IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

COR 2022 002108

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 63(2)

*Section 67 of the **Coroners Act 2008***

Findings of:	Coroner Dimitra Dubrow
Deceased:	Jordan Thomas Alexander McDonald
Date of birth:	18 April 2022
Date of death:	19 April 2022
Cause of death:	1a: complications of extreme prematurity in the setting of precipitant premature breech labour and a circumvallate placental membrane insertion
Place of death:	Epworth Hospital Geelong
Keywords:	Neonatal death, extreme prematurity, medication error, morphine

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INTRODUCTION AND THE CORONIAL INVESTIGATION

1. On 19 April 2022, Jordan Thomas Alexander McDonald was less than one day old when he died from complications of extreme prematurity following birth at 25 weeks 4 days gestation.

2. Jordan is the much-loved baby of Nick and Kate.

3. Jordan's death was reported to the coroner as it fell within the definition of a reportable death in the *Coroners Act 2008* (**the Act**). Reportable deaths include deaths that are unexpected, unnatural or violent or result from accident or injury.

4. The role of a coroner is to independently investigate reportable deaths to establish, if possible, identity, medical cause of death, and surrounding circumstances. Surrounding circumstances are limited to events which are sufficiently proximate and causally related to the death. The purpose of a coronial investigation is to establish the facts, not to cast blame or determine criminal or civil liability.

5. Under the Act, coroners also have the important functions of helping to prevent deaths and promoting public health and safety and the administration of justice through the making of comments or recommendations in appropriate cases about any matter connected to the death under investigation.

6. I took carriage of this matter upon my appointment to the Court in September 2024 for the purposes of finalising the investigation and making the required findings.

7. The Court was assisted by the Coroners Prevention Unit (**CPU**) in the review of medical records, statements, and other materials provided by the health services involved in Jordan's care.

8. The CPU was established in 2008 to strengthen the coroners' prevention role and assist in formulating recommendations following a death. The CPU is comprised of health professionals and personnel with experience in a range of areas including medicine, nursing, mental health, public health, family violence and other generalist non-clinical matters. The unit may review the medical care and treatment in cases referred by the coroner, as well as assist with research related to public health and safety.

9. The Court was also assisted by an expert opinion report from neonatologist, Dr Philip Henschke as well as the related submissions and statements from the health service providers.

10. This finding draws on the totality of the coronial investigation into the death of Jordan Thomas Alexander McDonald. Whilst I have reviewed all the material, I will only refer to that which is directly relevant to my findings or necessary for narrative clarity. In the coronial jurisdiction, facts must be established on the balance of probabilities.[1]

MATTERS IN RELATION TO WHICH A FINDING MUST, IF POSSIBLE, BE MADE

Circumstances in which the death occurred

11. On 13 April 2022, Kate attended a routine appointment with her obstetrician. There were no issues at this appointment, and Kate did not have any problems relating to her pregnancy before 18 April 2022.

12. On 18 April 2022, Kate called Frances Perry House, the hospital where she was to give birth, to seek advice about feeling pressure and a vaginal mass over the last 24 hours. Kate was advised to present to the closest Emergency Department (**ED**) for assessment.

13. Kate phoned ahead to the Epworth Hospital Geelong ED to relay the advice from Frances Perry House and that they would arrive in about 30 minutes.

Delivery in ED

14. At 18:53pm, 18 April 2022, Kate and Nick arrived at Epworth Hospital Geelong ED. Kate was triaged as Australasian Triage Scale category two and was taken into a resuscitation cubicle.

15. At about 7pm, the triage nurse escalated a request to the maternity ward for an urgent midwifery review.

16. At 7:01pm, Kate was reviewed by an ED Doctor.

17. The midwifery review noted palpable contractions, and the midwife immediately notified the on-call obstetrician of the impending delivery of Jordan.

18. At 7:25pm, an ED staff member notified the Paediatric Infant Perinatal Emergency Retrieval (**PIPER**) service, who were immediately dispatched and *en route* by 7:49pm.

[1] Subject to the principles enunciated in Briginshaw v Briginshaw (1938) 60 CLR 336. The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about, individuals unless the evidence provides a comfortable level of satisfaction as to those matters taking into account the consequences of such findings or comments.

19. At 7:29pm, an obstetrician conducted a vaginal examination which found that the vaginal mass was the amniotic sac and that Jordan's delivery was imminent.

20. The decision was made to deliver in the ED as there was insufficient time to transfer to the birth suite. Within 10 minutes of this decision, the treating team present included the following:
    - An obstetrician
    - Two paediatricians
    - A midwife
    - A registered nurse from the Special Care Nursery
    - An ED doctor
    - Three ED registered nursing staff

21. At 7:38pm, antenatal steroids were administered. The hospital stated that this is a routine measure in preterm delivery to assist premature lung function.

22. At 7:56pm, it was noted that Jordan was presenting in breech position.

23. At 7:58pm, Kate was instructed to push during contractions.

24. At 8:03pm, Jordan was born *en caul* (still in the amniotic sac) and the placenta was delivered immediately afterwards.

25. Jordan was initially placed on Kate's chest before being moved to a resuscitation cot.

26. Jordan's appearance was described as bruised with no site of bleeding from his body or umbilicus. Jordan was not vigorously crying and had APGAR scores of 3 and 5.

27. The APGAR score standardises the way healthcare professionals evaluate a baby's physical wellbeing at birth and how well each baby makes the physical transition from the womb into the outside world. The score uses five physical signs and is scored when the baby is 1 minute old and again when they are 5 minutes old. It ranges from 0 to 10, with a lower score indicating poorer outcomes. The maximum score is usually 9, since almost all newborns lose 1 point for blue hands and feet, a normal appearance after birth. The hospital stated that a score above 7 is considered normal.

Initial Neonatal Resuscitation

28. At 8:05pm, Jordan was moved to the *resuscitaire*, a standalone device to administer neonatal life support, and administered positive pressure ventilation. Spontaneous respirations were noted and Jordan's parents recalled hearing staff saying words to the effect of: *"he is doing well"*, *"can you hear him crying?"*, *"he is breathing, his heart rate is great, and he is a happy boy"*.

29. The hospital summarised the initial resuscitation as follows:

> From the time of birth, Jordan required active and ongoing support. This particularly related to respiratory support (breathing). Although there was some spontaneous respiratory effort, prolonged and effective spontaneous breathing was never achieved. Jordan required respiratory support in the form of ventilation and supplemental oxygen. This point notwithstanding, the view of the clinical team was that (until the umbilical line was inserted) Jordan's trajectory was about average for a 25-week neonate. There was reasonable confidence that he would be stabilised for transfer to Melbourne.

30. At just under 3 minutes of life, the oxygen was increased to 70% and Jordan had a heart rate of 153bpm.

31. Oxygen concentration in air is about 21% (**FiO_2** 0.21 or 21%). Oxygen can be administered at increased concentrations to up to 100% oxygen to help increase the amount of oxygen that can be transferred and used by the body.

32. At 3 minutes 10 seconds of life, the oxygen was increased to 100% concentration, and Jordan had occasional gasps and had oxygen saturations (**SpO_2**) of 47%.

33. The Royal Children's Hospital clinical guidelines document a standardised oxygen saturation target range of 91-95%.[2] Oxygen saturations can normally take ten minutes after birth to reach >80% as the neonate transitions from circulation inside the womb to outside the womb.[3]

34. By 4 minutes of life, Jordan's oxygen saturations increased to 89%, and by 5 minutes of life, 96% with a heart rate of 163bpm.

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[2] <https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Oxygen_Saturation_SpO2_Level_Targeting_Premature_Neonates/>

[3] UpToDate, Neonatal target oxygen levels for preterm infants. <https://www.uptodate.com/contents/neonatal-target-oxygen-levels-for-preterm-infants>

35. At 6 minutes 20 seconds of life, a trial of continuous positive airway pressure (**CPAP**) was commenced.

36. At about 7 minutes of life, oxygen saturations were 96%. It was also decided to intubate Jordan.

37. At 8 minutes of life, Jordan was opening his eyes and breathing spontaneously.

38. At 10 minutes of life, Jordan's heart rate was 190bpm and oxygen saturations 96%.

39. At 12 minutes of life, intubation was attempted. The first attempt was unsuccessful, and a second attempt at 13 minutes of life was initially successful. However, the endotracheal tube was removed three minutes later as it was unclear whether it was in the correct position.

40. At 16 minutes of life, Jordan's heart rate was 131bpm and oxygen saturations 99%.

41. At 17 minutes of life, Jordan was successfully intubated with documented good air entry and good rise and fall of the chest. Jordan was ventilated using manual ventilation with a Neopuff device. His heart rate was 183bpm and saturations 100%.

42. At 20 minutes of life, the oxygen was turned down to 80%. Jordan maintained his oxygen saturations, and over the next five minutes, the oxygen concentration was reduced to 30%.

43. At 29 minutes of life, *surfactant* was given. Surfactant deceases the surface tension in alveoli, the tiny air sacs at the end of branches in the lungs, so that they can inflate. Because alveoli are so small, without surfactant, surface tension causes alveoli to collapse in on themselves. The lungs of very premature babies do not yet make their own surfactant and so treatment of premature infants routinely includes administration of surfactant.

44. Jordan's oxygen requirements then increased, and by 35 minutes of life, Jordan had oxygen saturations of 90% in 50% oxygen, a heart rate of 158bpm, and a normal temperature.

45. At about 9:10pm, around 1 hour of life, a chest xray was performed, and the PIPER team arrived.

46. At 9:15pm, there was an unsuccessful attempt at inserting an intravenous cannula.

47. At 9:30pm, Jordan had oxygen saturations of 100% in 40% oxygen and a heart rate of 188bpm.

48. Around this time, Jordan was transferred to the PIPER ventilator in preparation for transport. The ventilator settings were set at a peak inspiratory pressure (**PIP**) of 23cmH_2O, positive end expiratory pressure (**PEEP**) of 6cmH_2O, and tidal volume of 6.7mL.

49. At 9:53pm, an umbilical line was inserted. Jordan had saturations of 92% and heart rate of 188 bpm.

50. At 9:56pm, Jordan's oxygen saturations were 86% and the oxygen concentration was increased to 60%, and PIP was set at 17cmH_2O.

51. At 10pm, a blood gas was taken and returned the following results:

Component	**Value**
pH	7.199
pCO_2	40.mmHg
HCO_3^-	15.8mmol/L
pO_2	24mmHg
Lactate	9.2mmol/L
Base excess	-12mmol/L

52. This was interpreted as a metabolic acidosis, excess of acid in the body. This was later interpreted by Dr Henschke as showing that the carbon dioxide level indicated that ventilation was adequate, and the metabolic acidosis was likely from inadequate tissue perfusion and oxygenation.

53. Jordan was administered 10mL of fluids as fluid resuscitation (approximately 10mL/kg).

54. At 10:08pm, Jordan's oxygen saturations were 88% in 75% oxygen.

55. At 10:12pm, an umbilical arterial line was inserted.

56. At 10:19pm, Jordan's oxygen saturations were 91% in 80% oxygen.

Administration of Supratherapeutic Morphine Dose

57. From 9:56pm, there was a clear increasing oxygen requirement to maintain adequate oxygen saturations.

58. At 10:26pm, a morphine bolus was administered. The hospital explained that this was part of the troubleshooting process to improve ventilation. The hospital went on to state that

administration of morphine is *"one of several measures employed to attempt to improve ventilation by relaxing Jordan and reducing asynchronous ventilation (Jordan breathing out of time with the ventilator)"*.

59. Jordan was verbally prescribed an order for a morphine dose of 100mcg/kg. At the time, Jordan's estimated weight was 700g which equated to a dose of 70 micrograms (mcg), or 0.7 milligrams (mg).

60. The PIPER fellow had prepared a drug calculation worksheet (called a NeoCalc worksheet) using an estimated weight prior to departing for Epworth. However, the PIPER fellow was scrubbed, and the calculation sheet was in a folder and unknown to the PIPER nurse drawing up the medication.

61. Instead, the dose was mentally calculated and prepared by a PIPER nurse and checked by an emergency nurse who was scribing the resuscitation.

62. 1millilitre (mL) from a morphine vial of concentration 10mg/mL was diluted to a total volume of 10mL with normal saline resulting in a concentration of 1mg/mL, or 1000mcg/mL.

63. The PIPER nurse then drew up 0.7mL of this solution into a 1mL syringe. This was erroneously calculated to be 70mcg (0.07mL) when in fact this equates to 700mcg, a 10-fold error from the prescribed dose.

64. The PIPER nurse realised that the 0.7mL did not look right and subsequently checked the dose on a calculator and on a Neocalc worksheet.[4] The PIPER nurse then realised the error and told the PIPER fellow, who confirmed by independently calculating the dose.

65. It is unknown exactly when the error was known to the wider treating team. However, subsequent documentation suggests that it was known, or at least suspected, within 15 minutes.

66. A retrospective note in the medical record made on the evening of 21 April 2022 commented the following about the impact of the morphine dose error on Jordan:

> [the error was] not felt to have immediate effect on baby as oxygenation issues prior to morphine (reason for morphine administration), baby intubated already. Baby already hypotensive (MAP 22) with plan for dobutamine (being prepared).

[4] <http://www.neocalc.org/>

> Baby continued to have ongoing oxygenation issues despite trouble shooting. Remained intermittently alert with eyes open and still had intermittent spontaneous movements (unchanged from before morphine).

67. In a subsequent statement, PIPER stated the following:

> The main side effects associated with morphine include respiratory depression and hypotension. As Jordan was already intubated and ventilated, the risk of respiratory depression was mitigated.

68. The factors contributing to the morphine dose error and its impact on the outcome were the subject of investigation and are discussed further later in this Finding.

Ongoing Resuscitation

69. At 10:27pm, one minute after administration of morphine, Jordan's heart rate was 180bpm and his oxygen saturation was 93% in 80% oxygen.

70. At 10:32pm, clinicians were preparing for an xray.

71. At 10:35pm, Jordan's oxygen saturations had deceased, and he was transferred from the PIPER ventilator back to the Neopuff. This improved saturations and at 10:36pm, they were 84% in 100% oxygen.

72. At 10:40pm, Jordan was administered a further 10mL fluid bolus for blood pressure support following identification of the erroneous supratherapeutic (excessive) morphine administration. The lungs were *transilluminated*, placing a bright light against the chest, which did not show *pneumothorax*, collapsed lung. The PIP was increased to 25cmH_2O, and oxygen saturations were 70% in 100% oxygen.

73. At 10:50pm, Jordan's blood pressure was recoded as 32/12mmHg, heart rate 156bpm, and oxygen saturations 60% in 100% oxygen. A blood gas showed continuing metabolic acidosis and increased pCO_2.

74. The blood gas results were helpfully summarised by the hospital in a subsequent statement.

Component	10:00pm	10:50pm	11:28pm	12:30am	1:55am	Reference range[5]
pH	7.199	7.31	7.02	6.9	7.07	7.35 – 7.45
pCO_2	40	67.7	61	59.4	48.3	35 – 45mmHg
HCO_3^-	15.8	17.9	15.7	14.3	14	22 – 32mmol/L
Base excess	-12	-13	-15	-17	-16	-5 – 5
Lactate	9.2	7.7	-	11.1	10.65	<3.3mmol/L
Glucose	3.6	3.2	2.7	6	-	-[6]

75. Between 11:06 and 11:13pm, Jordan was commenced on maintenance fluids and received intravenous broad-spectrum antibiotics. His blood pressure was 40/25mmHg.

76. At 11:28pm, Jordan was documented to have commenced a dobutamine infusion at a rate of 20mcg/kg/min. Dobutamine is a medication used to increase blood pressure.

77. At 11:35pm, Jordan's saturations were 60% in 100% oxygen and blood pressure was 44/25mmHg.

78. At 11:46pm, Jordan's blood pressure was 39/22mmHg.

79. At 11:51pm, *naloxone*, morphine reversal agent, was administered. This was documented in the medical record as being administered on the advice of the Director of PIPER after the team called for further advice about ongoing management because of Jordan's significant ongoing clinical instability.

80. PIPER stated that naloxone was not immediately administered because the treating team considered that the major side effects of morphine had been mitigated. Further:

> Although Jordan's severe clinical instability and blood gas abnormalities preceded the administration of morphine, naloxone was administered for the sake of completeness to account for the unlikely scenario in which the morphine overdose had materially perpetuated Jordan's deterioration.

[5] The reference ranges are not definitive and should be understood in the context that they generally vary between local pathology sites and that slightly different ranges were provided by the various health services.

[6] In neonates, there is a lack of consensus on what constitutes normal glucose level. However, there is consensus that a glucose level <2.6mmol/L warrants immediate intervention. See Hypoglyaemia Clinic Practice Guideline from Royal Children's Hospital Melbourne.

81. Jordan's heart rate fell to 48bpm and he was commenced back on the Neopuff device. His heart rate *"quickly recovered after a few seconds to 170bpm"*.

82. At 11:52pm, Jordan was transferred back to the PIPER ventilator.

83. At 12:25am, clinicians were preparing transfer Jordan into the PIPER cot. Jordan's rate dropped to 70bpm and the transfer was abandoned. His heart rate recovered to 170bpm but his oxygen saturations were 40% in 100%.

84. At 12:30am, a blood transfusion was commenced and administered over thirty minutes. The hospital stated that this was to address the possibility of blood loss related to placental abruption, a possible cause of the premature labour.

85. Jordan remained unsettled with cardiorespiratory instability with any handling. At this point, it became clear to the treating team that Jordan's critical condition had not improved even after the provision of full neonatal resuscitation and intensive care. It was very unlikely that he would survive the transfer to Melbourne.

86. The treating team formed the view that further intensive care was not in Jordan's best interests and at 1:30am, recommended to Jordan's parents that his care be redirected to comfort care.

87. There was extensive discussion between the neonatologists and Jordan's parents, and resuscitation and treatment continued during this time.

88. At 3:30am, active interventions were ceased to allow Jordan and his parents to be together. Monitoring also ceased at this time.

89. At 4:26am, Jordan and his parents were transferred to the maternity ward.

90. At 4:52am, Jordan passed away in the company of his parents and brother.

Identity of the deceased

91. Jordan's mother completed a statement of identification confirming the identity of Jordan Thomas Alexander McDonald, born 18 April 2022.

92. Identity is not in dispute and requires no further investigation.

Medical cause of death

93. On 22 April 2022, Forensic Pathologist Dr Victoria Francis from the Victorian Institute of Forensic Medicine (**VIFM**) conducted an autopsy and provided a written report of the findings.

94. The report incorporated examination of the placenta by a consultant anatomical pathologist from the Royal Women's Hospital and postmortem radiology findings of a consultant paediatric radiologist from the Royal Children's Hospital.

95. The autopsy revealed a gestationally normal male infant with no obvious congenital abnormality, no evidence of any significant infection, and no evidence other any other acute pathology.

96. The placenta was described as a second trimester singleton placenta with circumvallation of the membranes associated with old and recent marginal haemorrhage. There was no inflammation in the membranes, cord, or villi.

97. Dr Francis commented that circumvallate placental membrane insertion is associated with higher risk of pregnancy complications including placental abruption, premature rupture of membranes, low birth weight, and oligohydramnios (insufficient amniotic fluid).

98. The radiology findings showed no unexpected findings.

99. Toxicological analysis of postmortem blood showed morphine. Dr Francis commented that the medication administration error regarding morphine was noted in the history. However, it was difficult to interpret the contribution this error may have had to the death. Dr Francis recommended that a specialist medical opinion be sought.

100. Antemortem specimens showed no alcohol nor any other common drugs or poisons.

101. Postmortem microbiology, biochemistry, and metabolic testing showed non-specific findings.

102. Dr Francis provided an opinion that the medical cause of death was 1(a) complications of extreme prematurity in the setting of precipitant premature breech labour and a circumvallate placental membrane insertion.

103. I accept Dr Francis' opinion.

FURTHER INVESTIGATIONS

104. There were multiple reviews of this case and discussions with Jordan's parents. Epworth HealthCare and PIPER performed a joint review and produced a report of the findings. The report was submitted to Safer Care Victoria (**SCV**) through the Sentinel Event Program.

105. In Victoria, sentinel events are defined as an *"unexpected and adverse event that occurs infrequently in a health service and results in the death of, or serious physical or psychological injury to, a patient as a result of system and process deficiencies at the health service entity"*.[7]

106. Health services are required to report sentinel events to SCV.[8] This includes completing a Root Cause Analysis (**RCA**) or similar investigation to determine, among other things, what went wrong and how changes can be made to healthcare systems to prevent similar incidents occurring in the future.

107. Medication errors resulting in serious harm or death is a recognised sentinel event category requiring such investigation and reporting to SCV.

108. The Court engaged neonatologist Dr Philip Henschke to comment on the case with specific reference to the effects of the supratherapeutic morphine dose.

109. All parties, including Jordan's parents, were provided with Dr Henschke's report and each provided a response. Jordan's parents also independently raised their concerns with the care provided to Jordan, particularly regarding the morphine dose error, directly to the Court.

Joint Review by Epworth HealthCare and PIPER

110. An RCA was performed by an investigative panel of the following people:

- Director Midwifery/Clinical Services – Epworth Freemasons (lead)
- Director Medical Services/Emergency Physician – Epworth Geelong
- Neonatal Consultant Paediatrician – PIPER
- Medical Director/Neonatal Consultant Paediatrician – Royal Brisbane and Women's Hospital
- Group Director Quality & Clinical Governance – Epworth HealthCare

[7] *Health Services (Quality and Safety) Regulations 2020*, r 3A.
[8] *Health Services (health Service Establishments) Regulations 2024, r 66; Determinations by the Secretary 31 August 2024, 8-10*

- Quality Manager – Royal Children's Hospital
- Quality Coordinator – Epworth Geelong
- Nurse Unit Manager Midwifery – Epworth Freemasons
- Consumer advisor

111. Epworth HealthCare explained that an RCA…

> …is an investigation which employs a specific methodology of examining clinical events. The RCA process is designed to uncover root causes with the aim of introducing controls to prevent similar episodes. The process is particularly designed to identify system issues that can be modified or strengthened. An RCA team has a specific composition of members. This includes people from relevant craft groups and external healthcare participants as well as a consumer or patient representative

112. The RCA made findings and recommendations across the presentation with specific investigation and comment on the morphine drug dose error. The relevant findings are summarised below.

Delay in Initial Clinical Handover

113. The RCA found that the call to the hospital to advise that Kate and Nicholas were arriving was not appropriately recorded. This meant that triage and the broader hospital team was not initially aware of the impending presentation.

114. Nonetheless, the panel concluded that the subsequent notifications to PIPER, maternity, and special care nursery were timely, and the full team were present within 30 minutes of presentation.

115. Recommendations were made to ensure that relevant clinicians are notified of impending presentations to the emergency department.

Morphine Dose Error

116. Appropriately, both PIPER and Epworth HealthCare acknowledged and expressed regret in relation to the morphine dosing error. Epworth HealthCare's response to the Court in relation to the RCA findings included the following statement:

> We are deeply sorry that the morphine overdose occurred and acknowledge that this incident during Jordan's instability, would have been incredibly distressing for his parents and we have actively responded to the need to ensure expertise and safety in this area.

117. In relation to the impact of the dosing error, the review panel concluded that the administration of morphine was unlikely to have contributed to the death and that Jordan had several poor prognostic factors at birth. These included the following:

- Likely intrauterine compromise from placental abruption
- Breech delivery without prior steroid and magnesium sulphate loading
- APGARS 3 and 5
- Visibly bruised with no apparent source of injury
- Poor response to clinical intervention and deterioration with handling

118. The panel noted that Jordan was ventilated at the time of the morphine dosing error, and this would have overridden the respiratory depressive effects of the morphine. Jordan's blood pressure also responded well to fluid bolus.

119. The panel found that the morphine was prepared using standard adult dilution as opposed to neonatal dilution which led to a dilution step being missed.

120. The dose was prepared without reference to the usual visual and electronic tools used to check calculations because the PIPER team members were scrubbed.

121. The panel found there was a missed opportunity to involve a special care nursery nurse who would have been familiar with neonatal preparation and dilution procedures.

122. A recommendation was made for PIPER to develop a Medication Management Procedure to specially address the challenges of the retrieval environment.

123. A copy of the final draft policy was provided to the Court. The policy specifically addressed the situation where PIPER team members are scrubbed for a sterile procedure.

Expert Opinion Report

124. Dr Henschke outlined some background information about the challenges an extremely premature baby faces in the newborn period before turning to the specific question of the contribution of the supratherapeutic morphine administration to the death and the overall clinical care and management provided to Jordan.

Challenges of Extreme Prematurity

125. Dr Henschke noted that there was not an opportunity for Kate to receive appropriately timed antenatal steroids and that Jordan was not able to be delivered in a tertiary referral maternity hospital. These are two key factors which significantly influenced the chance of survival.

126. Dr Henschke explained that antenatal steroids accelerate lung maturity and likely reduce the severity of any lung disease. At 25 weeks gestation, the fetal lung is structurally and biochemically very immature which significantly compromises gas exchange and the mechanics of breathing.

127. Dr Henschke explained that babies can initially appear to be doing reasonably well, as was Jordan. However, in Dr Henschke's experience, this is not predictive of how well a baby will respond to the continuing support they will require.

128. Further, lung vessels may initially respond well but then constrict down again under conditions of stress, *"creating a scenario where the newborn baby is initially seemingly doing well, but then unexpectedly becomes unstable and achieving adequate oxygenation then becomes extremely difficult. This condition is known as persistent pulmonary hypertension of the newborn or PPHN"*.

129. Antenatal steroids also have a significant impact on cardiovascular stability in the newborn period. This is crucial in the context of a newborn baby's circulation transitioning from inside to outside the womb.

130. Dr Henschke explained that cardiovascular instability can similarly give an appearance that a baby may be coping, however, *"in reality, they are balanced on a* 'knife edge' *and with any further minor deteriorations in heart function the baby can appear to suddenly and unexpectedly collapse"*.

131. Dr Henschke went on to state that with access to *"all the monitoring available in a neonatal intensive care unit* [**NICU**]*...it is possible to detect early warning signs that the baby's clinical situation is precarious and pre-emptively institute treatment strategies that can head off impending disaster"*. Outside the NICU, *"it is very difficult to detect the early warning signs that the baby's circulation is deteriorating"*.

132. Dr Henschke used NIC-PREDICT to assist in explaining these challenges of extreme prematurity.[9] NIC-PREDICT is a digital tool is used by clinicians to help predict likely outcomes for extremely premature infants. The data is based on an Australian population cohort of over 2000 livebirths at 23 to 27 weeks gestation between 2009 and 2017.

133. This tool *"indicates that a male infant, delivered outside of a tertiary referral maternity hospital*[10] *at 25 weeks gestation, without adequate antenatal steroid cover has a 45 percent risk of death within the first year of life. In contrast, if this same infant were delivered in a tertiary referral maternity hospital with adequate antenatal steroid cover, the estimated risk of death is dramatically reduced to 19 percent"*.

134. I note that when rounded up to 26 weeks gestation, risk of death within the first year in a non-tertiary centre without antenatal steroids decreases to 31 percent.

Supratherapeutic Morphine Administration

135. Dr Henschke explained that the primary mechanism of death from morphine is opioid-induced respiratory depression.

136. Other effects of morphine overdose can include pulmonary oedema, fluid in the lungs. However, it is unclear whether this is a direct result of morphine or an indirect result that follows from morphine induced respiratory depression.

137. Morphine also causes dilation of the blood vessels. In premature babies, there is some evidence that there is a small but statistically significant fall in blood pressure following administration of morphine.

138. However, another study found that morphine had no effect on blood pressure in premature babies. Dr Henschke stated that he was unable to find any publications which specifically report on morphine overdose in very premature babies and so was unable *"to determine with absolute certainty that morphine does not cause unwanted cardiovascular effects in an overdose situation"*.

[9] Available at <http://www.nic-predict.com.au/>

[10] The NIC-PREDICT website refers to a tertiary perinatal centre with a co-located NICU which in Victoria currently includes the Royal Women's Hospital, the Mercy Hospital for Women (Heidelberg), Monash Children's Hospital and the Joan Kirner Women's and Children's Hospital.

139. Nonetheless, Dr Henschke went on to state that in the absence of evidence for significant adverse cardiovascular effects in overdose in adults, he considered that this is an unlikely side effect.

140. In Jordan's case, Dr Henschke noted that Jordan's oxygen requirement was starting to escalate well before the morphine was given. Further, the primary reason for administering morphine appeared to be because Jordan had become increasingly unstable and not tolerating handling.

141. Dr Henschke provided an opinion as follows:

> All these observations are consistent with a deteriorating circulation status…whilst Jordan did experience increasing difficulties with oxygenation around the time of the morphine administration, this deterioration was in process prior to the morphine, rather than being directly triggered by the morphine. Further, it appears that a more dramatic change in Jordan's status did not occur until approximately 25 minutes after the bolus dose of morphine.

142. Dr Henschke noted that Jordan's blood pressure was abnormal after morphine was administered. However, this was the first time his blood pressure was recorded, and based on the other clinical findings, considered that *"this low blood pressure was a consequence of pathologies already in effect rather than a new finding caused by the administration of an excessive dose of morphine"*.

143. Dr Henschke also opined that because Jordan was receiving full ventilation support at the time, the "*life-threatening complication*" of respiratory depression caused by the morphine was *"cancelled out"*. Further, as a very premature infant, Jordan would not have had the capability to drive his own ventilation so this side effect would not have altered an already absent respiratory drive.

144. Because of the ventilatory support provided, Dr Henschke considered that the concentration of morphine in the toxicology report *"in itself does not provide evidence to suggest that the excessive morphine dose Jordan received was a likely contributor to his death"*.

145. Dr Henschke provided the following conclusion about the supratherapeutic morphine dose:

> …the sequence of events ultimately leading to Jordan's death were already in process prior to the administration of morphine, and the processes that contributed to Jordan's escalating deterioration were not altered or accelerated by this drug dosing error.

> For these reasons, I am confident in saying Jordan did not die because he received an excessive dose of morphine. If the excessive dose of morphine had not occurred, without significant changes in the circumstances of Jordan's delivery and a different approach to clinical management, the outcome would have been no better.

Analysis of the care provided to Jordan

146. Dr Henschke emphasised throughout the report that retrospective analysis should be used with caution when examining the care provided. He stated that *"what may be evidence on retrospective review is often very difficult to discern in real time, particularly in circumstances where all the resources of a neonatal intensive care unit are not available to the managing clinicians"*.

147. Dr Henschke further emphasised that Jordan was at a significant disadvantage because it was not possible for delivery in a specialist maternity centre nor administration of a full course of appropriately timed antenatal steroids.

148. Dr Henschke stated the following:

> What is notable about the evidence presented to me is that I consider that following Jordan's delivery, the lung disease associated with being born extremely premature would have been survivable under different circumstances.
>
> Jordan's chest Xray was described as being reasonably good with appropriate expansion of his lungs and no obvious consolidation. Jordan had a good initial response to ventilation and administration of surfactant.
>
> Despite all the problems experienced with achieving oxygenation, the blood gases indicated that acceptable CO_2 exchange was achievable. When his ventilation parameters were escalated in response to oxygenation issues, these strategies had minimal effect on improving his condition.
>
> These observations do not indicate that Jordan's primary problem was severe lung disease.

149. Instead, Dr Henschke considered that circulatory compromise was the main driver of Jordan's deterioration and death.

150. Dr Henschke noted that Jordan was commenced on a dobutamine infusion and given a blood transfusion in response to recognition that his circulation needed escalating support. Although

there was some improvement in his recorded blood pressure, his metabolic acidosis was persisting.

151. Dr Henschke explained that persisting metabolic acidosis compromises the response to medications and other circulatory responses to stress. At some point, *"an extremely premature infant's body crosses a threshold where it is no longer possible to recover the situation irrespective of any treatments offered"*.

152. Dr Henschke provided the following opinion about the care provided to Jordan:

> In summary, in my opinion the evidence presented to me indicates that following Jordan's delivery, he was unable to adequately respond with the circulatory changes required to successfully transition from a fetal circulation to a newborn circulation. Whilst Jordan was able to maintain some stability in the initial hours after his birth, in the absence of early aggressive interventions to adequately stabilise his cardiovascular status, he progressively deteriorated until he reached a tipping point where the limited compensating mechanisms available to an extremely premature infant completely failed, triggering a rapid collapse that was witnessed in association with the handling that occurred when he had Xrays taken following insertion of his umbilical lines.
>
> In retrospect, in part due to limited monitoring that was available at the time, in my opinion Jordan's precarious state was not fully appreciated, and responses were both somewhat delayed and not aggressive enough to recover Jordan to a point where he could have tolerated transfer to a neonatal intensive care unit. The primary focus appeared to be on adjusting his ventilation in response to poor oxygenation.
>
> This is not intended as a criticism of Jordan's management. As previously stated, I have the advantage being able to analyse the evidence in a non-time critical manner. Appreciating such subtleties can be extremely challenging when faced with a rapidly deteriorating patient who does not respond to what would be considered to be normal clinical practices.

153. Dr Henschke highlighted the persisting tachycardia, elevated heart rate, as an indicator of potential cardiovascular compromise. There was a missed opportunity to recognise the need for more aggressive fluid resuscitation earlier.

154. Dr Henschke stated that:

> the PIPER team may not have fully appreciated the significance of the persisting tachycardia, and may have been falsely reassured by some of the other clinical findings.

> This in turn appears to have impacted to some degree on the team's approach to Jordan's management, particularly with respect to their initial response to Jordan's escalating instability being primarily focused on ventilation strategies. These interventions had very limited impact.

Was Jordan's death preventable?

155. Dr Henschke stated that with any 25-week gestation infant born outside a tertiary centre it is not possible to claim with any level of certainty that death is preventable. This is more difficult in the circumstances repeatedly highlighted by Dr Henschke being the inability to have appropriate antenatal steroid cover and the inability for delivery in a tertiary centre.

156. Further, Dr Henschke also noted the substantial risk of other complications of extreme prematurity even if an infant survives the first day. Instead, Dr Henschke thought a more appropriate question would be *"would it have been possible to safely transfer Jordan to a tertiary referral neonatal intensive care unit for ongoing care if he had received different management?"*

157. On this question, Dr Henschke stated the following:

> It is my opinion that Jordan responded well to initial stabilisation, but was in need of more aggressive cardiovascular support from very early on as evidenced by his persisting tachycardia and persisting lactic acidosis which ultimately impacted on his ability to tolerate handling and achieve adequate oxygenation with ventilation support. Because of initial difficulties in establishing vascular access, it was not possible to respond to his compromised cardiovascular status in the first hour of life and there was further delays in establishing vascular access because of the need to insert umbilical lines.
>
> Once vascular access was established, I consider that it would have still been possible to improve Jordan's cardiovascular status with earlier and more aggressive fluid loading and with earlier and more aggressive approach to use of inotropic agents, such that a safe transfer to a NICU could have been achieved.

158. Dr Henschke concluded that, in his opinion, *"with earlier and more aggressive cardiovascular support, it is possible that Jordan would have remained sufficiently stable to achieve transport and would have had some chance of surviving to discharge to home"*.

159. However, immediately prior to this conclusion, Dr Henschke reiterated that *"[w]ithout the full resources that a neonatal intensive care unit can offer, appreciating the more subtle signs that a newborn extremely premature infant is not coping can be challenging"*.

Review of Joint Review Report

160. Dr Henschke was also provided with and asked to comment on the joint review report. Overall, Dr Henschke mostly agreed with the findings and recommendations.

161. Dr Henschke disagreed with the finding that there was likely intrauterine compromise from placental abruption. Dr Henschke considered that the postmortem examination of the placenta did not suggest that there was abruption.

162. Further, Jordan's initial response to ventilation at delivery was not in keeping with an infant significantly compromised by placental abruption.

163. Dr Henschke also clarified that Jordan responded well to initial stabilisation and resuscitation. At the time of PIPER's arrival, he was saturating well in 40% oxygen. The reference to the finding that Jordan responded poorly to clinical intervention and handling should be confined to the second hour of life onwards.

Response from Epworth

164. Epworth HealthCare provided additional context to the medical record to address some of the issues raised in Dr Henschke's report, acknowledging the difficulties in capturing fully the complexities of the case in the medical record. The treating paediatrician and neonatologist also reviewed the report as part of the response.

165. The paediatrician advised that tachycardia was identified prior to PIPER arrival and discussed with the onsite PIPER neonatologist. However, *"until intravenous access was achieved, the initiation of cardiovascular support with saline bolus was unable to be provided. As soon as access was achieved the saline was administered"*

166. On the apparent delay in obtaining vascular access, the paediatrician noted that a cannula had not been attempted because of the initial competing priority of respiratory stabilisation and administration of surfactant. The plan was to proceed straight to umbilical vein cannulation, however, PIPER arrived prior to this. The PIPER team then attempted peripheral cannulation before proceeding to the umbilical vein cannulation.

Response from PIPER

167. Firstly, PIPER acknowledged the morphine drug dose error and expressed *"sincere regret for the distress, frustration and confusion this drug dose error has caused Kate and Nicholas"*.

168. Secondly, PIPER explained that there is significant variability in outcomes for premature neonates even if the same management is provided.

169. Thirdly, PIPER considered that the treatments initiated would be regarded by most neonatologists as *"aggressive"* management. Further, many neonatologists were involved in the review of Jordan's case, including a senior independent neonatologist who sat on the RCA panel, none of whom identified any concerns with the care provided. Specifically, *"there was no view expressed that a more aggressive approach would have resulted in Jordan being sufficiently stable to tolerate transfer to a NICU"*.

170. Finally, PIPER provided a set of many factors that may have contributed to Jordan's intermittently elevated heart rate. These were all *"appropriately addressed by the treating team in keeping with the expected standard of care"*.

Response from Jordan's parents

171. Jordan's parents remained concerned about the morphine overdose and it having a significant impact on Jordan's condition. Jordan's parents drew attention to the apparent inconsistency of describing the dosing error as life-threatening when it was found to not have contributed to death.

172. Such an error is life-threating, and an overdose of this magnitude would cause death through respiratory depression. However, the evidence was that, as Jordan was being mechanically ventilated, he was shielded from the effects of the morphine in relation to respiration. An alternative description could be formulated as *"life-threatening if not treated or managed"*.

173. Jordan's parents also referred to the toxicology notes attached to the toxicology report and pointed out that the level of morphine in Jordan's blood was in the same range as deaths attributed to morphine overdose.

174. Dr Henschke's explained that these deaths were presumably overdoses outside of the hospital where mechanical ventilation was not administered.

175. Finally, Jordan's parents provided a recent journal article which reported an increased risk of death from morphine infusions administered to intubated premature babies.

176. Jordan's parents wrote:

> Regardless of Jordan being intubated or not at the time, this overdose should not have occurred. This is an inexcusable error, and the fact that a pre calculated visual resource was available and not used is deeply concerning and a source of great distress to us.

Further Opinion of Dr Henschke

177. All responses were provided to Dr Henschke. Dr Henschke provided an additional statement addressing the response from Jordan's parents with specific analysis of the provided journal article.

Further Morphine Discussion

178. Dr Henschke stated the following from the outset about morphine and analgesia in neonates:

> Use of analgesia is considered to be an important, if not an essential part of the care of infants receiving ventilation support. There is now considerable evidence to suggest that pain and stress have lifelong adverse effects on the developing brain. Clinicians feel a strong responsibility to wherever possible minimize the impacts of both pain and stress in newborns receiving ventilator care.
>
> Additionally, experienced Neonatologists recognize that when a patient is experiencing pain or stress as a consequence of being ventilated in the newborn period, this can impact on the effectiveness of ventilation, particularly in circumstances where the patient is unstable, tolerating handling poorly and having significant difficulties with oxygenation.

179. Dr Henschke outlined a number of concerns in relation to the methodology, applicability and conclusions of the journal article provided and his opinion remained unchanged as to the contribution of the supratherapeutic morphine dose on the death.

Conclusions in relation to Care

180. Dr Henschke reiterated that the lack of the full resources available in a NICU meant that the subtle clinical signs referenced in the original report were difficult to recognise. Dr Henschke clarified that these were neither oversights nor errors and made no criticisms of the care provided by PIPER.

181. Dr Henschke explained that it was only with the full benefit of hindsight that the optimal management strategy could be appreciated and when faced with *"a variety of alternative directions in care, and a need to make time critical choices about management options, it is almost impossible for even the most experienced clinician to always choose the correct management strategy under such circumstances"*

182. Dr Henschke stated that the findings in the original report remained unchanged.

FINDINGS AND CONCLUSION

Pursuant to section 67(1) of the Act I make the following findings:

a) the identity of the deceased was Jordan Thomas Alexander McDonald, born 18 April 2022;

b) the death occurred on 19 April 2022 at Epworth Hospital Geelong, from *complications of extreme prematurity in the setting of precipitant premature breech labour and a circumvallate placental membrane insertion*; and.

c) the death occurred in the circumstances described above.

1. I make the following additional findings:

Finding 1: Morphine dose error

2. I find that Jordan was administered 10 times the prescribed dose of morphine as a result of an error in the calculation and preparation of the morphine bolus. A number of explanations have been provided for the morphine dose error including the time critical context in which the care team was operating in. In its report to the Court, Epworth HealthCare noted the way in which the usual preparatory steps for administering morphine to a neonate could not be followed and that:

> The conditions under which the morphine was being prepared was one of extreme pressure in a very rarely encountered context – a very preterm baby in an emergency department. This error, while understandable, was not inevitable. Both teams are accustomed to working under pressure. This was an uncommon error in the setting of an environment that was extreme.

3. While these factors are acknowledged and accepted, the recognition that the error was *"not inevitable"* is also appropriate. Medication errors in healthcare settings are well recognised as a source of avoidable injury and death and include wrong doses being administered.

4. The RCA review and the Sentinel Event report to SCV correctly recognised that the morphine overdose was a *"critical point in [the] management"* which in *"…an unventilated infant …would have certainly impacted on outcome"*.

5. Given the recommendation for PIPER to develop a Medical Management Procedure addressing preparatory aspects of drug calculation and administration, I do not consider that there is a need for further coronial recommendations to be made in relation to the morphine dose error.

Finding 2: Morphine unlikely causative

6. I find it unlikely that the supratherapeutic dose of morphine caused or contributed to the death.

7. In doing so, I acknowledge the understandable conclusion that the morphine overdose may have contributed to the death and indeed, Epworth HealthCare acknowledged in their correspondence to Jordan's parents that *"it was not possible to absolutely discount that the morphine had a significant impact."* However, after careful review of the evidence including the medical opinions of many neonatologists and the expert opinion of Dr Henschke, I find that the error and deterioration in Jordan's condition were in fact an unfortunate coincidence and unlikely to be causally related. This may explain the inconsistencies between initial discussions with Jordan's parents and subsequent in-depth analysis and review of the case by PIPER.

8. While there was a drop in oxygen saturations in the period following morphine administration, this is explained by the preceding increases in oxygen requirement from 9:56pm. Once the supplement oxygen reached maximum concentration, saturations then began to fall as there was no more room to increase oxygen further to compensate for whatever process was occurring prior to the morphine administration. Further, with adequate ventilation, this drop cannot be explained by the actions of morphine.

9. It remains that the error is still concerning. Nonetheless, I am satisfied that the joint review and associated recommendations have obviated the need for further coronial recommendations or comment.

Finding 3: Death from extreme prematurity

10. Jordan was born extremely premature and there was nothing that anyone could have done to prevent this. Jordan tragically died as a result of complications from extreme prematurity despite the efforts from all involved.

11. I am not comfortably satisfied that the evidence supports the contention that Jordan would have survived had the management been different. I acknowledge that this possibility was couched by Dr Henschke in terms that recognise that even if Jordan had survived the immediate post-natal period, the overall mortality rate of extremely premature newborns is high.

12. Further, while I accept that there was a chance for survival to transfer to a tertiary centre, this assessment was made with the full benefit of hindsight, and it would be unreasonable to expect the optimal treatment when the precise set of clinical interventions which would lead to survival cannot be known at the time. This chance of survival also does not consider the ongoing elevated risk of death once transferred. I am therefore not prepared to find, on the balance of probabilities, that Jordan's death was preventable.

COMMENTS

Pursuant to section 67(3) of the Act I make the following comments on matters connected with the death:

1. The medical evidence, including the data from NIC PREDICT, suggests that Jordan's best chance of survival was if he was delivered in a tertiary maternity hospital with the full suite of equipment of the NICU available to clinicians.

2. This case personifies these data and the known inequities between metropolitan and regional healthcare such as those reflected in the statistics within the NIC PREDICT tool.

I convey my sincere condolences to Jordan's family for their loss.

Pursuant to section 73(1A) of the Act, I order that this finding be published on the Coroners Court of Victoria website in accordance with the rules.

I direct that a copy of this finding be provided to the following:

Nick McDonald and Catherine Gannoni, Senior Next of Kin

Epworth HealthCare

PIPER, the Royal Children's Hospital, c/o Meridian Lawyers

CCOPMM

Safer Care Victoria

Dr Phillip Henschke

Signature:

Coroner Dimitra Dubrow

Date: 13 August 2025

NOTE: Under section 83 of the ***Coroners Act 2008*** ('the Act'), a person with sufficient interest in an investigation may appeal to the Trial Division of the Supreme Court against the findings of a coroner in respect of a death after an investigation. An appeal must be made within 6 months after the day on which the determination is made, unless the Supreme Court grants leave to appeal out of time under section 86 of the Act.