid, the discovery of meconium in the active phase of labour, nulliparity, post- dates, growth restriction, Fetal heart rate abnormalities during labour, low Apgar scores, and the presence of meconium below the vocal cords.

2) Can meconium aspiration be detected prior to birth?

Current literature focuses on risk factors, and there's a paucity of information on detection of meconium aspiration prior to birth. The above risk factors would warn clinicians to be aware of the possibility of meconium aspiration and manage the labour and birth with intrapartum Fetal surveillance using cardiotocography to detect Fetal distress, and act according to current Guidelines on intrapartum Fetal Surveillance.

3) Recent Statistics on the prevalence of meconium aspiration

The incidence of Meconium Aspiration Syndrome in the developed world is low and seems to be decreasing.

Queensland data is presented below in several tables from Queensland Department of Health, Statistical Services Branch. A summary narrative is provided to interpret the data:

Since the numbers are so small the data has been summarised over the entire period from 2012-2018.

1. *Between 2012 and 2018 3.5 per 1,000 total births occurred where neonatal meconium aspiration was coded as being present as a neonatal morbidity or main or contributing cause of death in the Queensland Perinatal Data Collection.*

2. *Between 2012 and 2018 86.7 per 1,000 total births occurred where either neonatal meconium aspiration was coded as being present as a neonatal morbidity or main or contributing cause of death or meconium stained amniotic fluid causing Fetal distress was coded as a labour or delivery complication in the Queensland Perinatal Data Collection.*

3. *The incidence of deaths where the main or contributing cause of death included meconium aspiration was 0.02 per 1,000 total births in Queensland between 2012 and 2018.*

Between 2012 and 2018 of all pregnancies in Queensland where labour and delivery were complicated by Fetal distress and presence of meconium in amniotic fluid, the rate of neonatal meconium aspiration ranged between 2.26 % to 3.01 %, without a trend over those years.

Between 2012 and 2018 of all births where there was meconium aspiration, the number of babies who were stillborn has declined to zero after 2016, and of those born alive the number of babies who subsequently died has declined since 2012 however the total numbers are too small to suggest statistical significance.

4) Any further observations that may assist the coronial investigation with reference to available material (to be provided).

Queensland Clinical Guideline Induction of labour {/OI} current at the time of Baby C's birth and death in December 2012 was Version 3 published in August 2011, to be reviewed in 2016. The recommendation in relation to prolonged pregnancy in this version at section 2.1 was:

- *For women with uncomplicated pregnancies, recommend IOL between 41 and 42 weeks.*
- *Waiting after 42 weeks is not recommended.*
- *Exact timing depends on the woman's preferences and loco/ circumstances*

At section 1.4 of this version Care if induction of labour declined, the following guidance appeared:

"No form of increased antenatal monitoring has been shown to reduce perinatal mortality associated with post-term pregnancy. However, it is recommended from 42 weeks, to offer increased antenatal monitoring consisting of twice weekly:

- *Cardiotocogrophy (CTG)*
- *Ultrasound assessment of amniotic fluid volume using: Estimation of maximum amniotic pool depth, or amniotic Fluid Index*
- *Umbilical arterial Doppler ultrasound*

I comment at this juncture, my understanding with reference to the Queensland Clinical Guideline (IOL) is that Ms B's pregnancy would be considered 'uncomplicated'. Noting that induction of labour occurred at 41 weeks and 3 days (full term plus 10 days), Ms B would not therefore fall within the recommendation for twice weekly antenatal monitoring (which if applicable would occur from 42 weeks).

117. I asked Dr Kimble to clarify my observation and she responded as follows:
    - *With reference to the Queensland Clinical Guideline (IOL) Ms B's pregnancy would be considered uncomplicated and noting that induction of labour occurred at 41 weeks and 3 days (full term plus 10 days) did (/ does) not fall within the recommendation for twice weekly antenatal monitoring (which if applicable would occur from 42 weeks).*

Comment and analysis

118. I accept that there were missed opportunities in the clinical care of Baby C. I have considered:

i. the delay in contacting The Townsville Hospital for Baby C to be transferred to a level 6 service; and

ii. the issue raised by Professor Tudehope and agreed by Dr Cartwright, that Baby C's pharynx was suctioned under laryngoscopic vision down to the vocal cords and he was not intubated for tracheal suctioning.

119. Professor Tudehope and Dr Cartwright agree that no standard has ever recommended direct suctioning of trachea under laryngoscopic vision without intubation.

120. The clinical review by CHHHS refers to the Queensland Maternity and Neonatal Clinical Guideline "Neonatal resuscitation" and notes that Dr S acted within those guidelines. Those guidelines refer to the tracheal suctioning via intubation.

121. Professor Tudehope recommends that the CHHHS should comply with the Clinical Services Capability Framework guidelines and that all clinical staff in Level 5 units complete a full Neonatal Resuscitation Course with refreshers every 2 years.

122. This course should include a detailed program on resuscitation of a baby born through meconium stained liquor, incorporating a requirement to ensure tracheal suctioning via intubation, and not suctioning under laryngoscopic vision down to the vocal cords.

Response from CHHHS

123. After considering draft findings Baby C's' mother Ms B raised a number of questions. I invited Dr Neil Archer the Clinical Director of Pediatrics at the Cairns Hospital to respond to those questions and concerns. I extract below from Dr Archer's written response:

Ms B's question	**My Response**
If possible, the Cairns Hospital to be a tertiary neonatal unit such as Townsville (level 6);	I refer to the CHHHS report dated 3 May 2019, paragraphs numbered 20.1 and 20.2 and confirm: o the Cairns Hospital, Neonate Unit is not a Clinical Services Capability Framework (CSCF) level 6; and o future amendments to the CSCF level of the Neonate Unit is a Department of Health (DoH) responsibility. The DoH is responsible for the system-wide maintenance and development of the CSCF v3.2 and subsequent versions. This responsibility includes, but is not limited to: 1. Further simplification of the CSCF where applicable. 2. Ensuring the CSCF aligns with future legislation, evidence-based clinical practice and policy direction evolution. 3. Updating existing CSCF modules as required. 4. Developing new CSCF modules as directed by the DoH.
Ms. B's question	**My Response**
	CSCF governance committee A CSCF governance committee has been established to oversee these responsibilities and make recommendation/s on future amendments to, and/or development of the CSCF to the Director General, DoH. I attach the CSCF governance arrangements factsheet (marked **NA1**).

	The CSCF governance committee members have been appointed by the CSCF sponsor – the Chief Health Officer and Deputy Director General, Prevention Division – on the basis of their position, sector, discipline and/or geographical location and includes 26 members + ad hoc clinical experts and/or discipline advisors as required. A list of names of the governance committee members is attached and marked **NA2.** The CSCF governance committee meets as required, with out-of-session communication occurring via electronic information sharing and/or discussion. **CSCF user group** A state-wide forum for CSCF users has been established and meets as required to: 1. Facilitate discussion on application of the CSCF in Queensland public hospitals and licensed private health facilities. 2. Raise and clarify issues specific to the CSCF. 3. Other suggestions for improvement to the Queensland CSCF. Participation in CSCF user group meetings is open to all interested parties, limited only by meeting venue space availability and/or video and teleconference capacity. The opportunity to participate in meetings is provided on a 'first in, first accommodated' basis via advance notice of meeting participation to the CSCF User Group Chair. A copy of the CSCF user group terms of reference is attached and marked **NA3.** A record of user group actions can be obtained by emailing Private_Health@health.qld.gov.au
High frequency oscillatory ventilation and inhaled nitric oxide therapy be made available in the Cairns neonatal department;	The Cairns Hospital Neonatal Unit can provide "*high frequency oscillatory ventilation*". The Neonate Unit does have a ventilator that can oscillate. The CHHHS to my knowledge has not (nor had need to consider) used this alternative mode of ventilation in a neonate subsequent to the case in question. "*Inhaled nitric oxide therapy*" is not available in the Cairns Hospital Neonate Unit, nor is it available in the Cairns Hospital Adult Intensive Care Unit.
Ms B's question	**My Response**
	Since I commenced with the CHHHS, approximately 3 years ago, no neonatal patient has needed the administration of nitric oxide whilst in Cairns Hospital. There is significant training, expertise and experience required in administering nitric oxide. Familiarity with the use of medical interventions is key to ensure they are used appropriately, safely and effectively. There is clear risk to the patient (and staff) in using techniques that are complicated, in which it is impractical or impossible to maintain recency of practice. Such balanced decisions are an everyday and ongoing aspect of healthcare commissioning and not specific to this treatment (e.g. neurosurgery is not provided at Cairns Hospital but requires transfer to Townsville). Discussions with colleagues at the level 6 Neonatal Intensive Care Unit (NICU) in Townsville have confirmed that it would be inappropriate to have this resource for the Special Care nursery in Cairns and is outside of the CSCF for a level 5 unit. Noting that today, consultation with the Townsville NICU would occur earlier, nitric oxide would be able to be brought by the Townsville NICU

	retrieval team, commenced in Cairns and utilised during the retrieval if required.
CHHHS policies around overdue delivery dates be reviewed to include close monitoring and request for an induction accepted if the mother wishes;	This question falls within the scope of the Obstetrics and Gynaecology Department.
Consider changes to be made for delivery of meconium babies – to inform the parents of severity (of the condition) and Townsville Hospital to be contacted on birth so they can determine if transfer is necessary;	As above.
All clinical staff in Level 5 units to complete a full Neonatal Resuscitation Course and have refreshers every 2 years (the course should include a details program on resuscitation of a baby born through meconium stained liquor, incorporating a requirements to ensure tracheal suctioning via intubation, and not suctioning under laryngoscopic vision down the vocal cords).	I refer to the CHHHS report dated 3 May 2019, paragraph 21 and confirm that "all nursing staff employed in the SCN, and all medical staff of the Paediatric Department, Cairns Hospital, complete as part of their mandatory training: ○ *The Advanced Neo-Resuscitation Course every 2 years;* ○ *The First Response Neo-Resuscitation Course annually."* The Advanced Neo-Resuscitation Course is delivered to a National Standard by the Victorian Newborn Resuscitation Project. Details of the content of the Advanced Resuscitation course are located at: https://www.neoresus.org.au/programs/advanced-resuscitation/ (Note: To reference content from the NeoResus website, I am required to acknowledge the author as: The Victorian Newborn Resuscitation Project: NeoResus (2019). NeoResus Content Development. Accessed 09/09/2019 from https://www.neoresus.org.au/)
Ms B's question	**My Response**
	The request to include that "*the course should include a details program on resuscitation of a baby born through meconium stained liquor, incorporating a requirement to ensure tracheal suctioning via intubation and not suctioning under laryngoscopic vision down the vocal cords*" be included, is not consistent with the contemporary standard of care that applies today. In October 2015 the International Liaison Committee on Resuscitation (ILCOR) Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR) guidelines were released. In relation to "***management of meconium*** *ILCOR found insufficient published human evidence to suggest routine tracheal intubation of non-vigorous infants born through meconium stained amniotic fluid as opposed to no tracheal intubation for suctioning. Initiating ventilation within the first 60 seconds after birth in the non-breathing, or ineffectively breathing newborn with poor muscle tone should take priority over tracheal intubation"* – refer to the Neoresus website at: https://www.neoresus.org.au/learning-resources/additional-resources/neonatal-resuscitation-specific-treatment-recommendations-ilcor-2015/ In addition, I attach 2 articles that confirm that it is recommended that "non-vigorous infants delivered through MSAF do not require routine intubation and tracheal suction":

	➢ Meconium “aspiration” (or respiratory distress associated with meconium-stained amniotic fluid (MSAF)?) – attached and marked **NA4**; and ➢ “Have the 2015 Neonatal Resuscitation Program Guidelines changed the management and outcome of infants born through meconium-stained amniotic fluid?” – attached and marked **NA5**.

Response from Obstetrics and Gynaecology Director – CHHHS

124. I sought further clarification of hospital policy in relation to requests by mothers to induce labour for non-medical reasons and asked if there was a tension between parental autonomy and hospital policy, and further the current practice in relation to fetal monitoring beyond full term.

125. Dr Samantha Scherman Clinical Director – Obstetrics and Gynaecology at the CHHHS provided the following response:

Report

1. The CHHHS policy as it is now, in 2020, in relation to request for induction (that fall outside hospital advices). Is there any difference to the policy now and what was provided in 2012 and 2015? Is there a tension now between parental autonomy and hospital policy?

    1.1 In 2020, in cases where women request Induction labour (IOL) for non-medical reasons, each request is looked at on an individual basis.

    1.2 The CHHHS, Cairns Hospital, will perform IOL for non-medical indications on request, if the women understand the process and there is no increased risk for the baby in proceeding. For example, IOL would not usually be considered before 38 weeks if for social or non-medical reasons only, due to the potential increased risks to the baby in delivering at 37 weeks as compared to 38+ weeks.

    1.3 It is preferable to try and wait until 39 weeks if possible as studies have shown potentially better outcomes for babies born at 39 weeks as compared to earlier (as referred to in the statewide Queensland Clinical Guidelines (SQCG): Induction of Labour, published March 2017, document number: MN17.22-V7-R22, attached and marked SS1, at page 14 of 30, cut and pasted below).

    1.4 By comparison, the GCG: IOL that applied in 2012 and 2015, attached and marked SS2, at page 12 of 26, cut and pasted below, provided:

2.12 Maternal request

Table 13. Maternal request

Maternal request	
Risk/Benefit	• There are no studies that address this group specifically[1] • In uncomplicated pregnancies consider the risk of neonatal respiratory distress syndrome and related adverse effects[13]
Recommendations	• Consider IOL based on *exceptional* circumstances of the woman and her family

1.5 We do have a lot of women with FIFO partners for example, who may request IOL at a specific time so that their partners can attend the birth.

2.8 Maternal request

Table 11. Maternal request

Maternal request	
Risk/Benefit	• For low risk women elective IOL at term is not associated with an increased risk of CS[64] • The long term population consequences of a significant proportion of low risk women receiving elective IOL are unknown • IOL requires more intensive clinical resources than spontaneous onset of labour in low risk women • Retrospective and population based studies suggest a possible association between birth prior to 39 weeks and developmental/early childhood health problems[65-68]
Clinical practice point	• Consider IOL at term based on exceptional circumstances of the woman and her family (i.e. not solely because of patient or health care provider preference[5])

1.6 It is my experience that an IOL will be performed on more occasions in 2020 than it was in 2012 to 2015. In particular, there are recent studies which suggests that a low risk patient is at no greater risk of a caesarean section with IOL. Historically it was thought a caesarean section was more likely with IOL.

1.7 There is no tension between parental autonomy and State policy. See also 1.1 and 1.2 QSCG 2020.

2. What is the current practice of the CHHHS in relation to fetal monitoring beyond full term?

2.21 In terms of postdated IOL – or generally in relation to postdates EDD there is currently no evidence that any form of monitoring postdates pregnancies reduces perinatal mortality (see AQGC 2020 at 1.2, 2.1)

2.2 As per the SQCG: IOL, attached and marked SS1, IOL is recommended for postdates from 41+0-41+3, unless there is an indication for earlier IOL.

2.3 Generally, the SQCG provides for monitoring as per the report to the Northern Coroner dated 18 June 2018, see paragraph C “the nature and extent of foetal monitoring after EDD” The SQCG remains unchanged on that issue since that report as set out in SQGC 2020.

Findings Pursuant to s45 of the *Coroners Act 2003*

126. I find as follows:

Identity of the deceased:	[Baby C – de-identified for publication]
How he died:	Baby C was born on 13 December 2012 at 6.33am at 41 weeks and 2 days (full term plus 9 days). Baby C was declared deceased at 00:50 hours on 14 December 2012 at The Cairns Hospital. He was aged 18 hours and 17 minutes at the time of his death.
Date of death:	14 December 2012
Place of death:	Cairns Hospital
Cause of death:	Baby C died from meconium aspiration syndrome complicated by persistent pulmonary hypertension.

Further considerations

Fetal monitoring and request by mother for iOL

127. The infant's mother Ms B requested during review on 10 December 2012 that she be induced (induction of labour), she was then full term plus 6 days. She was advised that IOL was recommended after 10 days of the estimated due date and IOL was then booked in for 14 December 2012.

128. During the 10 December review the baby's fetal heart rate was recorded in the 160's. The heart rate was not conveyed or explained to the mother. No further fetal surveillance was undertaken that day, or prior to Baby C's birth. Ms B was unaware of the high heart rate and she had inadvertently been provided with records from a previous pregnancy after the consultation. Being an experienced mother, she says that had she been aware of Baby C's high heart rate she would have sought clarification and follow up.

129. I am satisfied that the high heart rate noted during the 10 December review required further exploration by the Consultant – it is not clear if the heart rate of 160bpm was recorded at the peak of the contraction or sustained. If the fetal heart rate was sustained at 160bpm on 10 December then further testing including a CTG was warranted. This was a potential missed opportunity to gauge any fetal distress, or potential issues.

130. I accept Associate Professor Kimble's conclusion that with reference to the Queensland Clinical Guideline (IOL) Ms B's pregnancy would be considered uncomplicated and noting that induction of labour occurred at 41 weeks and 3 days (full term plus 10 days) did (/ does) not fall within the recommendation for twice weekly antenatal monitoring

(which if applicable would occur from 42 weeks). Dr Cartwright in his report also refers to the current guideline, such monitoring would be recommended from 42 weeks.

131. In accordance with the QCG guideline Ms B did not require twice weekly ante natal monitoring because she has not yet reached 42 weeks.

132. However, I am satisfied that the issue of the baby's heart rate of 160pbm on 10 December required further investigation at the time the elevated heart rate was detected.

133. Regarding Ms B's request for induction of labour, and with reference to Dr Scherman's response, a maternal request to the CHHHS for IOL at full term plus 6 days would be considered on an individual basis. The CHHHS will perform IOL for non-medical indications on request, (although not before 38 weeks). In Ms B's case, no increased risks were indicated at that time. I am informed that inductions of labour will be performed on more occasions in 2020 than in 2012-2015. I am advised there is no tension between parental autonomy and State policy.

134. The Qld Maternity and Neonatal Clinical Guidelines indicate that 'the exact timing of induction of labour depends on the woman's preferences and local circumstances. I note Professor Tudehope's comment that 'recent advances in ethical principles in the practice of perinatal medicine would suggest that patient autonomy over-rides the other principles.

135. I remain unable to reconcile why Ms B's request for induction of labour at full term plus 6 days was not acceded to by the CHHHS in 2012.

Tracheal intubation or initiating ventilation

136. At birth Baby C was covered in thick meconium, staining his skin, nails and umbilical cord. He had a significant amount of meconium on his lungs, he cried although his breathing was shallow (depressed respirations). He was immediately placed on his mother's chest.

137. Direct suctioning of the trachea under laryngoscopic vision was undertaken without intubation. After considering this issue and with the benefit of two expert reports I am satisfied that 'no standard has ever recommended direct suctioning of trachea under laryngoscopic vision without intubation'.

138. Baby C was not intubated for tracheal suctioning at birth. For intubation to be effective it must be undertaken before the first breath.

139. I note the October 2015 International Liaison Committee on Resuscitation (ILCOR) Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Case

Science with Treatment Recommendations (CoSTR) guidelines (which came into effect after the birth of Baby C): ***'initiating ventilation within the first 60 seconds after birth in the non-breathing, or ineffectively breathing newborn with poor muscle tone should take priority over tracheal intubation'***.

Professional training re: neo-resuscitation

140. As at May 2019 the CHHHS advised that all medical staff of the Paediatric Department, Cairns Hospital, complete as part of their mandatory training:

    a. The Advanced Neo-Resuscitation Course every 2 years;
    b. The First Response Neo-Resuscitation Course annually

141. I am satisfied that the implementation of the CHHHS neo-resuscitation training accords with contemporary best practice.

Arrival of Townsville Hospital NETS team and nitric oxide therapy

142. The treating team initially formed a view that the baby had stabilised sufficiently and did not require immediate transfer to the Townsville Hospital. A call for the Townsville Hospital (Newborn Emergency Transfer Service) NETS team was made at 3.30pm, (9) hours after Baby C was born.

143. At about 8:50pm the Townsville NETS team arrived at the Special Care Nursery (SCU) at Cairns, some (5) hours and (20) minutes after receiving the request. The delay was explained as an unavailability of the Royal Flying Doctors Service Plane and a change of shift of staff. By the time the NETS team arrived Baby C was in a critical condition.

144. The treating team at Cairns whilst doing all they believed necessary, did not appreciate the severity of the meconium aspiration and therefore the potential for Baby C's rapid deterioration.

145. I find there was a missed opportunity for the treating team in Cairns to contact the Townsville Hospital earlier (optimally within the first (2) hours of his life). The Townsville Hospital is a Level 6 tertiary hospital service which incorporates a neonate emergency team embedded within the service. This early call would have provided an opportunity for the Townsville NETS team to mobilise. The NETS team arrived almost (15) hours after Baby C was born.

146. I find the delay was a missed opportunity to provide effective care and treatment to Baby C such that he could be transferred to the Townsville Hospital.

147. I find that successful transfer to the Townsville Hospital Neonate Unit would have provided an opportunity, perhaps the only opportunity), to alter Baby C's course, and to prevent his death.

148. Had there been an opportunity to administer iNO therapy (nitric oxide) by late morning, both experts (Professor Tudehope and Dr Cartwright) agree that blood gases were reasonable would have been successful in achieving better oxygenation and quite possibly allowing some weaning of ventilator pressures that might have decreased the chance of the later occurrence of pneumothorax, and would have allowed safe transfer to Townsville, and most likely survival.

149. As at the time of arrival by the NETS team I accept that 'There was no chance that iNO was going to be successful as a last ditch attempt to salvage Baby C. Had the call for retrieval been made at 0833hrs and retrieval team arrived at SCBU at CBH at 1133 hrs [5 hours of age] when gases were pH7.32, pCO2 38, pO2 38, O2 saturation 67%, Bicarb 20 and BE-6 a trial of iNO and attention to systemic BP might have stabilised Baby C sufficiently to transport him safely to TTH'.

150. I note Professor Tudehope's conclusions that 'had Baby C been born in a tertiary Perinatal Centre he almost certainly would not have died.

151. I do not go so far as to accept and find that to be so. I do accept that Baby C's best (and perhaps only) chance in retrospect, was care and treatment in, and from, a tertiary perinatal centre from the time of birth.

152. I also accept and adopt Professor's Tudehope's conclusion that 'there was no antenatal or intrapartum indication for him to have been born in a tertiary centre. Out born babies with MAS who are transferred by a retrieval team to a tertiary centre have higher mortality and long term disability rates than inborn babies with MAS'.

153. In May 2017 the CHHHS including the Clinical Director of Obstetrics and Gynaecology, met with Ms B and indicated that:

- An incident occurred within the last week of pregnancy caused Baby C to poo, resulting in meconium aspiration. Clinical staff have not been able to determine what caused the event, however it could have been due to a change in his blood pressure (decrease) resulting in a stroke. They can only speculate on what occurred.'

154. This accords with professor Tudehope's opinion that Baby C passed meconium in utero some hours or even days before birth. The time of aspiration into lungs was not able to be determined with certainty.

155. It is probable that the timeframes indicated for Baby C passing meconium by both the CHHHS (within a week of birth) and the expert commissioned to provide a report for the investigation (within hours or days of birth), overlap with last consultation Ms B

attended, during which consultation, an elevated heart rate was detected. As no further testing was undertaken, fetal distress at that time cannot be excluded.

156. I find that baby C aspirated meconium (first faeces) prior to his birth and went into immediate respiratory distress causing his progressive and worsening deterioration, and ultimately his death. For Baby C to have any chance of survival he required immediate effective preventative management, timely specialist emergency intervention, and nitric oxide therapy (not available at the Cairns Hospital, a Level 5 service). The nearest Level 6 tertiary peri-natal centre was the Townsville Hospital. A specialist neonate retrieval team did not arrive until 15 hours after birth. By then the opportunity for meaningful care and treatment, and transfer to Townsville, had passed.

157. I am informed and accept that in the past three years no neonate has required nitric oxide therapy at the Cairns Hospital. I am also informed that today, consultation with the Townsville NICU would occur earlier, nitric oxide would be able to be brought by the Townsville NICU retrieval team, commenced in Cairns and utilised during the retrieval if required.

158. I accept that improved outcomes have been / will result from earlier consultation between Cairns and Townsville hospitals (or other relevant facility) in circumstances such as those in the case of Baby C.

Concluding comments of Coroner

159. Ms B was an experienced mother with three older children. Whilst grieving the death of her baby within hours of his birth, (those hours marked by the shock and trauma of emergency care in attempts to save his life) Ms B has remained a consistent advocate for her son and maintained her concerns (addressed above) summarised below:

i. a failure to further assess / monitor the elevated heart rate at the last appointment with an obstetrician;
ii. the provision of the baby's incorrect medical records to her after that appointment which she says (and I accept) would have concerned her and caused her further enquiry regarding the heart rate;
iii. labour not induced as requested by her;
iv. the lack of information about her son's life threatening condition from the time of his birth;
v. The lack of clarity she has since received upon her own enquiry of the hospital;
vi. The failure of the hospital to report this death at the time, thereby delaying the commencement of the investigation by some 2 years with potentially a lost opportunity for a forensic examination;

160. Ms B's concerns have been borne out in this coronial investigation.

161. At the conclusion of this investigation I am left with the impression of highly skilled, professional, and caring clinicians who were galvanised and committed to providing the care and treatment they could best offer to Baby C at the time of his birth.

162. One of the lead clinicians was attending to Baby C essentially whilst ‘off-duty’ that day. The (18) hours and (17) minutes of Baby C’s short life were marked by intensive medical intervention. A hiatus in Baby C’s decline provided an impression that his condition was stabilising. That was not the case and when realized by the treating team, a series of delays to call in and deploy the neonate emergency retrieval team thwarted any opportunity for baby C’s survival. I am also in no doubt that baby C’s treating team of specialist clinicians and medical staff were shocked and deeply affected by his untimely death in these circumstances.

163. I extend my thanks to the Cairns Hospital and Hinterland Health Service and to the Townsville Hospital (now the Townsville University Hospital) and Health Service for their co-operation with the coronial investigation, and to each of the experts who have provided invaluable assistance by way of their considered opinion.

The family

164. I acknowledge with all sincerity the advocacy of baby C’s mother who has persisted, and insisted, over many years that she be provided answers that are supported by the most accurate information available, regarding the circumstances of her son’s death.

165. I thank Ms B for her dignified engagement with our office over many years, all the while grieving her child. All at the Office of Northern Coroner provide every best wish for her continued healing.

166. I extend my deepest condolences to Baby C’s parents Ms B and Mr B, and siblings for their tragic loss.

167. I close the investigation.

Nerida Wilson
Northern Coroner
CORONERS COURT OF QUEENSLAND
26 August 2020