Hutt Valley District Health Board
Radiology Service
Radiologist, Dr B

A Report by the
Deputy Health and Disability Commissioner

(Case 18HDC00279)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

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Executive summary

1. This report concerns the radiology care provided by a radiologist and a radiology service, and the obstetric and paediatric care provided by Hutt Valley DHB (HVDHB) in 2015.

2. A woman was pregnant with mono chorionic, diamniotic twins and required two-weekly ultrasound scans (USS). A sonographer performed a USS at the radiology service. The reporting radiologist reviewed the sonographer's worksheet and images, but his USS report did not note any indication of twin-to-twin transfusion syndrome (TTTS). Following the scan, the radiologist did not undertake any follow-up action.

3. Three days later, at 28 weeks and 3 days' gestation, the woman experienced abdominal pain and was admitted to hospital. She was assessed by an obstetrician who relied on the findings from the radiologist's USS report undertaken three days earlier. The obstetrician planned to transfer the woman to a main centre hospital but became concerned about the fetal heart rate of both twins. The obstetrician performed a USS and noted obvious TTTS, and immediately recommended an urgent C-section.

4. Two obstetricians undertook the C-section at 10pm, and Twin 1 was born at 10.10pm. Twin 1 was floppy with no heartbeat, and required immediate resuscitation. Twin 2 was born at 10.12pm in good condition. At the time of delivery, a paediatric registrar and a senior house officer were present in the theatre, and a paediatric consultant arrived at 10.17pm.

5. The theatre staff had not been advised that two babies were to be delivered, and a small theatre room was used and a second resuscitaire had to be located quickly. Three attempts to intubate Twin 1 were made but there was no improvement in Twin 1's ventilation. During the third attempt using a smaller endotracheal tube (ETT), the paediatric staff noticed that the oxygen cylinder had not been turned on.

6. Once the oxygen tank was turned on, Twin 1's oxygen saturations gradually improved to 81%, but did not rise further to the expected oxygen saturation of 90–100%. The paediatric consultant called a main centre NICU and was advised that an ETT of 2.0mm was too small for a baby of Twin 1's size. The consultant agreed to wait for the Neonatal Retrieval Team to arrive to change the ETT for transport.

7. The NICU team inserted a large ETT, and Twin 1's oxygen saturation improved to 90–100%. Subsequently, Twin 1 was diagnosed with right hemiplegia. The woman was not advised about the equipment issues until her first paediatric appointment.

Findings

8. The Deputy Commissioner considered that the radiologist's report was inadequate, and was critical that he did not undertake any follow-up action after the scan. The Deputy Commissioner found the radiologist in breach of Right 4(1) of the Code.

9. The Deputy Commissioner made adverse comment that the radiology service provided a service carrying out high-risk obstetric scans such as third-trimester monochorionic-diamniotic twin pregnancy ultrasounds, without ensuring that its staff were adequately skilled in reporting on specialist obstetric scans.

10. The Deputy Commissioner was critical that HVDHB did not have in place appropriate policies to ensure the early involvement of a paediatric consultant for an urgent or emergency birth; that the operating theatre was not prepared for the delivery of twins, and initially the oxygen tank on the portable resuscitaire was not turned on; and that a size 2.0mm ETT was stored in the resuscitaire trolley incorrectly and, as a result, used for Twin 1's intubation. The Deputy Commissioner found HVDHB in breach of Right 4(1) of the Code, and made adverse comment about the lack of timely communication to the woman.

11. The Deputy Commissioner criticised the obstetrician's standard of documentation.

Recommendations

12. The Deputy Commissioner recommended that the radiology service report back to HDC about the changes it implemented after this event, and that the radiologist apologise to the woman. In response to the recommendations made in the provisional report, HVDHB provided an apology to the woman and provided HDC with an update on the steps taken to carry out the external reviewer's recommendations.

Complaint and investigation

13. The Health and Disability Commissioner (HDC) received a complaint from Mrs A about the services provided by Hutt Valley District Health Board (HVDHB) to herself and to her twins. Following the assessment of Mrs A's complaint, concerns were also identified about the care provided by Dr B at the radiology service. The following issues were identified for investigation:

- *Whether Hutt Valley District Health Board provided Mrs A, Twin 1, and Twin 2 with an appropriate standard of care between 22–23 Month1[1] 2015.*
- *Whether the radiology service provided Mrs A with an appropriate standard of care on 19 Month1 2015.*
- *Whether Dr B provided Mrs A with an appropriate standard of care on 19 Month1 2015.*

14. This report is the opinion of Rose Wall, Deputy Commissioner, and is made in accordance with the power delegated to her by the Commissioner.

[1] Relevant dates are referred to as Months 1–6 to protect privacy.

15. The parties directly involved in the investigation were:

Mrs A	Complainant/consumer
Hutt Valley DHB	Provider
Dr B	Radiologist
Radiology service	Radiology clinic
Dr C	Obstetrician
Dr D	Obstetrician
Dr E	Paediatrician
Dr F	Paediatrician

16. Also mentioned in this report:

Dr G	Radiologist
Ms H	Sonographer
Dr I	Radiologist
Dr J	Chief Medical Officer of DHB2
Dr K	Paediatrician
Dr L	Paediatric registrar

17. Further information was received from:

DHB2
ACC

18. Independent expert advice was obtained from a radiologist, Dr Robert Sim (Appendix A), an obstetrician, Dr Jenny Westgate (Appendix B), and a paediatrician, Dr David Montgomery (Appendix C).

Information gathered during investigation

Background

19. Mrs A, aged in her twenties at the time of the incident, was pregnant. An ultrasound scan undertaken at Hospital 1 at 8 weeks and 3 days' gestation[2] noted: "A mono chorionic, diamniotic twin[3] intrauterine pregnancy is shown."

20. This opinion concerns the following:

a) The interpretation of Mrs A's final scan on 19 Month1 by Dr B[4] at the radiology service;

[2] Duration of the pregnancy from conception.
[3] Monochorionic-diamniotic (MCDA) twins are identical twins who share a placenta but not an amniotic sac.

b) The obstetric care provided to Mrs A during her labour on 22 Month1; and

c) The paediatric care provided by HVDHB to Mrs A and at the birth of her twins, Twin 1 and Twin 2, on 22 Month1.

Twin pregnancy and associated risk

21. Identical twins are monozygotic; that is, they arise from one fertilised ovum and commonly have a shared placenta with connecting blood vessels between the two fetal circulations. Identical twins are usually monochorionic and diamniotic. These terms refer to the two membranes surrounding a fetus in the womb — the inner membrane around the fetus is called the amnion, and the outer membrane is called the chorion. Twin pregnancies are referred to as either:

a) Dichorionic diamniotic — where each twin has his/her own placenta, chorionic sac, and amniotic sac;

b) Monochorionic diamniotic — where the twins share the placenta and chorionic sac but have their own amniotic sac; or

c) Monoamniotic monochorionic — where the twins share the placenta, chorionic sac, and amniotic sac.

22. Chorionicity is a critical consideration in the management of twin pregnancies, as monochorionic twin pregnancies exhibit the increased complication rates characteristic of non-identical twin pregnancies (such as the risk of preterm birth, and increased maternal risks), and are also at a higher risk of a number of specific monochorionic complications such as twin-to-twin transfusion syndrome (TTTS),[5] which occurs in approximately 15% of monochorionic/diamniotic twin pregnancies.

Radiology care

23. Mrs A booked privately with obstetric specialists Dr C and Dr D[6] as her Lead Maternity Carers (LMCs). The arrangement was that Mrs A would alternate antenatal appointments between Dr D and Dr C, who would provide shared antenatal care.

24. Dr C and Dr D arranged for Mrs A to have ultrasound scans with the private radiology service at 12 weeks', 17 weeks', 20 weeks', 22 weeks', 24 weeks', 26 weeks', and 28 weeks' gestation. According to the radiology reports, none of the scans reported evidence of TTTS.

[4] Dr B is a fellow of the Royal Australian and New Zealand College of Radiologists (RANZCR). He is a general radiologist with subspecialty interests and expertise in MRI, and works in private practice.

[5] Twin-to-twin transfusion syndrome is a rare, serious condition that can occur in pregnancy when identical twins share a placenta. Abnormal blood vessel connections form in the placenta and allow blood to flow unevenly between the babies.

[6] At the time of the incident, Dr D and Dr C were shareholders of a company, and provided private as well as public obstetric care.

Radiology care on 19 Month1

25. On 19 Month1, at 28 weeks' gestation, Mrs A attended the radiology service for her routine ultrasound scan. The sonographer was Ms H, and the scan was reported by Dr B.

26. Dr B told HDC that he is a general radiologist with subspecialty interests and expertise in MRI, and he works in private practice. He said that he "reports pregnancy ultrasound as part of a wider case mix and complexity". He is not a subspecialist obstetric radiologist, and none of his colleagues in the region are recognised as subspecialist obstetric radiologists.

27. A copy of Mrs A's scans were provided to HDC. Ms H performed the scans using two different ultrasound machines, as the views of the first scan "were limited, with limited resolution, detail and visualisation". Ms H told HDC that despite the second attempt with another ultrasound machine, "this did not aid visualisation of Twin A or the membrane".

28. Dr B stated:

> "I reported a pregnancy ultrasound on [Mrs A] on 19 [Month1]. The report was based on my own review of the images on our PACS[7] system in conjunction with written worksheet and comment as provided by the sonographer, [Ms H], who performed the scan at our branch …"

29. A copy of the sonographer's worksheet was provided to HDC. Ms H recorded in the worksheet that the study was "suboptimal due to body habitus[8]", and that the examination status was "incomplete". Under the Twin 1 section of the worksheet, Ms H noted: "[U]nable to obtain an MCA trace[9] in fetus A today due to technical factors." The worksheet also showed that the Twin B MCA Doppler was unable to be measured.

30. The sonographer's notes record:

> "Unable to identify the membrane between [Twin] A & B today. Plenty of fluid[10] seen within the sac[11] but unable to measure Twin A fluid as it was sitting against the uterus wall and therefore can't confidently identify Twin A sac (fluid seen in stomach and bladder). Unable to rule out fluid discrepancy between [Twin] A&B. During the scan while assessing twin B, Twin A turned from trans with head to maternal left into cephalic presentation[12] … There appears to have been a slight drop in growth of Twin

[7] PACS (picture archiving and communication system) provides storage, retrieval, management, distribution, and presentation of medical images.
[8] The physique or body build.
[9] Middle cerebral artery Doppler measurement is an important part of the assessment of fetal cardiovascular distress, fetal anaemia, and fetal hypoxia.
[10] Amniotic fluid.
[11] Amniotic sac.
[12] The baby is positioned head-down, facing the mother's back.

> A, however on reviewing previous imaging the centiles[13] seem to vary quite a lot from scan to scan."

31. Ms H told HDC: "This examination and the limitation were discussed with a radiologist before sending the patient away."

32. Dr B noted in his report dated 19 Month1:

> "…
>
> Findings:
>
> Growth Scan with comparison, most recent [5 Month1]
>
> There is a twin pregnancy (monochorionic/diamniotic), though the membrane between the twins is not clearly seen today …
>
> Overall amniotic fluid volume is normal and is difficult to exclude a liquor discrepancy between the twins as the membrane has been poorly seen.
>
> Conclusion:
>
> Ongoing viable pregnancy. Slight reduction in growth with respect [to Twin A. Assessment is limited] by short imaging intervals. Normal overall amniotic (see above comments) and Doppler."

<u>Further information from Dr B</u>

33. Dr B stated:

> "I agree I did not explicitly state that Twin B MCA Doppler was unable to be measured which is an omission, and I may have assumed that this information would have automatically populated in the body of the report."

34. Dr B's scan report did not note any indication or diagnosis of TTTS. Following the scan, Dr B did not raise any concerns with the referring clinicians, Dr C and Dr D, and he did not suggest a repeat scan or further imaging. He stated:

> "I did not suggest a repeat scan to [Mrs A's] obstetrician. I cannot recall why I did not do so but suspect that I probably thought the obstetrician would do their own scan or refer her back for a follow up scan if they had any concerns."

35. Dr B also said that if he had suspected TTTS, he would have contacted the referring clinician immediately by telephone. He stated that in this case he did not suspect TTTS, so did not contact the referring clinician. Dr B did not note the performance difficulties associated with the scan, as referenced in the worksheet. Dr B told HDC:

[13] The expected pattern of growth.

> "I do typically include a comment about technical limitations of scans [in the] report, and I am not sure why I did not in this particular case. I agree that patient build was a factor in this being a technically difficult case."

36. Dr B's report noted: "[T]he membrane between the twins is not clearly seen today." However, the worksheet noted: "[U]nable to identify the membrane between A and B." Dr B told HDC:

> "I acknowledge that I did not report the sonographer's comment as she had written it … I could have been clearer in my reporting of [the sonographer's] comment.
>
> …
>
> I have since asked another colleague to review and they likewise would have been reassured by normal umbilical Doppler and twin A MCA Doppler, fluid within the stomach and lack of new twin growth discordance which, in hindsight, was a false reassurance … In hindsight I did not consider that this was a case of twin-twin transfusion due to misinterpretation of challenging findings and being reassured by a lack of variation in fetal size and normal umbilical artery Doppler. Our sonographer follows established guidelines and imaging protocols. I am aware of the relevance and importance of protocols in all ultrasound imaging, including obstetric ultrasound.
>
> …
>
> I am aware of the importance of how to formulate a report with a conclusion, and agree that in hindsight, my conclusion was not correct in that I failed to make the diagnosis of twin-twin transfusion."

37. In Dr B's response to ACC, he also stated:

> "This scan was a technically difficult and challenging scan for the sonographer. The sonographer did the best that she could and followed our standard protocols for 3rd trimester[14] pregnancy scanning as best as possible. She had difficulty with the scan but the images that she took were the best possible and she made the special effort to rescan with a different machine."

38. Dr B told HDC:

> "I was very sorry to learn of the complications at the birth of the twins 3 days after the ultrasound I reported on 19 [Month1]. With the benefit of hindsight and knowledge of the outcome, I am sorry that I did not suggest the diagnosis of twin-twin transfusion and phone the referring obstetrician."

39. Subsequently, Dr C saw the report when Mrs A was admitted to HVDHB. Dr C told HDC that the report "confirmed normal scan finding with no evidence of twin to twin transfusion (TTTS)", and that initially this reassured her that TTTS had been excluded.

[14] The third trimester begins in week 28 of the pregnancy and lasts until birth.

Dr G's report

40. Dr B engaged Dr G, a radiologist, to provide comment about the care he provided to Mrs A. In summary, Dr G advised:

a) This was technically a difficult scan.

b) Radiologists are very dependent on the sonographer's written report and the record images. Radiologists are very dependent on whether the sonographer says it is a normal scan or whether the sonographer alerts the radiologist to a problem.

c) "I believe the technical limitation of the ultrasound examination (maternal size) which could compromise the diagnostic information, should have been stated. This would have alerted the referrer to the diagnostic quality of the scan. It is unlikely to have altered any decisions."

d) "[Dr B] states that the membrane has been poorly seen, whereas the sonographer states she was unable to see a membrane between twin A and twin B. I believe that he should have recorded what the sonographer had stated."

e) "The MCA artery Doppler in twin B was not able to be recorded by the sonographer (because of position of the [fetal] head) and she states this in her comments. This should have been recorded in the radiologist's report."

f) "Considering the standard of the report overall, given the information supplied to [Dr B] by the sonographer, the standard of [Dr B's] report is a mild deviation from the normal standard of reporting."

g) "The sonographer notes do not raise the possibility of twin-to-twin transfusion. Based on the information given I believe a significant number of radiologists would not have raised concern regarding TTTS."

h) "I believe that on viewing the images and the sonographer report, I would have been concerned about the difficulty in obtaining satisfactory abdominal measurement for twin A while a good abdominal measurement of twin B, with liquor surrounding the twin was obtained. This is likely to have prompted me to recall the patient for further imaging, perhaps with a different sonographer and also a different radiologist's assessment. I would not have concluded that this was likely TTTS …"

i) "Some of my peers who reviewed this case without the knowledge of the outcome — TTTS, did not recommend early follow up. Based on this whilst I believe that I would have recalled the patient, [Dr B's] conclusion fall[s] within the standard that would be expected."

ACC report

41. ACC engaged radiologist Dr I to provide advice about the radiology care provided to Mrs A. Dr I's advice considers the link between the care provided to Mrs A, and the outcome, as the role of ACC is to determine whether injury occurred during the course of, or as a result of, being given treatment. ACC seeks to identify retrospectively whether a treatment injury occurred, and the information relied on by ACC did not include statements directly from the clinicians involved. This is not a criticism of the ACC process, but it is necessary to highlight the purpose and limitations of the ACC report when it is referred to in my

opinion. HDC's independent advisors are asked to focus on the accepted standard of care, not the outcome, and they have the benefit of reviewing information obtained over the course of the investigation, which includes statements from the clinicians involved. Although I refer to the ACC report in my opinion, in view of the purpose and limitations of the ACC report, I place less weight on its findings.

42. A copy of Dr I's report was provided to HDC. In summary, Dr I advised:

a) Dr B does not offer the referring clinician any advice regarding follow-up imaging in this pregnancy where there are acknowledged increased risks associated and where equivocal information has been obtained by scan about fetal size and liquor volume.

b) Despite the normal Doppler value for Twin A, the lack of liquor around Twin A and the size discrepancy required close monitoring with follow-up imaging to exclude a developing TTTS.

c) It is not possible to make a confident diagnosis of MCDT with TTTS on the basis of this scan, but there are warning signs with poor visualisation of the membrane dividing the twins and the technically difficult AC measurement of Twin A.

d) An early repeat scan should have been suggested in the report.

22 Month1 — premature delivery of twins

Obstetric care

43. On 22 Month1, at around 5.15pm, Mrs A telephoned Hospital 1 Delivery Suite to advise that she had right-sided pain. A hospital midwife advised Dr D that Mrs A was experiencing abdominal pain and had been vomiting. Dr D requested that Mrs A go to Hospital 1 for an assessment by Dr C, who was the on-call obstetric consultant that day.

44. Mrs A arrived at Hospital 1 at 7.15pm and was seen by midwifery staff, who noted that she had had right-sided abdominal pain for two days and had vomited all day. Mrs A's pain score was documented as 7 out of 10,[15] and she reported that the fetal movements had not changed. The midwives attending Mrs A were unable to obtain a CTG[16] of the fetal heart rate (FHR) of either twin, and it was noted that this was because Mrs A was very uncomfortable and found it difficult to tolerate the pressure of the transducers on her abdomen.

45. On admission, Mrs A's blood pressure was 110/74mmHg, her pulse rate was 89bpm,[17] and she was afebrile. The midwifery staff telephoned Dr C and noted that Dr C would attend to assess Mrs A, and that the plan was for an intravenous line to be inserted, and blood to be taken from Mrs A for pre-eclampsia testing.

46. Following the midwifery entry in the clinical notes, Dr C made an untimed entry. All of Dr C's records in the clinical notes on this date were untimed and, as a result, it is not possible

[15] A score of 0 indicates no pain, and a score of 10 indicates very severe pain.
[16] Cardiotocography (CTG) records the fetal heartbeat and uterine contractions.
[17] Beats per minute.

to establish a clear timeline of events. Dr C told HDC: "I can only but apologise for the absence of time entries in the notes … I do acknowledge I could have done it retrospectively the following day."

47. Dr C noted that the CTG was very difficult to obtain, and that Twin 1 had an FHR variability of 5–10 beats, but mostly about 5bpm, while Twin 2's variability was 15 beats. Dr C also wrote: "?? Indicative of fetal compromise? TTTS."

48. Dr C told HDC that on her arrival in the Delivery Suite, Mrs A was clearly in discomfort, and on examination Mrs A's abdomen was soft with no tenderness. Dr C said that she logged onto her private practice system to review the scan reports, including the report of the scan performed on 19 Month1, which she had not seen previously. She stated that the report "confirmed normal scan finding with no evidence of twin to twin transfusion (TTTS) [and that] [t]his reassured [her] that chronic twin to twin transfusion was excluded".

49. Dr C said that she monitored the CTG for around 40 minutes and discussed with Mr and Mrs A that she was concerned about Twin 1. Dr C stated that she requested steroid administration[18] and discussed transferring to Hospital 2 for delivery if this was possible. Dr C decided to seek a second opinion from Dr D and ask him to review the CTG, as she was not confident that the babies could be transferred to Hospital 2 safely.

50. Dr C's understanding was that an ambulance was being requested for transfer while she was obtaining a second opinion. Dr C said that while she was waiting for Dr D, she had a discussion with the Hospital 2 Neonatal Team and an obstetrician at Hospital 2 about the possibility of transferring Mrs A to Hospital 2.

51. Dr C recalled calling back the Hospital 2 Obstetric Team and telling them that the FHR variability of Twin 1 was just 5bpm, so she was not confident that Mrs A could be transferred to Hospital 2 safely. Dr C said that she was concerned that despite the actual travel time between Hospital 1 and Hospital 2 of around 15–20 minutes, practically it may take at least 1.5 to 2 hours before the delivery can be conducted in Hospital 2.

52. In retrospective notes documented on 16 Month5, Dr C noted that Dr D was asked to review the CTGs around 8.40–8.50pm, and he agreed that Mrs A should be transferred to Hospital 2. Dr C told HDC: "On arrival, [Dr D] sighted the CTG and on discussion, was of the view that there was time to continue with the transfer."

53. Dr D stated:

> "On arrival at the hospital, I agreed with [Dr C] that the CTG was at that stage not reassuring but we both felt we could safely transfer [Mrs A] to [Hospital 2] as her babies were 28 weeks. I left the hospital once arrangements for transfer were in process."

54. Dr C did not conduct a bedside scan at this stage. She stated:

[18] Steroids are administered in preterm labour to help to mature the baby's lungs.

> "I did not consider a bedside [USS] to exclude chronic [TTTS] was indicated because the [USS] 3 days prior was reported as normal. This reassured me that chronic [TTTS] was not reported."

55. Dr C said that soon after Dr D left, the CTG deteriorated further. The FHR variability of Twin 1 dropped to 3–5bpm, and the midwife was unable to monitor the FHR of Twin 2 on CTG. Dr C then performed a USS and recorded in the clinical notes: "[D]ifficult to see [FHR] on Twin B." Dr C noted that the fetal head appeared "squashed", and documented: "[H]ighly suspicious of … TTTS." Dr C told HDC that she "scanned [Mrs A] at the bedside to help the midwife locate the fetal heart of twin 2 and noted obvious twin-to-twin transfusion … [T]win 1 was becoming bradycardic[19] (slow) and twin 2's heart beat was difficult to see at all on scan."

56. Dr C documented in the clinical notes: "I did not think it is safe to [transfer patient] to [Hospital 2] … urgent [Caesarean] section done here … Paediatric Consultant called." She told HDC:

> "It was obvious at that point that [Mrs A] could not be transferred to [Hospital 2] and immediate delivery was indicated i.e. the decision to deliver was because of bradycardia of twin 1 and inability to monitor twin 2, not because of scan finding."

57. Dr C stated:

> "[T]he CTG, which is done with light-sensitive ink, has faded and become unreadable. However, there was no disagreement amongst the team that given the slowing/loss of fetal heart on the scan with the background of previously abnormal CTG, that immediate delivery was indicated."

58. Dr C documented retrospectively on 16 Month5 that Dr D was "called back again once [Caesarean] section was decided to be done here". Dr D told HDC that he was called back by Dr C between 5 and 10 minutes later, as she felt that the CTG was deteriorating and an urgent Caesarean section was required. Dr D stated: "I returned immediately to the caesarean theatre and assisted [Dr C] with an emergency caesarean section."

59. A midwife noted retrospectively that at 10pm, Dr C was unable to find Twin 2's FHR, and a crash Caesarean section was called. Dr C and Dr D carried out an emergency Caesarean section under general anaesthetic. Dr C said that "the Neonatal RMO[20] and Consultant were informed".

60. Twin 1 was born at 10.10pm. She was floppy with no heartbeat, and required immediate resuscitation. Twin 2 was born in good condition at 10.12pm.

Timing of ambulance transfer

61. The clinical notes do not record when an ambulance was requested. Dr C told HDC:

[19] The heart rate was becoming too slow.
[20] Resident medical officer.

> "There is no record of the time the decision was made to call the ambulance and it was requested. To the best of my recollection it would have been 8.40–8.50pm, once the decision was made to transfer [Mrs A] to [Hospital 2] and [Dr D] was called in."

62. Dr D told HDC:

> "By the time I was called in [Dr C] had already consulted with [Hospital 2]. I do not have a record of the time when this was done. When I arrived, the transfer arrangements were already in process."

63. The ambulance service had no record of a transfer request before the birth of the babies. HVDHB told HDC:

> "[T]he midwife was unsure of the time then and we have no record of when the ambulance for the initial transfer to [Hospital 2] was called but the decision to birth the babies came very quickly after … we have asked [the ambulance service] for their records from that day which state they received a call at 22.23pm on 22 [Month1] from [DHB2] to pick up two resuscitaires and proceed to Hutt Valley DHB."

Further information about obstetric care

64. Dr C stated:

> "I acknowledged that my note keeping was not as detailed as it could have been. By way of explanation, this was an incredibly busy time and I was focused on reviewing the CTG (every 10 minutes), being in the room discussing the findings, arranging transfer and seeking second opinions."

65. Dr C did not perform a vaginal examination. She told HDC:

> "I did not perform a speculum or internal examination given there was no history of contractions, ruptured membranes or PV discharge or bleed. In such circumstances, I do not consider a vaginal examination was indicated."

66. Dr C stated:

> "[W]ith respect to the investigations to identify the cause of abdominal pain, I requested FBC, U&E, LFT and CRP to exclude PET/HELLP and cholecystitis or other causes of pain."

67. Dr D did not document any notes in the clinical record on 22 Month1. He stated:

> "I was called in by [Dr C] in a supportive role regarding her management, which is why I made no contemporaneous written account about our discussion. Normal practice in this situation would be for the treating consultant to make any relevant notes as clinically indicated."

Dr J's report

68. HVDHB engaged Dr J, a consultant obstetrician at DHB2, to provide advice on the obstetric care undertaken on 22 Month1. Dr J said that in his opinion, it would be harsh to criticise Dr C for not performing a vaginal examination to check for cervical change, not performing a bedside scan earlier to aid recording of the FHRs and to assess liquor volume, and not giving a differential diagnosis for Mrs A's abdominal pain.

69. Dr J noted that Dr C arrived in the Delivery Suite, assessed the patient, and organised transfer to Hospital 2. She also asked for a second opinion with regard to the transfer, and her decision was supported. Dr J considered that once the situation changed with regard to the FHRs, Dr C performed an emergency Caesarean section appropriately. In Dr J's opinion, an earlier bedside scan would not have changed the management of transferring to Hospital 2 and, regardless of the differential diagnosis, Mrs A still needed to be transferred. Dr J stated that "whether [Mrs A] could have been transferred to [Hospital 2] earlier is a [moot] point".

Preparation of operating theatre

70. HVDHB was unable to provide HDC with the exact time when the paediatric staff were advised of the emergency Caesarean section. HVDHB stated:

> "[T]he theatre coordinator was not told to prepare for an emergency twin delivery, therefore only one resuscitaire was available in theatre 2 at time of the twins' birth. The second resuscitaire was brought into theatre shortly after that but could not readily access the wall oxygen air supply given the configuration of equipment already in this theatre. It was arranged therefore that twin 1 was placed on resuscitaire 1 and ventilated using the neonatal transport incubator's Neopuff.[21] Twin 2 was placed on the second resuscitaire, but had ventilation given by the Neopuff circuit from resuscitaire 1."

71. HVDHB told HDC:

> "[W]e have communicated with all relevant staff who were on duty the night of the twin's delivery. We have been unable to clarify who called the Theatre Coordinator and therefore are unable to confirm if this information was communicated to the theatre staff."

72. The Shift Coordinator who prepared the operating theatre stated: "I was given no information regarding the fact this was a twin caesarean section. This information was provided when the patient entered the theatre."

[21] The Neopuff infant resuscitator delivers controlled, consistent, and precise pressures of ventilation.

Paediatric care

73. Dr L, a paediatric registrar, and Dr E, a paediatric senior house officer, were present at the delivery. Twin 1's Apgar score[22] was 2 at 1 minute, 2 at 5 minutes, and 4 at 10 minutes. Twin 1's birth weight was 1076g. Twin 2 had an Apgar score of 7 at 1 minute, 9 at 5 minutes and 9 at 10 minutes. Twin 2's birth weight was 802g.

74. Dr L was involved in the resuscitation of Twin 1, and Dr E was responsible for the care of Twin 2. Around 10.17pm, Dr F, a paediatric consultant, arrived at Hospital 1 from home. At this time, Twin 1 was 7 minutes of age.

75. Dr F made retrospective clinical notes at 12.15am the following morning (23 Month1).

76. Dr F noted that she was called to attend an urgent "crash section". The information she received from the consultant obstetrician on arrival was "non-reassuring CTG on one twin [and] no fetal heart rate seen in other ? [TTTS] Delivered at 10.10pm." Dr F told HDC:

> "I do not recall being given any information about imminent delivery of the twins prior to arrival at [Hospital 1], but on arrival I learned that the decision to deliver … had been made very quickly by [Dr C]."

77. Dr F documented that she arrived when Twin 1 was 7 minutes of age, and noted: "[Twin 1] reportedly delivered with some slight movement seen, pale and floppy, no heart rate noted."

78. Dr F said that on her arrival she was informed by Dr L that intermittent positive pressure ventilation via a T-piece[23] had been commenced, with poor chest wall movement with attempted inflation, and no rise in oxygen saturation. Dr F was told that no heart rate had been noted with this intervention, and that chest compressions[24] had been commenced, and Dr L had attempted to intubate[25] Twin 1 in order to deliver more effective ventilation. Dr F told HDC: "[T]he first intubation attempt on [Twin 1] did not result in improved ventilation … it was at this point that I arrived."

79. Dr F said that she then supervised a second intubation attempt by Dr L, and it did not result in a rise in oxygen saturation. Dr F stated that because the previous intubation attempts had failed, she then took over and chose a smaller diameter ETT tube[26] of 2.0mm to improve her chance of success. Dr F told HDC:

[22] Apgar stands for appearance, pulse, grimace, activity, and respiration. A score of 2 indicates severe birth asphyxia (a condition arising when the body is deprived of oxygen), 3–4 indicates moderate birth asphyxia, 5–6 indicates mild birth asphyxia, and 7–10 indicates a normal presentation.
[23] Resuscitaire circuits. A T-piece can be connected to a mask or endotracheal tube.
[24] Application of pressure on the chest to assist blood flow through the heart.
[25] Insert an endotracheal tube (ETT) through the mouth and into the airway so that a patient can be placed on a ventilator to assist breathing.
[26] Endotracheal tube.

> "[I was able to pass] the cords under direct visualisation. Inflation through the tube with a bag mask device[27] (rather than T-piece) provided some chest wall rise but saturations remained low and [Twin 1's] colour remained pale, indicating poor oxygenation."

80. Dr F documented retrospectively: "3x attempts at intubation — 3rd successful."

81. It was then discovered that the oxygen cylinder connection to the tube was not turned on. Dr F told HDC:

> "[Dr L] checked the connections and realised that at some point in the set up process prior to delivery the oxygen from the transport incubator had either not been turned on to flow through the tubing to the baby, or had been turned off. It is not known who had done this. I had not been aware of the unusual setup until this point."

82. Dr F said that Dr L then turned on the oxygen cylinder connection, and when oxygen began flowing to Twin 1, her saturations improved to 60%, her colour improved to pink, and her heart rate improved. Dr F documented retrospectively: "[A]dequate ventilation, at around 12 [minutes] of age [10.22pm]."

83. Dr F said that at this stage, the expected oxygen saturation would have been 90–100%, but it remained at 61–70%. Therefore, she implemented further medical interventions, including IV access[28] to administer a fluid bolus[29] and red blood cells, and surfactant[30] via the ETT to try to improve Twin 1's lung inflation. Dr F told HDC:

> "At this point, I called [the] on-call consultant for [Hospital 2] NICU, as we would need to transfer the twins to a more intensive unit. [The consultant] kindly provided advice until the retrieval team arrived. She noted that an ETT tube of 2.0 mm diameter would be very small for a baby of this size and recommended changing to a larger diameter."

84. Dr F said that they agreed to wait for the Hospital 2 Neonatal Retrieval Team to arrive to change the ETT, as it was likely that they would place a new ETT in a more secure position for transport. Dr F documented in the notes retrospectively, and told HDC: "Oxygen saturations improved to 81% but did not rise further until the retrieval team arrived at approximately 35 minutes of age [at 10.45pm]."

85. Dr F said that following the arrival of the Hospital 2 NICU Retrieval Team, the management of the twins was transferred to them. Dr F told HDC that the Hospital 2 NICU Team spent around 45–60 minutes in the operating theatre at HVDHB stabilising both babies, and that a larger ETT was inserted and Twin 1's saturation improved to 90–100%. The exact time at which the Hospital 2 NICU Retrieval Team left Hospital 1 is not recorded in the HVDHB clinical notes.

[27] A hand-held device used to provide positive pressure ventilation to patients who are not breathing adequately.
[28] Access to the bloodstream through a vein.
[29] Rapid administration of fluid.
[30] A substance used to assist gas exchange.

86. The HVDHB Discharge Summary noted that the twins were discharged at 1.30am and transferred to Hospital 2 to receive further care. While in NICU[31] at Hospital 2, Twin 1 was diagnosed with hypoxic ischaemic encephalopathy (HIE).[32]

87. On 22 Month2, the twins were transferred back to Hospital 1, and stayed in the Hospital 1 Special Care Baby Unit until 4 Month4, when they were discharged with follow-up care to be provided by a multidisciplinary team.

Further information — equipment set-up

88. HVDHB told HDC: "The preparation of the resuscitation equipment was not of the required standard." The DHB acknowledged that initially there was a failure to provide oxygen during the resuscitation of Twin 1.

89. Dr E stated:

> "I would not usually be involved in the preparation of the operating theatre with regards to any equipment not pertaining to the resuscitaire and was not involved on this particular night."

90. Dr F told HDC:

> "At the time of my arrival, I was not aware that the set up of the theatre had had to be altered due to it being a twin delivery in a theatre not normally used for twin deliveries. I was also not aware that the oxygen connection was not-standard, ie connected to a portable oxygen cylinder mounted on a resuscitaire rather than being connected to a piped supply at the wall.
>
> …
>
> [F]ollowing this adverse resuscitation an informed debrief was held between myself, [Dr L] and [Dr E] regarding the oxygen setup. [Dr L] expressed her dismay this had happened and undertook to file an event form which activated an official review process."

91. On 9 Month2, Dr L completed an adverse event report. She noted that the contributing factors to the adverse event were communication failure, equipment maintenance, and equipment use. HDC was unable to obtain a statement from Dr L.[33]

Use of a 2.0mm diameter ETT

92. Dr F told HDC:

> "One of the established responses when there is difficulty in passing an ETT is to try a smaller ETT … In retrospect, my decision to choose 2.0 ETT, which was available on the

[31] Neonatal Intensive Care Unit.

[32] Brain injury caused by oxygen deprivation to the brain.

[33] HVDHB told HDC that it has attempted to contact Dr L, but she has not responded, and HVDHB believes that she is no longer in New Zealand. According to the Medical Council registrar, Dr L has not practised in New Zealand since 2018.

> resuscitation trolley, was an error made under pressure. My priority after two failed attempts and a pale floppy infant was to get an airway as soon as possible."

93. HVDHB told HDC: "It is correct that the size 2.0 ETT tube is not in line with the ANZCOR[34] guidelines. The size 2.0 ETT tube is no longer in the neonatal resuscitation trolleys."

Subsequent events

94. Dr C told HDC: "I debriefed [Mr A] immediately and [Mrs A] once she was awake after surgery and explained the events to both again the following day …" These discussions were not documented in the notes. In response to the provisional report, Mrs A told HDC that after the birth Dr C came into her room and advised there had been an issue in theatre. She said that this was the only mention to her or her husband from anyone about Twin 1's injury until a week later when she was advised of it at Hospital 2. Mrs A stated: "At this meeting they explained [Twin 1's] injury however they did not mention the issues in theatre instead stating brain bleeds were common in prem[ature] babies."

95. Dr C said that about six weeks after delivery, she met with Mrs A again to explain the adverse event, including an explanation of the reasons for the difficulty with decision-making and the need to deliver the babies urgently. This meeting was also not documented. In response to the provisional report, Mrs A told HDC that she did meet Dr C around six weeks after her birth. Mrs A stated:

> "[Dr C] took the time to answer any questions that I had and ensured that I understood the time leading up [to] the twins birth. While we did discuss [Twin 1's] injury again we never discussed the cause of this."

96. On 16 Month5, an internal meeting with the clinicians involved, including Dr F and Dr C, took place at HVDHB to review the care provided. A copy of the meeting notes was provided to HDC. Several recommendations were noted, including that theatre staff are responsible for ensuring that equipment used in theatre is connected appropriately and ready to be used; all scans for monochorionic twins are to be carried out by the HVDHB Radiology Department; and that all documentation is to be dated and/or timed, named, and signed with a designation. Dr F stated:

> "After this meeting, the consensus was that myself and [Dr C] would fully inform the parents of the chain of events from the antenatal scan through to the issues with oxygen supply."

97. On 14 Month6, Dr F and Dr C met with Mr and Mrs A. Dr F stated: "[T]his was the earliest point at which the availabilities of myself, [Dr C] and [Mr and Mrs A] coincided." A file note summarising the meeting was sent to Mrs A, and a copy of the file note was provided to HDC. The file note recorded that Mr and Mrs A were informed about issues with the scan at the radiology service on 19 Month1, and the issues with the resuscitation of the twins.

[34] Australian and New Zealand Committee on Resuscitation.

The file note documented that Dr C had informed Mrs A about the findings after the birth of the twins, and that Mr and Mrs A were offered the opportunity to meet again if needed.

98. Dr F said that she also discussed the filing of an ACC claim form, and the complaint and review process, including complaints to Hospital 1 and external reviews by HDC.

99. Mrs A told HDC:

> "In [Month5] at [Twin 1's] first paediatric appointment the paediatrician mentioned to me that there had been an equipment failure at [Hospital 1]. Following the disclosure my husband and I went back in [Month6] to see [Dr F]. At this visit we were told that [Twin 1's] oxygen supply had not been turned on at [Hospital 1]."

ACC report

100. ACC asked a neonatal paediatrician to provide external clinical advice. The neonatal paediatrician confirmed the physical injuries as hypoxic ischaemic encephalopathy and a left-sided grade 4 intraventricular haemorrhage that has led to a right hemiplegia. The neonatal paediatrician identified that in large part the outcome involved the failure to diagnose twin-to-twin transfusion syndrome and to transfer Mrs A to a tertiary obstetric and neonatal unit for further management; in addition, there was a poor trace on the CTG when Mrs A presented to Hospital 1, and resuscitation was not optimal owing to various reasons.

Further information

101. Mrs A told HDC that she wants "to get the full story of what happened at the birth".

102. HVDHB told HDC:

> "After this event, the theatre and midwifery team focused on the equipment failure. In retrospect the hospital's communication with the family was inadequate. We apologise for the distress this has further created for the family."

103. HVDHB also stated:

> "[We] sincerely apologise for the emotional and physical impact that this series of events has had on [the family]. We have focused our efforts on ensuring that should such an event happen again our systems and processes are robust."

Relevant policies

Radiology service

104. The radiology service's Ultrasound Manual (November 2014) Obstetric section stated:

> "The standard ultrasound examination will include evaluation of [fetal] number, [fetal] cardiac activity, Placental localisation, gestation age, amniotic fluid, [fetal] presentation, [fetal] anatomy, any [fetal] abnormality … it is recognised that not all [fetal] abnormalities can be identified, but if there is any uncertainty, a secondary opinion will be sought."

HVDHB

105. HVDHB's "Emergency Move to Theatre Caesarean Section or post-partum Haemorrhage (PPH)" provides:

> "O[bstetrician] & G[ynaecologist] makes the decision for emergency move to theatre
>
> Day Process [8am–11pm]
>
> Designated Midwife or [Obstetrician & Gynaecologist] Junior to:
>
> 1. Dial [emergency number and] stay on the line and you will be connected to the Theatre Coordinator.
> 2. Operator confirms 'Emergency move to Theatre C-section' or 'PPH' and connects call to extension … Operator sends out 'Emergency move to Theatre C-section' or 'PPH' page.
> 3. Midwife or [Obstetrician & Gynaecologist] briefs theatre Coordinator.
> 4. Begin move to theatre after conversation with Theatre Coordinator."

106. There is no documented mention of seeking the paediatric team's assistance.

107. HVDHB's "Guidelines for Seeking Senior assistance with Neonatal resuscitation" (July 2014) did not include "Category 1[35] 'crash' GA caesarean sections" and "premature twins" as one of the scenarios for paediatric RMOs to contact the paediatric consultant. These two scenarios were updated in the September 2019 Guidelines.

Changes made since incident

108. Dr B told HDC that he has "reflected on this incident on an almost daily basis and think[s] about [his] report of this [USS] and how [he] could have done better". He also said that he has read widely about multiple pregnancies and TTTS, and now avoids reporting on twin pregnancies. He told HDC: "I also compare directly with prior images, and seek a 2nd opinion from a colleague when in doubt over imaging findings in a complex or difficult case."

109. The radiology service told HDC that as a result of this incident it made changes to its practice, including a review of the scan imaging at the regular Radiologist Peer Learning meeting, including the presentation, stages, and imaging of TTTS. TTTS was also reviewed at a subsequent sonographer meeting.

110. The radiology service said that it is aware that new Ministry of Health NZ Obstetric Ultrasound Guidelines are about to be published. All its sonographers and radiologists are now familiar with the new Guidelines, which were circulated to both groups after release. The Guidelines will be incorporated into the radiology service's daily practice and ultrasound manual.

[35] Immediate threat to the life of a woman or fetus.

111. Dr C told HDC that as a result of this incident she made several changes to her practice, including:

a) Checking patient weight and documenting it on every visit, and ensuring that the risks of increased weight are discussed and documented;

b) When delivering babies in the HVDHB region, getting the Hospital 2 Neonatal Team out much sooner if they are available;

c) Performing baseline PET bloods in case of high blood pressure or a sudden increase in blood pressure; and

d) Ensuring that there is a detailed record of her examination findings, including symptoms, differential diagnoses, and a plan.

112. Dr C further noted that all scans for monochorionic-diamniotic twins are performed every 2 weeks from 16 weeks' gestation in HVDHB's Radiology Department, not in the private sector.

113. Dr D said that following this incident, he stopped private practice and now works in a public hospital setting only.

114. Dr F told HDC that as a result of this incident she attended regular neonatal life support training activities, and attended conferences including those on international best practice in neonatology. She stated: "I have reflected on this incident and have changed my practice accordingly: for example, I will not use a 2.0 ETT for resuscitation again."

115. HVDHB told HDC that as a result of this incident:

a) It created four new midwifery positions to be on call for all Caesarean sections.

b) New equipment was purchased, and the theatre is now set up with two resuscitaires.

c) The resuscitaires are checked daily by the theatre staff, which includes re-checking following the use of the resuscitaires.

d) The hospital Paediatric Attendance at Delivery Policy was updated to state that on-call Senior Medical Officers must attend in these emergency situations. A copy of the updated policy was provided to HDC. The policy has been printed in colour and laminated, and placed on the wall by the infant resuscitaires in theatre.

e) It identified the need to increase the FTE Associate Clinical Midwifery Manager (ACMM) and increase the position to 24/7 cover, and submitted a business case to enable after-hours senior midwifery clinical oversight. In June 2019, the ACMM role over 24 hours was signed off successfully, and the process of recruitment commenced. HVDHB stated: "[O]ne of the roles of the ACMM is to coordinate any emergency response. This means that clinicians are able to focus on the patient while the ACMM is able to manage the communication with relevant services such as Theatre, Anaesthetists, Paediatrics and [DHB2] NICU."

f) In 2018, it established a new theatre midwifery team made up of midwives who have been trained and oriented in theatre practices.

g) It arranged with the public hospital's radiology service a space every day for urgent maternity ultrasound services.

h) It moved the formal team handover from a clinical area to a private area closed to interruptions. All multidisciplinary team members are required to attend so that multi-disciplinary perspectives are fed into the clinical picture, to inform a plan of care and highlight any concerns or gaps in clinical care. Care decisions are also informed by the Obstetrics & Gynaecology Team and the ACMM to ensure that the resourcing of care required can be managed safely. There is a handover sheet that holds information about the patient, and the senior medical officer on duty completes a physical assessment of all the women having an induction of labour in the morning.

i) The size 2.0 ETT is no longer available in the neonatal resuscitation trolleys.

j) The theatre staffing model for an acute call has changed to require the entire team to come (previously the first person called would decide how many of the team were required). The Paediatrics Team at Hospital 1 has established closer ties with Hospital 2 NICU and, in the last two years, two Paediatric Senior Medical Officers have completed a two-week secondment there. There are plans to continue this in the future, as the service acknowledges the importance of continuing education and closer working relationships with Hospital 2.

k) The theatre staff undertook additional training around neonatal resuscitation.

l) Full-day Newborn Life Support courses (NZ Resuscitation Council) are now run four times a year through the clinical training unit at Hospital 1. Staff who may be involved in a Caesarean section are now required to attend these courses on a regular basis. This includes theatre staff, all midwives, neonatal nursing staff, and paediatric resident medical officers.

116. In November 2018, HVDHB commissioned an independent external review of its maternity services. The review identified several areas of risk that threatened the safety of the service, including a severe staff shortage, and made a number of recommendations. In June 2019, HVDHB accepted the majority of these recommendations.

Responses to provisional opinion

Mrs A

117. Mrs A was provided with an opportunity to respond to the "information gathered" section of the provisional decision. Mrs A told HDC that the radiology service was unable to accommodate her request to have a senior member of staff scan her despite this being recommended by staff during her scans.

118. Mrs A stated that she and her husband will never forget the events of 22 Month1. She said that she remembers Dr C touching her hand to reassure her before she went to sleep, and told HDC:

"Despite the events around the twins birth I will be forever thankful to [Dr C] and her actions that evening. In my eyes she saved my [babies] as I know deep down they wouldn't have survived being transferred to [Hospital 2]."

119. Mrs A told HDC that the cause of Twin 1's injury was never mentioned until the first paediatric appointment. She said that it is clear that even those who were present in the theatre do not fully understand what happened. She told HDC that she is happy with the changes that have been made, and she "hope[s] that all staff involved in this case never forget it and the impact it has had on [her] family".

Dr B

120. Dr B was provided with an opportunity to respond to the provisional report. He sought further advice from Dr G and provided HDC with a copy of Dr G's further advice. In summary, Dr G advised:

a) He agrees with Dr Sim's advice that it is common practice for radiologists to consult with a colleague when there is uncertainty in formulating reports in areas outside their area of expertise. However, he disagrees with Dr Sim's advice that he would have expected Dr B to discuss the USS with a colleague within the radiology service.

b) The sonographer does not raise concerns in her report about possible TTTS. The sonographer report is vague regarding liquor volumes, and does not mention the reduced liquor in Twin A or the increased fluid in Twin B.

c) He refers to the usage of the Quintero classification system.[36]

d) There is no sonographer summary stating that "this is a pregnancy at risk of TTTS" or a statement such as, "I am concerned about this pregnancy and I believe an early scan is required." As a result, from the information there was no alert provided to Dr B that immediate action was required.

e) Dr B and his assessment of the images and conclusions fall within the standards that would be expected.

121. Dr G also provide a further advice report, which, in summary, stated:

a) He agrees with Dr Sim that Quintero classification may add another layer of complexity in assessing such cases. He said that this is a classification system used commonly worldwide, although it is not one he had used in the past. He stated that had Quintero classification been used, according to the sonographer's report this would have been Quintero stage one,[37] and it is unlikely that diagnosis of TTTS would have been made, and hence no early recall.

b) As well as assessing the sonographer's report, the radiologist must view the images. From his review of the images recorded, it is apparent that the liquor volume surrounding Twin A is reduced.

[36] Quintero staging is a system of quantifying the severity of twin-to-twin transfusion seen in monochorionic twin gestations through sonographic assessment.
[37] The least severity of TTTS according to Quintero classification.

c) "I believe that I would have recalled the patient for an earlier scan at 1 week instead of the normal 2 weeks. Although it could be argued that the normal 2 week recall would have been acceptable if it was Stage 1 Quintero classification."

d) "Both Dr Sim and myself have had extensive experience in ultrasound during training and post qualification at a time when many radiologists performed a large number of ultrasound scans themselves. This earlier practice has allowed Dr Sim and myself to develop an almost intuitive assessment of ultrasound images in a way that many young radiologists do not have. The majority of scans are now performed by sonographers.

This significant change means that radiologists rely heavily on the sonographer's report to formulate their final report, but the radiologist must also view the images and make their own assessment."

e) "Like Dr Sim I believe an earlier recall would have been desirable. However it is readily apparent to me that the current practice of some of the younger radiologists … would have led to a decision for the standard recall at two weeks. Particularly if the radiologist was using the Quintero classification type system."

f) He disagrees with Dr Sim's comment that there were clear indications of sonographer uncertainty. He said that comments such as "suboptimal due to body habitus" and "status classification incomplete" are often seen on sonographer reports, and these comments do not portray uncertainty, they are stating fact. He then stated: "[H]owever there is significant uncertainty in other parts of the sonographer's report, which is vague …"

g) He disagrees with Dr Sim that in addition, review of the images identifies that the examination on 19 Month1 was performed on two different machines, which was an uncommon occurrence that would have alerted the reporting radiologist. Dr G does not believe that during routine review the radiologist would have detected that the scans had been performed on two different machines.

h) "In our practice if there is a difficult scan, we encourage repeat scanning with a different sonographer, as we all have different skills and a second pair of eyes sees and interprets differently."

Radiology service

122. The radiology service was provided with an opportunity respond to the provisional report. It told HDC that it has undertaken the following:

"1 — reviewed this particular case, and more broadly reviewed Twin-Twin Transfusion Syndrome (TTTS), at Radiologist and Sonographer Peer Learning meetings.

2 — integrated the new MoH NZ Obstetric Ultrasound Guidelines into our Ultrasound Practice Manual and daily practice routines. All Radiologists and Sonographers are familiar with these new guidelines."

Dr C

123. Dr C was provided with an opportunity to respond to the provisional report. Dr C stated:

> "I have carefully reviewed the comments made about my documentation when [Mrs A] was urgently admitted on 22 [Month1] and have taken them on board. While this was an acute and incredibly busy time when I was focused on viewing the CTG, being in the room discussing the findings, and arranging transfer and seeking second opinions, I wish to reassure you that I very much understand the importance of keeping good clinical notes and this case has served as the timely reminder."

HVDHB

124. HVDHB was provided with an opportunity to respond to the provisional report. The Chief Executive told HDC:

> "I sincerely apologise that the care provided to [Mrs A] and her [babies] was not at the level required. The DHB and all staff involved in [Mrs A's] care unreservedly apologise for the significant distress that resulted for [Mrs A], her partner and her [babies].
>
> The [Deputy] Commissioner's findings, breach of Right 4(1) of the Code, are accepted by [HVDHB]. The findings following our investigations … presented a significant opportunity for learning. I can reassure you that considerable work has been done to establish how our system failed, and importantly to put in place measures to mitigate the risk of this, or similar event, happening again."

125. In response to the recommendation made in the provisional report that HVDHB update HDC on the steps taken to carry out the external reviewer's recommendations, HVDHB advised the following:

a) Base staffing has been increased in the Women's health area, which includes: increase in Director of Midwifery to 1.0 FTE; increase in Associate Clinical Midwifery Manager FTE to ensure 24-hour coverage; increase in Clinical Midwifery Manager to 1.6 FTE; implementation of Midwifery Continuity Team 3.2 FTE; Midwifery Educator role established; core midwifery staffing vacancies have been resolved; and currently HVDHB has a small waiting list of midwives who would like to work in the DHB.

b) Care Capacity Demand Management has been implemented in Maternity, and the information gained from the process is actively utilised in the identification of safe staffing levels.

c) HVDHB has recruited to the Associate Clinical Midwifery Manager positions with 24-hour cover in place. These roles began in September 2019.

d) Work on clinical guidelines and policies is now embedded as part of continuous quality improvement in the service.

e) Attendance at the RANZCOG Fetal Surveillance Education programme is an annual requirement of all clinical staff, face to face or online. This is recorded and will be monitored by the Midwifery educator.

f) Every three months, an audit of all babies transferred to Hospital 2 Neonatal Intensive Care Unit is carried out by one of the DHB's Paediatric Clinical Heads of Department.

g) A retrospective review was actioned for 2017, and on an ongoing basis individual cases are reviewed in a combined maternity and paediatric case review process.

h) A review of equipment was undertaken, and several pieces of equipment have been replaced.

Relevant standards

126. The RANZCOG's Management of monochorionic twin pregnancy[38] (reviewed in July 2014) states:

> "**Recommendation 2**
>
> All women with monochorionic pregnancies should receive ultrasound surveillance for TTTS and IUGR.[39] Following an ultrasound scan at 11–14 weeks for assessment … ultrasound should be performed every 2 weeks from 16 weeks' gestation …
>
> Ultrasound should be undertaken by a centre with sufficient experience to recognise these complications and refer appropriately if they occur. Outcomes with TTTS are optimised where there is timely diagnosis and referral to a tertiary centre for consideration of surgical therapy …
>
> **Recommendation 3**
>
> Ultrasound examination in monochorionic twins should include growth, amniotic fluid volume in each sac, bladder volume, umbilical artery and, (after 20 weeks) middle cerebral artery Doppler wave forms."

Opinion: Introduction

127. This opinion concerns various aspects of the care provided to Mrs A and her babies, Twin 1 and Twin 2. In particular, the opinion addresses:

a) The radiology care provided by Dr B and the radiology service on 19 Month1;

b) The obstetric care provided by Dr C and HVDHB staff on 22 Month1; and

c) The paediatric care provided by HVDHB to Twin 1 and Twin 2 on 22 Month1.

[38] Available from https://ranzcog.edu.au/RANZCOG_SITE/media/RANZCOG-MEDIA/Women%27s%20Health/Statement%20and%20guidelines/Clinical-Obstetrics/Management-of-Monochorionic-Twins-(C-Obs-42)-review-July-2017.pdf?ext=.pdf

[39] Intrauterine growth restriction (IUGR) refers to a condition in which an unborn baby is smaller than it should be because it is not growing at a normal rate inside the womb.

128. First, I would like to acknowledge the traumatic impact these events have had on Mrs A and her family. It is understandable that they have sought an independent review from my Office. I note that Mrs A stated in her complaint that she would like "to get the full story of what happened at the birth".

Opinion: Dr B — breach

129. On 19 Month1, Mrs A was 28 weeks' gestation and underwent a routine USS at the radiology service. The sonographer who conducted the scan was Ms H. Dr B reviewed the images and the sonographer's worksheet and prepared his radiology report.

Quality of Dr B's report

130. The sonographer conducted the USS on two different machines, as the views of the scan were limited and, despite the second attempt with another machine, this did not aid visualisation. The sonographer's worksheet was provided to HDC and, in summary, the sonographer noted:

a) The limitation and difficulty with the scan;

b) The scan was suboptimal owing to body habitus;

c) MCA Doppler assessment was not technically possible in Twin A;

d) Fluid discrepancy between Twin A and Twin B could not be excluded;

e) The membrane between Twin A and Twin B could not be identified;

f) Twin A's fluid was unable to be measured; and

g) Twin B's MCA Doppler was unable to be measured.

131. Dr B's report noted that "the membrane between the twins [was] not clearly seen", although the sonographer's worksheet stated that she was "unable to identify" the membrane between Twin A and Twin B. Dr B did not note the technical limitation of the scan in his report, and he did not note that MCA flow could not be assessed with Doppler in Twin B. Dr B accepts that he did not report the sonographer's comment as she had written it, and that he could have been clearer in his reporting.

132. Expert advice was obtained from Dr Sim, a radiologist, who advised:

> "A carefully written radiology report is important to guide the referring clinician's management decisions. In particular the conclusion/summary is pertinent, which the radiologist's interpretation of the findings may be the only part of the report read by a clinician.

> My view is that the performance difficulties associated with this scan, referenced by the sonographer in the worksheet … are important and were not expressed in the written radiologist's report."

133. Dr Sim also opined that the missing pieces of information in the radiology report were:

> "1. adequate documentation of the technical limitations of the study, noting that obesity contributes to reduced detail, 2 Failure to appreciate that one twin has reduced fluid and appears stuck, 3. failure to visualise the dividing membrane … 4. [MCA] Doppler flow in one twin; 5. Lack of visualisation of fetal bladder in [Twin A]."

134. Dr Sim concluded:

> "[Dr B's] report both the content and the conclusion, represents a moderate departure from expected radiology reporting standard. My peers would also consider this a moderate departure from their standard of reporting …"

135. Dr B engaged his own radiology advisor, Dr G, who advised that the limitation of the scan should have been stated in the report, that Dr B should have recorded what the sonographer documented — "unable to see a membrane between twin A and twin B" — and that MCA Doppler in Twin B was not able to be recorded. Dr G stated:

> "Considering the standard of the report overall, given the information supplied to [Dr B] by the sonographer, the standard of [Dr B's] report is a mild deviation from the normal standard of reporting."

136. I accept Dr Sim's advice, and also acknowledge the comments from Dr G. I am critical of the quality of Dr B's report in that he did not document the limitations of the scan and failed to document the information from the sonographer's worksheet appropriately.

Diagnosis of TTTS and follow-up actions

137. Dr B did not diagnose TTTS in his report. He also did not arrange a repeat scan or contact the referring clinician about the issues with the scan. Dr B told HDC that if he had diagnosed TTTS he would have contacted the referring LMC immediately. Dr B said that he did not consider TTTS because he was reassured by a lack of variation in fetal size and normal umbilical artery Doppler.

138. Dr Sim advised:

> "The examination strongly suggests TTTS. This information should have been conveyed to the referring clinician in the written report and by phone … my personal approach would have been a phone discussion to discuss the findings of TTTS and my concerns with the referring clinician."

139. However, Dr B noted that unlike Dr Sim, who is subspecialised in obstetric radiology, he is a general radiologist with subspecialty interests in MRI.

140. Dr G advised: "[B]ased on the information given I believe a significant number of radiologists would not have raised concern regarding TTTS." Nevertheless, Dr G also stated:

> "I believe that on viewing the images and the sonographer report, I would have been concerned about the difficulty in obtaining satisfactory abdominal measurement for twin A while a good abdominal measurement of twin B, with liquor surrounding the twin was obtained. This is likely to have prompted me to recall the patient for further imaging, perhaps with a different sonographer and also a different radiologist's assessment."

141. Dr Sim accepted that he had more experience in obstetric USS and is more exposed to manifestation of TTTS than Dr B. In any event, Dr Sim advised:

> "It is common practice for radiologists to consult their colleagues when there is uncertainty in formulating reports in areas outside their areas of expertise … it is surprising and of concern that he did not discuss the ultrasound examination with a colleague with the radiology service …
>
> It is possible that bias was introduced to [Dr B] by the sonographer's worksheet, but collectively the comments indicated uncertainty in a scan compromised by increased BMI … it is my view that the worksheet content should have alerted [Dr B] that this case required particularly careful review."

142. ACC also engaged a radiology expert advisor, Dr I, for the purpose of Mrs A's treatment injury claim. Similar to Dr G and Dr B, Dr I is not subspecialised in obstetric radiology. Dr I advised that it was not possible to make a confident diagnosis of MCS twins with TTTS on the basis of this scan, but said that there are warning signs. Dr I stated:

> "[Dr B] does not offer the referring clinician any advice regarding follow up imaging in this pregnancy where there are acknowledged increased risks associated and where equivocal information has been obtained by scan about fetal size and liquor volume … the lack of liquor around [Twin A] and the size discrepancy requires close monitoring with follow up imaging to exclude a developing Twin to Twin transfusion."

143. In response to my provisional opinion, Dr B submitted further advice from Dr G. Dr G agreed with Dr Sim's advice that it is common for radiologists to consult a colleague when there is uncertainty, but disagreed with Dr Sim's advice that it was surprising and of concern that Dr B did not discuss the USS with a colleague. Dr G said that there is no sonographer summary stating that "this is a pregnancy at risk of TTTS" or that "an early scan is required". He considers that Dr B's assessment of the images and conclusions fall within the standard that would be expected.

144. Dr Sim considers that there were clear indications of sonographer uncertainty, which should have alerted Dr B that total reliance on the sonographer worksheet was inappropriate. Dr Sim advised:

> "I believe there were sufficient reasons to indicate uncertainty and concern and for [Dr B], who has acknowledged his inexperience in assessment of twins by ultrasound, to consult with colleagues, before issuing a report."

145. Dr G responded to Dr Sim's advice, and said that "like Dr Sim [he] believe[s] an earlier recall would have been desirable", and he would have recalled the patient for an earlier scan at one week. However, Dr G said that some of the younger radiologists would not have recalled earlier, and would have left it to the standard recall at two weeks. Dr G disagreed with Dr Sim that there were clear indications of sonographer uncertainty, but also stated that "there is significant uncertainty in other part of the sonographer's report". Dr G also noted that as well as assessing the sonographer's report, the radiologist must view the images.

146. I note Dr G's view that while a number of clinicians would not have raised concerns regarding TTTS, an earlier recall would have been desirable. However, having carefully considered all the submissions, I remain of the view that there were warning signs in the scan that signalled that Mrs A's images required particularly careful review and further action from Dr B. In all the circumstances set out above, I remain critical that Dr B did not arrange follow-up scans or consult with any of his colleagues or the referring clinicians about the issues with the scan.

Conclusion

147. I am critical that Dr B's report was inadequate, and that he did not undertake any follow-up action despite the issues with the scan. As a consequence, the diagnosis of TTTS was not identified earlier. I consider that Dr B failed to provide services to Mrs A with reasonable care and skill and, accordingly, that he breached Right 4(1) of the Code of Health and Disability Services Consumers' Rights (the Code).[40]

Opinion: Radiology service — adverse comment

148. The radiology service has an organisational duty to provide services of an appropriate standard. This includes providing adequate support to staff in respect of the application of relevant policies, and ensuring that all staff work together and communicate effectively.

149. Mrs A had her antenatal USS at the radiology service. As stated above, Dr B advised that he is not specialised in obstetric scanning, and told HDC that none of his colleagues in the region are recognised as subspecialist obstetric radiologists.

150. The RANZCOG Guidelines recommended that ultrasound assessment of monochorionic twins be undertaken in a centre with sufficient experience to recognise the complications. However, I note that my expert obstetrics advisor, Dr Westgate, advised:

[40] Right 4(1) states: "Every consumer has the right to have services provided with reasonable care and skill."

> "I have worked in a number of DHBs where it is not always possible to follow the RANZCOG advice due to a number of factors; one is the limited availability of ultrasound services in the DHB area to deal with the volume of requests, another is a lack of highly experienced obstetric scanners (sonologists) and radiologists being available in all ultrasound locations at all times."

151. Dr Sim advised:

> "This case suggests the reporting of a high risk monochorionic diamniotic twin pregnancy by a radiologist reporting outside his field of expertise, who did not recognise the interval change and significance of the findings, and was unaware of the need for strict adherence to recognised guidelines in ultrasound scanning and reporting of complications in monochorionic twin pregnancy …
>
> Whether there are systemic issues within the radiology service is outside my knowledge from the information provided. I have formed the view that the issues I identified in my previous report were more likely related to decisions made by [Dr B] than indicating deficient systems within the radiology service."

152. I am concerned that the radiology service provided a service carrying out a high-risk obstetric USS such as a third-trimester monochorionic-diamniotic twin pregnancy USS, without ensuring that its staff were adequately skilled in reporting on specialist obstetric USS. However, I note that HVDHB now performs all high-risk second and third trimester twin pregnancy USS in house, and I am pleased that the radiology service is integrating the new 2019 Ministry of Health NZ Obstetric Ultrasound Guidelines in its USS manual.

Opinion: Hutt Valley DHB — breach

Introduction

153. HVDHB provided obstetric and paediatric care to Mrs A and her babies on 22 Month1 when her twins had to be delivered prematurely.

154. Mrs A was admitted to Hospital 1 around 7.15pm on 22 Month1, as she had right-sided abdominal pain and was vomiting. Following her arrival, Mrs A was seen by Dr C. Dr C did not diagnose TTTS initially, as she was relying on the radiology report from Dr B undertaken three days earlier, which did not identify any concerning signs of TTTS.

155. Dr C planned to transfer Mrs A to Hospital 2, but was concerned about the FHR of both twins, and performed a USS and noted obvious TTTS. Dr C decided that an urgent C-section needed to be done at Hospital 1. Dr C and Dr D undertook the C-section at 10pm, and Twin 1 was born at 10.10pm. Twin 1 was floppy with no heartbeat, and required immediate resuscitation. Twin 1's Apgar score was 2 at 1 minute and 4 at 10 minutes. Twin 2 was born at 10.12pm with an Apgar score of 7 at 1 minute and then 9 at 5 minutes.

Policy on availability of paediatric consultant

156. Dr L, a paediatric registrar, and Dr E, a paediatric senior house officer, were present at the delivery. Dr L resuscitated Twin 1, who was in a critical condition, and Dr E was responsible for the care of Twin 2. No paediatric consultant was present on site until Dr F arrived at the Delivery Suite around 10.17pm. When Dr F arrived, Dr L had already made a first attempt to intubate Twin 1, but this did not result in improved ventilation.

157. The HVDHB's "Emergency Move to Theatre Caesarean Section Policy" or "Guidelines for Seeking Senior assistance with Neonatal resuscitation" do not provide details about when to seek the paediatric team's involvement. HVDHB's "Guidelines for Seeking Senior assistance with Neonatal resuscitation" (July 2014) did not include "Category 1 'crash' GA caesarean sections" and "premature twins" as scenarios requiring paediatric RMOs to contact a paediatric consultant. These two scenarios were added to the Guidelines in September 2019.

158. Expert advice was obtained from Dr David Montgomery, a paediatrician, who advised:

> "There should be a policy which emphasises the requirement for communication with the paediatric service at the earliest opportunity, and at a senior level … The policy in place at the time of this emergency did not adequately address the importance of having the consultant paediatrician present at the delivery of a very high risk infant … in my opinion the policy should have ensured that the consultant paediatrician was contacted immediately after the Category 1 Caesarean Section had been declared …"

159. Dr Montgomery also advised:

> "The majority of paediatricians would disapprove of the lack of a clear organisational policy regarding the communication process for category 1 Caesarean Section, and the lack of clear guidance as to when the consultant paediatrician is required to be present."

160. I accept Dr Montgomery's advice. I am critical that HVDHB's policies at the time did not encapsulate the importance of having a consultant paediatrician at the delivery of a very high-risk infant. As a result, no paediatrician consultant was present until Twin 1 was 7 minutes of age. I acknowledge that the policies have been updated since this event.

Preparation of operating theatre and equipment failure

161. The operating theatre was not prepared for a twin birth. The Theatre Coordinator said that she was not informed that the theatre was required for a twin birth and, as a result, a small theatre room was used instead of a larger one, and a second resuscitaire had to be brought to the theatre room just before the babies were born. Because of the way the room was set up, one resuscitaire had to be connected to a portable incubator, while the other resuscitaire was connected to the wall.

162. HVDHB told HDC that it does not know who called the Theatre Coordinator, but it advised that the issue with communication was attributed to the lack of a rostered Maternity

Coordinator 24 hours a day. Dr F said that she was not involved with the preparation and the set-up of the operating theatre.

163. Dr Westgate advised:

> "This scenario is understandable if the labour ward was very busy when the call for the emergency CS occurred. It might have been that the only person free to call theatre was someone not involved in the case."

164. Dr F undertook the third attempt to intubate Twin 1, and at this time Dr L checked the oxygen connections and realised that at some point the oxygen from the transportable incubator had either not been tuned on or had been turned off. The oxygen cylinder was then turned on, and immediately Twin 1's oxygen saturations improved to 60% at 12 minutes of age.

165. Dr Westgate advised:

> "[P]reparation of the resuscitation equipment was not at the required standard. This was due to a combination of systemic issues which seem to me to be attributable to multiple factors unique to Hutt Valley DHB. I have not encountered a similar sequence of events elsewhere. This is a very serious departure from an appropriate level of care."

166. Dr Montgomery advised: "The communication with the operating theatre supervisor was inadequate … The departure from the standard of care is significant."

167. Dr Montgomery also referred to the ANZCOR standard, which noted that there should be access to a source of oxygen and medical air with an air/oxygen blender whenever the requirement for neonatal resuscitation is possible. He stated:

> "The failure to provide oxygen during the resuscitation of Twin I, who was severely compromised and bradycardic at birth, is a significant departure from accepted practice."

168. I accept Dr Westgate's and Dr Montgomery's advice. I am critical of HVDHB that the operating theatre was not prepared for a delivery of twins, and that initially the oxygen supply was not turned on for Twin 1's resuscitation. I note that this is also relevant to my earlier criticism that had a paediatric consultant been involved earlier, there would have been more senior clinical input into the preparation of the resuscitaires and the initial paediatric care. Nevertheless, I acknowledge that this was a very urgent clinical situation and, at the time, no paediatric consultant was present until Twin 1 was 7 minutes of age. I note that following this event HVDHB purchased a new resuscitaire and established new midwifery posts.

Use of size 2.0mm ETT

169. On the third attempt to intubate Twin 1, Dr F used a smaller size 2.0mm ETT that was available in the resuscitaire trolley. Dr F told HDC that she decided to use this size because

two previous attempts at intubation had failed. After the oxygen tank was turned on, Twin 1's oxygen saturations gradually improved to 81%, but did not rise further. Dr F said that by this stage the expected oxygen saturations would have been 90–100%. Dr F then called the Hospital 2 NICU and was advised that an ETT of 2.0mm was too small for a baby of Twin 1's size. Dr F agreed to wait for the Hospital 2 Neonatal Retrieval Team to arrive to change the ETT, as they were likely to place a new ETT for transport.

170. The Hospital 2 NICU arrived at around 10.45pm (when Twin 1 was 35 minutes of age). A larger ETT was inserted, and Twin 1's oxygen saturations improved to 90–100%.

171. Dr F accepted that the use of a size 2.0mm ETT was an error made under pressure. HVDHB said that size 2.0mm ETTs are no longer stored in the resuscitaire trolley.

172. Dr Montgomery advised:

> "It is worth noting that many hospitals no longer stock size 2.0mm tubes because they are generally unsuitable even for the smallest premature infants, and none of the current neonatal resuscitation guidelines in use in New Zealand recommend that 2.0mm tubes are stocked on resuscitaires … I recommend that size 2.0mm are no longer stocked and that Hutt Valley DHB's checklist should be revised accordingly …
>
> The use of size 2.0 mm ETT is a departure from the ANZCOR recommendations, which would recommend a 3.0mm ETT for a baby over 1kg."

173. However, Dr Montgomery also opined:

> "The decision to re-intubate her with a larger ETT needed to be balanced against the risks, including the risk of IVH with repeated attempts at intubation, and the other priorities at the time. With the imminent arrival of the NICU transport team, greater expertise at intubation was only minutes away. Therefore, the decision to defer reintubation until the NICU transport team arrived may have been reasonable under the circumstances."

174. I accept Dr Montgomery's advice. I am critical that HVDHB stored 2.0mm ETTs in the resuscitaire trolley, and that as a result of this, a size 2.0mm ETT was available to Dr F. However, I accept that although the size 2.0mm ETT was too small, the decision to leave it in place while waiting for the Hospital 2 Neonatal Team to arrive was reasonable. I note that Dr F used the smaller size ETT because Twin 1's oxygen saturations had not improved despite two intubation attempts. When Dr F made the decision to use the smaller size ETT, she was unaware that the oxygen tank had not been turned on.

Conclusion

175. I consider that at the time of the incident, HVDHB had several systemic issues, including the lack of appropriate policies, poor staff communication, and inadequate equipment set-up and use, which affected the care provided to Mrs A and Twin 1.

176. Overall, I am critical of the following:

a) HVDHB did not have appropriate policies in place to ensure early involvement of a paediatric consultant for an urgent or emergency birth, including a Category 1 C-section, and, as a result, no paediatric consultant was present until Twin 1 was 7 minutes of age.

b) The operating theatre was not prepared for a delivery of twins, and initially the oxygen tank on the portable resuscitaire was not turned on, and Twin 1 did not receive oxygen until she was 12 minutes of age.

c) A size 2.0mm ETT was stored in the resuscitaire trolley and, as a result, it was used for Twin 1's intubation.

177. I find that HVHB failed to provide appropriate care to Mrs A and Twin 1, and breached Right 4(1) of the Code.

Communication about adverse event — adverse comment

178. After this event, Dr C debriefed Mrs A immediately, and again six weeks after the event. Mrs A and Dr C also had a meeting with Dr F in Month6. Mrs A told HDC that she was first informed about the equipment failure issues at Twin 1's first paediatric appointment at Hospital 2 in Month5. She then saw Dr F in Month6, and it was at this meeting that she was told that there were issues with Twin 1's oxygen supply.

179. HVHB told HDC: "In retrospect the hospital's communication with the family was inadequate. We apologise for the distress this has further created for the family."

180. Dr Montgomery advised:

> "The disclosure meeting with the family took place in [Month6], over four months since the birth of the twins. The ideal time to conduct this meeting would have been a lot earlier."

181. I acknowledge that Dr C did discuss the adverse event with Mrs A immediately and again six weeks after the incident. However, it appears that the issue of the oxygen supply was not explained to Mrs A fully until Month6. I am critical of HVDHB that this issue was not disclosed to Mrs A earlier.

Opinion: Dr C — adverse comment

182. Dr C provided private LMC antenatal care to Mrs A, and was the obstetrician consultant who cared for Mrs A on 22 Month1.

Urgent event management on 22 Month1

183. On 22 Month1, Mrs A was admitted to Hospital 1 as she was suffering from abdominal pain.

184. Dr C did not document the possible cause of Mrs A's abdominal pain. Dr C told HDC:

> "[W]ith respect to the investigations to identify the cause of abdominal pain, I requested FBC, U&E, LFT and CRP to exclude PET/HELLP and cholecystitis or other causes of pain."

185. However, Dr C did not note her treatment plan in the notes.

186. Dr Westgate advised:

> "Based on the clinical notes I am unable to advise whether [Dr C's] management of [Mrs A's] acute presentation was or was not acceptable standard … I remain of the opinion that [Dr C's] clinical notes relating to the acute admission were below an acceptable standard. I fully appreciate the complexities of the situation and in my view this adds to the importance of careful clinical note keeping."

187. HVDHB also sought advice from Dr J, Chief Medical Officer of DHB2, who advised that he agrees with Dr C's approach on the day.

188. Given the lack of documentation, I am unable to make a finding on whether the management by Dr C on 22 Month1 was appropriate. I acknowledge Dr J's comment that he agrees with Dr C's approach, and I accept that this was an urgent situation. However, I remain critical of Dr C's poor documentation.

Timing of C-section

189. All Dr C's clinical records on this day were untimed. Both Dr C and Dr D confirmed to HDC that an ambulance was called, but there is no documentation of this. The original CTG scan was unable to be reviewed, as the light-sensitive ink had faded.

190. Dr Westgate advised:

> "[T]he lack of both adequate contemporaneous notes and a CTG record means that I am unable to determine if there were clear indications that delivery by CS was warranted at any stage before [10pm]."

191. Dr Westgate also stated: "I am able to confidently state that once the decision was made that a 'crash' CS was required the response time was very quick."

192. I accept Dr Westgate's advice and, given the lack of clear documentation and no CTG record, I am unable to make a finding about whether there was a delay in performing the C-section.

193. I acknowledge that the C-section response time was very quick. However, I am critical that Dr C did not document the timing of events in her notes. I remind Dr C that appropriate documentation provides an accurate reflection of clinical assessments and changes in clinical state, and ensures an accurate account of treatment, care planning, and delivery of care.

Recommendations

194. I note that since this event Dr B has ceased reporting on twin obstetric scans. I recommend that Dr B provide a written apology to Mrs A for the breach of the Code identified in this report. The apology is to be sent to HDC, for forwarding to Mrs A, within three weeks of the date of this report.

195. I recommend that the radiology service report back to HDC regarding the implementation of the changes stated at paragraphs 109–110 of this report, within four months of the date of this report.

196. I acknowledge that since these events, HVDHB has taken a number of steps to improve its systems. In response to my recommendations in the provisional opinion, HVDHB provided an apology letter to Mrs A and a detailed update on the steps taken to implement the external reviewer's recommendations. This is detailed at paragraph 125 above.

Follow-up actions

197. A copy of this report with details identifying the parties removed, except the experts who advised on this case and HVDHB, will be sent to the Medical Council of New Zealand, and it will be advised of Dr B's name.

198. A copy of this report with details identifying the parties removed, except the experts who advised on this case and HVDHB, will be sent to RANZCOG, the Ministry of Health, the Royal Australian and New Zealand College of Radiologists, the Medical Radiation Technologists Board, the Royal Australasian College of Physicians, the Health Quality & Safety Commission, and the Neonatal Encephalopathy Taskforce, and placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Appendix A: Independent advice to the Commissioner

The following expert advice was obtained from Dr Robert Sim:

"…

15 May 2019

…

Re: **Complaint: [Radiology service]**

HDC Ref: **18HDC00279**

Thank you for your correspondence of 2 April.

The Commissioner has sought an opinion on care provided by [Dr B], Radiologist, at the radiology service to [Mrs A] (NHI …) on 19 [Month1].

[Mrs A] was 28 weeks pregnant the time of ultrasound examination. The ultrasound examination was performed by [Ms H], and [Dr B] reviewed the images and provided the report.

I note [Mrs A's] wish to: *Get the full story of what happened at the birth of my [babies] and to have their full medical notes.*

The HDC has requested comment on:

1. The standard of [Dr B's] report on 19 [Month1].
2. Whether an early or repeat scan should have been suggested to [Mrs A] following the scan on 19 [Month1].
3. Any other matters in this case that you consider warrant comment.

Documents provided:

1. Letter of complaint dated …
2. [The radiology service's] response dated 25 March 2019
3. Statement from the sonographer, [Ms H] 25 March, 2019.
4. [Dr B's] response dated 26 March 2019.
5. Clinical records from [the radiology service] including ultrasound scan reports and PACS ultrasound images from [early in the pregnancy] to 19 [Month1], and sonographer worksheet from 19 [Month1].

   [The radiology service] 28 weeks 0 days
   [The radiology service] 12 weeks
   [The radiology service] 17 weeks 5 days
   [The radiology service] 20 weeks 0 days
   [The radiology service] 22 weeks 1 day
   [The radiology service] 24 weeks

[The radiology service] 26 weeks

6. Ultrasound report at 8 weeks 3 days gestation from [the ultrasound service]

Review:

I have reviewed the images of the examination of 19 [Month1], according to the HDC suggestion that mimic my usual working practice. I know the outcome of this pregnancy to be unfavourable, but have no further detail other than [the radiology service's] reference to reviewing twin-twin transfusion syndrome at subsequent radiologist and sonographer audit meetings.

My usual practice would require:

1. Review of the referral form.
2. Review of previous ultrasound reports, and if necessary PACS retrieval and review of images, for a scan performed by another radiology/ultrasound provider.
3. Assessment of the current ultrasound images.
4. Correlation with the sonographer's worksheet.
5. Assessment of growth by plotting biometric parameters on growth charts.
6. Provision of a report to the referrer for the examination.

I have determined this is a serial ultrasound scan on a monochorionic diamniotic (MCDA) twin … at 28 weeks gestational age.

I have also ascertained from the provided referral information that the patient [has a high BMI] based on the NZ Heart Foundation calculator and definition.

Previous sonographer worksheets were not provided for review.

A well established and nationally accepted protocol for assessment of monochorionic diamniotic twins is in place on the NZMFM website, and has been in routine use and acknowledged by radiology and ultrasound providers. The reference is attached, and an example of how this has been locally adopted at NWH Ultrasound, ADHB, is also appended.

The NZMFM website records that monochorionic twins are at high risk of complications including Twin to Twin Transfusion Syndrome (TTTS) and Twin Anaemia-Polycythaemia Sequence (TAPS), Selective Growth Restriction, and require detailed assessment on every occasion. TTTS develops in 10–15% of monochromic twins. It is noted the risk of fetal death is around three times higher for monochorionic than dichorionic twins after 24 weeks.

The parameters I expect to assess on this ultrasound scan for monochorionic diamniotic twins, at serial two weekly interval scans from 16 weeks, (or more frequently if requested by the clinician), are as follows:

1. Growth of each twin using head, abdominal and femur length measurements and the estimated fetal weight (EFW).
2. Assessment of the membrane between the sacs.
3. The deepest pocket of amniotic fluid in the amniotic sac for each twin.
4. Presence of fluid in the fetal bladder and stomach of each twin.
5. Umbilical artery PI for each twin.
6. Middle cerebral artery peak systolic velocity from 24 weeks for each twin.

These assessments are used to determine, if possible, early markers for twin to twin transfusion syndrome (TTTS) and other potential complications. Discordant amniotic fluid volumes are the initial findings.

Ultrasound imaging of this patient has clearly been technically difficult based on the recorded images. It is observed that if there were technical limitations imposed on the previous ultrasound image detail/resolution these have not been expressed in the preceding radiologists' reports.

The examination conducted on 5 [Month1] was demonstrably difficult as the patient has been examined on two different ultrasound machines, which is an uncommon occurrence and clearly an attempt by the sonographer to improve poor image detail, which is compromised. This I attribute to poor sound penetration due to obesity, unfavourable fetal position and reduced amniotic fluid volume around one fetus as the membrane is not seen between the two sacs.

The sonographer electronic worksheet records the study as *'suboptimal due to body habitus and f (sic)'*, and also records the examination status as *'incomplete'*. Middle cerebral artery Doppler assessment was not technically possible in Twin A. The sonographer worksheet also states *'unable to exclude fluid discrepancy between A and B'*, and also that *'on reviewing previous imaging the centiles seem to vary quite a lot from scan to scan'*.

The report I would write on 19 [Month1] would read as follows:

Indication: Serial two weekly growth scan in MCDA twins

Gestational age: 28 weeks 0 days based on … dating and early ultrasound ([the ultrasound service]) EDD …

Findings: Detail is compromised, despite scanning on two ultrasound scanners. This is attributable to a combination of obesity, fetal position and reduction in amniotic fluid volume in one sac. The dividing membrane is not identified on this examination and discrepant amniotic fluid volume in the two sacs is therefore suspected. Generous fluid is associated with Twin B, and reduced in Twin A. Both twins are recorded as active.

Fetal biometry:

Twin A (transverse)

BPD 57mm HC 250mm AC 228mm FL 52mm EFW 1027gm

Umbilical artery PI 0.81

MCA PSV 27.2cm/sec

Reduced amniotic fluid, with no measurable pocket of fluid, with suspicion this twin may be a stuck twin, trapped against the anterior uterine wall.

Fetal stomach seen. Fetal bladder not seen.

TWIN B (flexed breech, spine to the right)

BPD 64mm HC 263mm AC 236mm FL 51mm EFW 1108gm

Umbilical artery PI 0.93

MCA PSV unable to obtain due to technical factors

Deepest pocket of amniotic fluid is measured at greater than 8cm

Fetal bladder and stomach seen.

The single placenta is anterior and clear of the cervix.

Comment: Technically difficult examination.

Fetal growth based on these measurements appears satisfactory with 10% discordance in the estimated fetal weights (EFW). Twin A is suspected to be a stuck twin.

The dividing membrane is not seen, and there is now evident discrepancy in fluid volumes between the two sacs, as individual sac volumes and the membrane were readily identified as normal at 26 weeks. Fetal bladder not demonstrated in twin A. The umbilical artery PI for both twins is normal. The MCA PSV for twin A is normal at 0.81MOM. The MCA PSV for twin B could not be obtained for technical reasons.

Urgent specialist tertiary review is recommended, as -FTS is suspected on this examination.

Report phoned.

1. The standard of [Dr B's] report on 19 [Month1]

[Dr B's] report conclusion reads:

Ongoing viable pregnancy.

Slight reduction in growth with respect to 20 a bulging assessment is limited by short Imaging interval.

Normal overall amniotic fluid (see above comments) and Doppler.*

The observation referenced by asterisk in the report is:

** Overall amniotic fluid volume is normal and is difficult to exclude a liquor discrepancy between the two twins as the membrane is poorly seen.*

Note made of the transcription error in the report from [Dr B]: *Slight reduction in growth with respect to 20 a bulging assessment is limited by short Imaging interval.* This is open to correction but is taken to read:

Slight reduction in growth with respect to twin A. Assessment is limited by short Imaging interval.

A carefully written radiology report is important to guide the referring clinician's management decisions. In particular the conclusion/summary is pertinent, in which the radiologist's interpretation of the findings may be the only part of the report read by a clinician.

My view is that the performance difficulties associated with this scan, referenced by the sonographer in the worksheet, and also in her subsequent statement to the HDC in letter of 25 March 2019, are important and were not expressed in the written radiologist's report. It is always relevant to record technical limitations of a radiology examination which may compromise the diagnostic information obtained.

Neither was the concern regarding failure to visualise the membrane and consequent inability to exclude discrepant amniotic fluid volume in the two sacs as recorded by the sonographer on the worksheet, adequately emphasised in the radiology report and conclusion. The sonographer states on the worksheet that she is *'unable to identify the membrane between A and B today'*. Whilst the difficulty in identifying the membrane is referenced in the radiology report, it is incorrectly flagged in the report *'as the membrane is poorly seen'*.

What matters in MCDA twins is not the 'overall amniotic fluid volume', but the individual sac volumes expressed as deepest pockets. In the context of recognising TTTS, the difficulty in assessing a fetus and the dividing membrane between sacs, may relate to reduced amniotic fluid volume around one fetus which has the membrane more closely applied, with the fetus 'stuck' or close to the uterine wall. The fluid volume is increased in the second sac. This is demonstrated on this study.

Also relevant is review of the US examination at 26 weeks, in which the depth of amniotic fluid could readily be assessed in both sacs with identifiable membrane between the sacs. There is therefore a significant change in the two week interval.

Middle cerebral arterial flow could not be assessed with Doppler in Twin B. This was not noted in the body of the report or the conclusion. Dopplers were incorrectly referenced in the report conclusion as normal rather than the cerebral Doppler of one twin not being assessed.

The report conclusion was not worded appropriately to alert the referring clinician to potential onset of TTTS.

It should be noted that individual amniotic sac fluid volumes may remain normal in TAPS with differing middle cerebral artery flow.

In summary the missing pieces of information in the radiology report were:

1. Adequate documentation of the technical limitations of the study, noting that obesity contributes to reduced detail.
2. Failure to appreciate that one twin has reduced fluid and appears stuck.
3. Failure to visualise the dividing membrane is due to discrepant amniotic sac fluid volumes.
4. Middle cerebral artery Doppler flow in one twin (sometimes this measurement cannot be obtained for technical reasons, and long ultrasound dwell times are discouraged because of potential thermal effects).
5. Lack of visualisation of fetal bladder in Twin A.

The report fails to make important observations, with a conclusion that, apart from being marred by a transcription error, does not adequately signal the critical change in amniotic fluid volume in the two twin gestational sacs which has occurred since the previous examination two weeks earlier.

The examination strongly suggests TTTS. This information should have been conveyed to the referring clinician in the written report and by phone.

[Dr B's] report, both the content and conclusion, represents a moderate departure from expected radiology reporting standard. My peers would also consider this a moderate departure from their standard of reporting, noting that they have a low threshold for considering the possibility of TTTS.

Whether an early or repeat scan should have been suggested to [Mrs A] following the scan on 19 [Month1]

Decisions on whether to immediately admit for hospital assessment, refer for immediate regional Fetal Medicine service assessment, or a short interval ultrasound scan are clinical ones for the referring clinician.

My personal approach would have been a phone discussion to discuss the findings of HS and my concerns with the referring clinician, advising immediate regional Fetal Medicine service evaluation.

Accordingly I believe that this represents a moderate departure from expected standards of communication of pertinent findings with the clinician. Immediate specialist obstetrician review was required. The need for further ultrasound in this context then becomes a clinical decision, not a radiologic one. My peers would share this view.

Any other matters in this case that you consider warrant comment.

The learning points from this review are:

1. Assessment of MCDA twins with serial 2 weekly ultrasound according to the protocol on the NZMFM website is important, as this is usually the only way for early detection of TTTS and TAPS.
2. Adherence to a sonographer protocol in scanning reduces the risk of unintentional omission of quantitative and qualitative components.
3. Use of a sonographer worksheet and adequate communication with the reporting/ supervising radiologist should reduce final radiology report errors. This is critical as it is usually only the sonographer who witnesses the study in real time.
4. Use of radiology reporting templates can assist in ensuring all data and important negatives are recorded. Use of PACs electronic worksheets linked to draft radiology reports is well advanced in obstetric ultrasound reporting in an attempt to improve report content and reduce transcription errors.
5. The importance of an accurate short summary/conclusion in the report with pertinent positives and negatives.
6. Suboptimal studies with technical limitations should be appropriately flagged to the clinician in the radiology report. This ensures clinical vigilance, and may signal the need for further or alternative short interval imaging, referral to secondary or tertiary care.
7. Obesity is well documented in the literature as adversely affecting resolution and detail in obstetric ultrasound examinations. With a [high BMI], this will have contributed to the poor detail in the examination.

This case suggests the reporting of a high risk monochorionic diamniotic twin pregnancy by a radiologist reporting outside his field of expertise, who did not recognise the interval change and significance of the findings, and was unaware of the need for strict adherence to recognised guidelines in ultrasound scanning and reporting of complications in monochorionic twin pregnancy.

References:

1. Brady Adrian P. Insights Imaging 2017 8: 171–182. Error and discrepancy in radiology: inevitable or avoidable.
2. Twin pregnancy ultrasound. ADHB Obstetric Ultrasound Protocol. Issued September 2010. Reviewed February 2019
3. Multiple Pregnancy. NZ Maternal Fetal Medicine Network guidelines — Multiple pregnancy-network/?solo=otherList&index=5”

Dr Sim provided the following further advice:

"…

26 October 2019

…

Re: **Complaint: [Radiology service]**

HDC Ref: **18HDC00279**

Thank you for your correspondence of 21 October.

The Commissioner has sought advice following submission of further documents.

Documents provided:

1. [The radiology service's] response 15 October 2019
2. [Lawyer's] letter 18 October 2019
3. [Dr G's] report 12 October 2019
4. [Dr B's] response 17 October 2019

The Commissioner has asked whether these documents cause me to amend the conclusions in my previous advice or make any additional comments.

Comment is also requested on:

1. Whether overall the departures from the standard of care in this case are attributable to any systematic issues at [the radiology service] or to a particular clinician.
2. Any further comments or amendments to my initial advice following [Dr B's] response.
3. [Dr G's] report, in particular, but not limited to, a response to his comment that:
   a. The sonographer's notes and comments about liquor volume, fluid within the fetal bladder, Doppler measurements and AC measurement made it less likely for [Dr B] to identify and raise these issues;
   b. On viewing the images and the sonographer's report, [Dr G] would have likely recalled the patient for further imaging, but he would not have concluded that this was likely TTTS;
   c. [Dr B's] conclusions fall within the standard that would be expected;
   d. I had more exposure to pregnancy ultrasound and I would have seen all manifestations of twin-to-twin transfusion while [Dr B] and [Dr G], who are general radiologists, would have a reduced exposure to pregnancy ultrasound
4. Any other matters in this case that I consider warrant further comment.

Reflecting on the documents and correspondence does not cause me to change my previous advice.

In response to the request I offer the following:

I note the reference to my background as having subspecialty interest in the radiology of obstetrics and gynaecology, and not being a suitable peer. My experience includes 30 years' association with a tertiary referral centre in this field and community based experience as a general radiologist.

The assertion that I have more experience than [Dr B] and [Dr G] in obstetric ultrasound and seen more manifestations of TTTS is accepted. This has not disqualified me from contributing to activities which might improve the quality of obstetric ultrasound. This includes providing advice to the HDC. Working with colleagues/peers who report obstetric ultrasound, but for whom it is not their subspecialty area, provides a perspective and knowledge of what is reasonable.

My community based colleagues have varied areas of subspecialty expertise also. In the context of community based radiology reporting we all have a widely varied case mix, and examinations are readily discussed, shared, assigned to and reported by radiologists with appropriate knowledge and interest when there are issues of uncertainty, complexity or specific requirements. These are the peers I have chosen to reference in my advice.

Whether there are systemic issues within [the radiology service] is outside my knowledge from the information provided. I have formed the view that the issues I identified in my previous report were more likely related to decisions made by [Dr B] than indicating deficient systems within [the radiology service].

It is common practice for radiologists to consult their colleagues when there is uncertainty in formulating reports in areas outside their areas of expertise as noted above. Given that [Dr B] was reporting a serial examination in a monochorionic diamniotic twin pregnancy, with findings previously described, and with his own acknowledgement that he had never previously diagnosed TTTS, it is surprising and of concern that he did not discuss the ultrasound examination with a colleague within [the radiology service].

It is possible that bias was introduced to [Dr B] by the sonographer's worksheet, but collectively the comments indicated uncertainty in a scan compromised by increased BMI, in which the scan was described by the sonographer as incomplete, and with an inability to exclude fluid discrepancy between the twins, or obtain all Doppler values. It is my view that the worksheet content should have alerted [Dr B] that this case required particularly careful review.

I have reflected on the effort made by the sonographer in an attempt to obtain diagnostic quality images, which included examining [Mrs A] on two different ultrasound machines, and the content of the worksheet. As noted previously

communication between sonographer and supervising/reporting radiologist reduces error. I am unclear from [Dr B's] commentary whether dialogue occurred between the radiologist and sonographer at the time of the scan. This seems unlikely. Within my work environments, both in hospital and a multi branch community based radiology practice, the expectation would be for this to have happened.

One of the advantages of PACS based networks is the ease with which images can be shared and the ability to solicit further opinions and advice amongst radiologists.

Indeed on review [Dr G], a recognised peer, indicated he would have recalled [Mrs A] for further ultrasound examination 'perhaps with a different sonographer and also a different radiologist's assessment' to attempt to complete the examination and clarify uncertainty.

[Dr B's] conclusion to the report does not fall within the expected standard.

[Dr G] provides a perspective and commentary on changes over his working life in the performance of obstetric ultrasound, the interaction amongst sonographers and reporting radiologists and their experience which 'has reduced over time'.

I am in agreement with [Dr G] and note that radiologists are required to have oversight, skill and knowledge in obstetric ultrasound. Total reliance on the sonographer's worksheet, without critical review of the archived ultrasound images and poor obstetric ultrasound reporting is an increasingly recognised problem.

I note [Dr B] records that he has, 'read widely about multiple pregnancies and twin-twin transfusion … and now avoid reporting twin pregnancies'. I would encourage him to use and enhance this knowledge, and continue to seek the advice of a colleague, when appropriate, to which he also refers.

I also strongly commend the imminent Ministry of Health NZ Obstetric Ultrasound Guidelines which are referenced by [the radiology service]. These have been formulated with considerable input and editorial oversight from a radiologist who works within [the radiology service].

Yours sincerely

Robert Sim
Radiologist"

Dr Sim provided the following further advice:

"Re: **Complaint: [Radiology service]**

HDC Ref: 18HDC00279

Thank you for your email of 29/06/2020 and attached further correspondence dated 18/6/2020 from [Dr G] on behalf of [Dr B], which you have asked that I review.

I have read [Dr G's] further comment, which has not changed my previously expressed view.

I make the following observations:

1. Obstetric ultrasound scans require radiologist oversight according to Section 88 Maternity Services notice.

2. In my earlier review I deliberately did not reference the Quintero classification and outcomes as it adds another layer of complexity. The observation by [Dr G] regarding management and outcome of Quintero stage 1 TTTS is not relevant to this missed opportunity to diagnose TTTS by ultrasound.

3. The scanning protocol for MCDA twins with two weekly intervals provides the opportunity to assess interval change by comparing with the previous examinations. In this case changes in liquor volume from the US scan at 26 weeks on 5 [Month1] is sufficient to have raised concern regarding potential TTTS.

4. There were clear indications of sonographer uncertainty that should have alerted [Dr B] and why total reliance on a sonographer worksheet was inappropriate, as referenced previously. These include the sonographer describing the study as '*suboptimal due to body habitus and ƒ (sic),'* noting the examination status as '*incomplete*,' and stating '*unable to exclude fluid discrepancy between A and B,*' and '*on reviewing previous imaging the centiles seem to vary quite a lot from scan to scan.'* In addition review of the images identifies the examination of 19 [Month1] to have been performed on two different machines, an uncommon occurrence, which would have alerted a reporting radiologist.

5. I believe there were sufficient reasons to indicate uncertainty and concern and for [Dr B], who has acknowledged his inexperience in assessment of twins by ultrasound, to consult with colleagues, before issuing a report.

Yours sincerely

Robert Sim"

Appendix B: Independent advice to the Commissioner

The following expert advice was obtained from Dr Jennifer Westgate:

"18 April 2019

…

Hutt Valley DHB

C18HDC00279

Thank you for asking me to provide advice on this case. I am a Fellow of the Australian and New Zealand College of Obstetricians and Gynaecologists and am on their Expert Witness Register. I work as a general O&G Specialist and I provide medical opinions for the ACC. I have no personal or professional conflict in this case.

I have read the documents you provided which are listed in your letter of instruction to me (dated 8 March 2019). I requested further information and on 16 April 2019 was provided with the following 5 documents:

1. Management of acute acute surgery Policy. Hutt Valley DHB.
2. Emergency Move to Theatre instructions. Hutt Valley DHB.
3. Retrospective note written by [Dr F] 23 [Month1]
4. Letter written by co-Clinical Head of Paediatrics at Hutt Valley DHB to HDC 21 May 2018
5. File note written by [Dr C] dated 14 [Month6].

Clinical Summary.

[Mrs A] became pregnant for the first time [in her twenties] in 2015 … A scan done [at] 8 weeks and 4 days of gestation (8w+4) showed a monochorionic diamniotic twin pregnancy (MCDA twins). This means the twins shared a placenta and had separate inner sacs (of the amnion membrane) but shared the outside sac (of the chorion membrane).

[Mrs A] was referred to the [Hospital 1] Antenatal Clinic and was seen there on [date]. She received information on MCDA twins and the need for secondary care. It was recorded that [Mrs A] had already done first trimester screening bloods and was already taking folate and iodine.

Her raised BMI … led to a recommendation for a Glucose Tolerance Test at 18 weeks gestation. A plan was made to review her in 3 weeks. However, [Mrs A] did not attend the next appointment as she had decided to book privately with an obstetric specialist as her Lead Maternity Carer. She was then cared for jointly by [Dr C] and [Dr D] who also held DHB specialist (SMO) appointments at the hospital.

[Mrs A] was first seen in the private antenatal clinic [at] 11 weeks of gestation. The Risk Factors noted for her pregnancy were:

1. …

2. MCDA twins

3. ? von Willebrands.

The notes show that [Mrs A] was given advice about twin pregnancies, their complications and timing of delivery at this visit.

[Mrs A] was seen more frequently than usual due to the increased risks associated with a MCDA pregnancy. Further visits occurred at 15 weeks, 17 weeks, 19 weeks, 23 weeks, 25 weeks and 27 weeks.

[Mrs A] had ultrasound scans at 12 weeks, 17 weeks, 20 weeks, 22 weeks, 24 weeks, 26 weeks and 28 weeks of gestation. None of these scans reported evidence of TTTS. The last scan report at 28 weeks noted that there had been a fall in growth velocity of the estimated fetal weight (EFW) of both twins compared to the scan at 26 weeks.

The scan report at 28 weeks (19 [Month1]) described overall normal liquor volume but no comment could be made about individual sac liquor volume as the dividing membrane was difficult to identify. The umbilical artery Doppler studies were reported as normal for both twins.

The other aspect of note in the antenatal visit records is that [Mrs A's] blood pressure (BP) was a little higher than usual at the booking visit. The record of her BP recordings and urine protein tests is as follows:

On 4 [Month1] at 26 weeks of gestation, [Mrs A] phoned the hospital to report abdominal pain present since the previous evening. She was asked to come in for assessment and arrived at 1150 hours. Her BP was 125/86 mmHg, a cardiotocograph (CTG) recording of the twins' fetal heart rates (FHR) was commenced. [Dr D] was phoned and came to review [Mrs A] at 1245. He recorded [Mrs A's] symptoms and the results of an abdominal and vaginal examination. He described the CTGs as being satisfactory. He recorded that his impression was that [Mrs A's] discomfort was due to constipation/bowel pain, gave her advice about oral fluids and prescribed her lactulose. [Mrs A] was seen in the antenatal clinic 8 days later on 12 [Month1]. No mention of abdominal pain was made in the notes of that visit.

On 22 [Month1] at 28w+4 days gestation [Mrs A] again phoned the Delivery Suite of the hospital to advise that she had right sided pain. She had already called [Dr D] who advised her to go to the hospital. She arrived at 1915 hours.

The midwifery staff recorded that [Mrs A] had right sided abdominal pain for two days and had vomited 'all day' on 22 [Month1]. Her pain score was 7/10. She had not had a bowel movement for some days and had used the lactulose. She reported that her

fetal movements had not changed; the left twin usually moved less than the right. The midwives attending to her were unable to obtain a CTG recording of the FHRs of either twin. It was noted that this was due to the fact that [Mrs A] was very uncomfortable and did not like having the transducers on her abdomen. [Mrs A] had a BP of 110/74, a pulse rate of 89/min and was afebrile. [Dr C] was phoned and requested that an intravenous line be inserted and bloods be taken from [Mrs A] for pre-eclampsia tests.

[Dr C] made an untimed entry in the clinical notes following the midwifery entry. She noted that the CTG was very difficult to obtain and that twin 1 had a FHR variability of 5–10 beats while twin 2's variability was 15 beats. Baseline 140–150. [Dr C] wrote:

'??indicative of fetal compromise ? TTTS'

She requested steroid administration to [Mrs A] and rang [Hospital 2] to arrange transfer to [Hospital 2] as [Hospital 1] only had a Level 2 Special Care Baby Unit (SCBU) which catered for babies from 32 weeks up. The CTG was continued during this time.

In a retrospective note written on 16 [Month5]. [Dr C] recorded that she also asked [Dr D] to come in to see the CTGs (2040–2050) and he agreed that the pattern was suspicious/pathological and that [Mrs A] should be transferred to [Hospital 2].

The time that the decision to transfer [Mrs A] was made is not recorded. However, [Dr C] must have charted antenatal steroids close to this time. The notes show that these were administered at 2035. [Dr C] also said that she had already spoken to [Hospital 2] to arrange the transfer by the time [Dr D] attended. Based on this assumption it seems likely that referral to [Hospital 2] occurred around 2030 to 2040.

On 22 [Month1] [Dr C] recorded (page 45 Hutt Valley DHB notes) that while waiting for the ambulance, the FHR variability reduced to 3 to 5 bpm and was difficult to interpret. She noted that the FHR variability between 'twin A and B' was different and also different to the CTG done two weeks earlier. She then performed an ultrasound and noted that it was difficult to see the fetal heart for twin B and the head seemed squashed. She suspected TTTS. In view of the fact that the twins were difficult to monitor and the CTG was suspicious to non-reassuring it was not safe to transfer [Mrs A] to [Hospital 2] and the babies required delivery by urgent CS.

[Dr C] wrote (page 41 Hutt Valley DHB notes) that she had difficulty finding the FHR for [Twin 2] on scan and noted that this was the twin with the 'reassuring f'. It is possible that she was going to write fh or fhr for fetal heart/rate.

A retrospective note written by a midwife later that evening gave the following timeline of events:

1940 iv line in and bloods taken

1955 75 mg pethidine given as an intramuscular injection (imi)

2005 10 mg metoclopramide given

2035 dose of Betamethasone administered (to assist with fetal lung maturation)

End of retrospective note

2200 Code 4 called for a 'crash' caesarean section. [Dr C] unable to find second twin FHR on CTG or ultrasound.

In a letter to the HDC written on 10/5/18, [Dr C] provided further details of the events of that evening. She explained that twin 1 had poor FHR variability but twin 2 was OK. While waiting for the ambulance to arrive the FHR of twin 1 deteriorated and then could not be recorded. She did a bedside scan and saw evidence of obvious acute TTTS:

[Twin 1] had a large amount of fluid and was bradycardic (had a low FHR)

[Twin 2] was stuck in the right upper quadrant and was difficult to see.

As a result she had to call for a crash caesarean section.

No CTG records were included in the notes sent to me. [Dr C] reported in her 10/5/18 letter that the CTGs had been recorded on light-sensitive paper and the recording had faded so much over time that they were now unreadable.

[Mrs A] had an emergency section under general anaesthetic. [Dr D] assisted [Dr C]. [Twin 1] was delivered at 2212 and [Twin 2] at 2214.

No operation note was included in the hospital notes sent to me. In her letter of 10/5/18 [Dr C] reported that at the time of the operation TTTS was confirmed as twin 1 had polyhydramnios (a large volume of amniotic fluid) and twin 2 had no amniotic fluid and was smaller and pale.

The paediatric registrar and Senior House Officer (SHO) were present for delivery. The paediatric specialist (SMO) on call was phoned to attend and arrived in the theatre at 2217.

[Twin 1] was born floppy with no heart rate. She was resuscitated by the registrar. Her Apgar scores were 2, 2 and 4 at one, five and ten minutes. She weighed 1076 grams. [Dr F], the attending paediatric SMO summarised the events of the resuscitation in her letter to the HDC dated 6/6/18. [Twin 1] was resuscitated with chest compressions and bagging but little improvement was noted. She was intubated by the registrar but no chest wall movement was noted. This indicates that the lungs were not being inflated and usually suggests that the endotracheal tube is not correctly sited. [Dr F] arrived at this stage. She supervised a second intubation but again there was no improvement in [Twin 1's] condition.

[Dr F] then performed the third intubation but used a smaller tube and rearranged the tubing so that gas flow was not dependent on the tubing from oxygen supply. She was able to get both chest wall movement but no improvement in saturations. At this point the registrar checked the oxygen tubing and discovered that the oxygen was not turned on or had been on but was subsequently turned off. The registrar turned the

oxygen on and there was an immediate improvement in [Twin 1's] condition. Her oxygen saturations rose to 60% her heart rate rose and was over 100bpm by approximately 12 minutes of age. However, her oxygen saturations were still lower than expected. A catheter was inserted in one of [Twin 1's] umbilical vessels and fluid and blood were given, and artificial surfactant was administered through the endotracheal tube to help her lungs function better. [Twin 1's] saturations improved to 81%. Telephone advice was obtained from the neonatal specialist at [Hospital 2] who advised that it was unlikely that [Twin 1's] saturations would increase further as the endotracheal tube had a small diameter (2 mm). The [Hospital 2] retrieval team arrived when [Twin 1] was approximately 35 minutes of age and as part of their preparations for transfer, [Dr F] reported that they replaced the endotracheal tube with one of a standard size for [Twin 1's] age.

[Twin 2] was born in a good condition with Apgars of 7, 9 and 9 at one, five and ten minutes. [Twin 2] weighed 802 grams. [Twin 2] required only CPAP to help [with] breathing after birth. [Dr F] noted that a cord blood gas sample taken from [Twin 2] was incorrectly logged in the hospital system as coming from [Twin 1]. The paper result was filed in [Twin 2's] notes despite being recorded as from [Twin 1]. [Dr C] had written on the paper print out that despite the label, the result did come from twin 2. [Dr F] was very clear that the results of the cord gas were consistent with [Twin 2's] condition and not [Twin 1's] condition at birth. [Dr F] believes that no cord gas sample was taken (or could be taken) from [Twin 1].

[Dr F] noted that the set up in the theatre was unusual as a second Resuscitaire had been brought in to accommodate two babies. She also reported that both the theatre staff and the paediatric staff filed adverse event reports about these events. A critical incident meeting occurred on 16 [Month5]. [Dr F] and [Dr C] were present.

[Mrs A] has advised the Commissioner that a [Hospital 2] paediatrician had advised her that [Twin 1] had not received enough oxygen after birth and had a number of brain bleeds which placed her at risk of being paralysed. [Mrs A] reported that [Twin 1] had cerebral palsy but was 'doing well'.

[Dr F] advised the Commissioner that she and [Dr C] had met with the parents of [Twin 1] and [Twin 2] on 14 [Month6] to have a 'full and frank discussion' about the events related to their birth, the resuscitation and equipment difficulties. This discussion was documented in the notes by means of a File Note that [Dr C] dictated the same day. It does not appear that a letter summarising the discussion was sent to [Mrs A].

Response to specific questions.

1. The appropriateness of [Mrs A's] antenatal care prior to giving birth to the twins by [Dr C] and whether more consideration should have been given to the possibility of twin to twin transfusion syndrome.

1A. Antenatal care with respect to MCDA twin pregnancy.

Twin pregnancies in general carry risks of pre-term delivery, growth restriction of one or both twins, increased incidence of diabetes in pregnancy and hypertension in pregnancy and malpresentation. Twins who share a placenta (mono chorionic twins) have increased risk related mainly to the blood vessel connections within their shared placenta which can lead to an imbalance of blood supply. TTTS is the most well-known of such complications and occurs in 10 to 15% of all MCDA twins. TTTS can occur chronically or acutely and depending on the time course can result in a difference in fetal size and the amount of liquor volume around each twin. The recipient twin can experience complications due to fluid overload including strain on the fetal heart which affects its function and results in hemodynamic instability which can cause ischaemic and haemorrhagic events in the brain (Djaafri et al, 2017). Intrauterine death can also occur. If excessive amniotic fluid accumulates in the sac of the recipient twin, there is a high risk of preterm labour due to overdistension of the uterus.

Reference.
Djaafri F, Stirnemann J, Mediouni I, Colmant C, Ville Y. Twin to twin transfusion syndrome. What we have learned from clinical trials. Seminars in Fetal & Neonatal Medicine 22 (2017) 367e375

a. Expected antenatal information for [Mrs A] regarding her twin pregnancy.

We would expect a mother to be informed of the risks of twins and specifically MCDA twins, to be advised of the warning symptoms and signs of TTTS, preterm labour, symptoms of pre-eclampsia or alternations in fetal movements and to be aware of an overall management plan for her pregnancy.

Two copies of the private antenatal notes were provided to me; one was in the pdf file named 'Clinical Records from Hutt Valley DHB' (page 19 onwards). This copy of the notes was provided along with a letter from [Dr D] dated 28/9/15 (when [Mrs A] was 25 weeks of gestation) which advised the hospital that [Mrs A] should be booked for delivery under the private care of [Dr D] and [Dr C] as her obstetricians. The other copy of the private antenatal notes was in the pdf named 'Clinical notes provided by [Mrs A]'. There are three differences between the two versions of these notes:

1. [Mrs A's] provided version has a plan for management listed under the section entitled Risk Factors (page 2 of her version). The plan stated was:

Scan every two weeks

Delivery at 36–37 weeks.

In the DHB provided version there is no entry under the heading Plan.

2. [Mrs A's] provided version of her antenatal visit which on [date] has the following written after the comment 'Scan — MCDA twins':

'IUD Preterm, TTTS etc. Maternal hypertension diabetes. 2 weekly visits discussed.'

This information is not in the DHB provided version.

3. The last antenatal visit recorded in the DHB provided version was [at] 23w+1 whereas [Mrs A's] provided version has two further visits: [at] 25w and 12 [Month1] at 27 weeks.

In accordance with the HDC instructions I will comment on the two versions of the private antenatal notes available. There are two possible explanations for the discrepancy. One is that there were two different electronic copies of [Mrs A's] private notes saved at the private practice and the version sent with the booking notification did not contain the same information as in the other version which was given to [Mrs A]. The other option is that the comments present in [Mrs A's] version were added retrospectively to clarify what information was discussed with [Mrs A] but were not labelled as retrospective entries.

Both versions of the notes show that [Mrs A] was provided with some information about the risks and management of her twin pregnancy. [Mrs A's] version of the notes show details of risk factors discussed which included the possibility of TTTS. There is no record as to the advice [Mrs A] was given about symptoms which might suggest acute TTTS, preterm labour or pre-eclampsia and that she should report these immediately. It is possible that mention of these risk factors indicates that this information was given but not specifically recorded in the notes. The alternative is that advice about warning symptoms was not given. This would fall below an expected level of practice and the departure would be moderately severe. I believe that my peers would agree.

b. Expected frequency of ultrasound for MCDA twins.

The recommended management of MCDA twins in 2015 was to perform two weekly scans from 16 weeks of gestation looking for evidence of complications which include TTTS (RANZCOG 2014). [Mrs A] had scans at 17, 20, 22, 24, 26 and 28 weeks of gestation. This indicates that the risk of TTTS was recognised and regular scans were requested. Ideally, [Mrs A] should have had scans at 16 and 18 weeks as opposed to one at 17 weeks. I believe the departure from the recommended standard is minor.

Reference.
RANZCOG. Management of monochorionic twin pregnancy. C Obs 42. Last reviewed 2014.

c. Expected parameters assessed on ultrasound for MCDA twins.

The RANZCOG recommendations for scans of monochorionic pregnancies are as follows:

Ultrasound examination in monochorionic twins should include growth, amniotic fluid volume in each sac, bladder volume, umbilical artery and, (after 20 weeks) middle cerebral artery Doppler wave forms.

And:

Ultrasound should be undertaken by a centre with sufficient experience to recognise these complications and refer appropriately if they occur. (RANZCOG, 2014).

Most of [Mrs A's] scans appear to have been done in the community by [the radiology service] and were reported by different radiologists. None of the scans reported evidence of TTTS. The scan report at 28 weeks noted a fall-off in growth of both twins but stated that the dividing membrane between the sacs could not be identified. The report described that the overall amniotic fluid volume was normal but the liquor in each sac could not be assessed. Umbilical artery Doppler studies were normal but only twin 2 had middle cerebral artery doppler studies and bladder volume for either twin was not reported. [Mrs A] presented acutely with abdominal pain only a few days after the scan and before her next scheduled antenatal visit at 29 weeks of gestation.

The report of an inability to determine the liquor volume surrounding each twin is concerning. I do not know whether [Dr C] or [Dr D] saw the 28-week scan report prior to [Mrs A's] presentation on 22 [Month1] or whether they would only have seen the report at the time of the next scheduled antenatal visit. The scan report did not record any additional efforts to transmit this information to the specialists as had been done, for example, at the time of the 20 weeks scan. That scan ([20 weeks]] showed some discrepancy in fetal size and amniotic fluid volume and the report was both faxed to [Dr C's] private rooms and their clinic nurse was 'alerted'.

In her File Note of 14 [Month6] [Dr C] recorded that following [Mrs A's] delivery the ultrasound films of the scan done at 28 weeks of gestation were reviewed and it was found that there was evidence of TTTS which was not noted at the time; [Twin 1] had increased liquor volume [Twin 2] had very little surrounding liquor and her bladder could not be seen.

[Dr C] recorded that she told [Mrs A] of this error in the scan report within days of the delivery. [Dr C] recorded that as a result of these events, in future all MCDA twins would have their growth scans done at [Hospital 1] and not with private scan providers in the community.

Comment. If [Dr C's] File Note is correct, failure to recognise evidence of TTTS at the scan done at 28 weeks has had a significant impact on the management of [Mrs A's] pregnancy. Had the signs of TTTS been identified I expect that one of her obstetricians or at least their clinic nurse/midwife would have been notified by telephone as a matter of urgency. It is likely that [Mrs A] would have been reviewed by one of her obstetricians and referred to the materno-fetal medicine specialists at [Hospital 2] that day or the following at the latest. There she would have received further clinical and ultrasound assessment by a fetal medicine sub-specialist. Given the relatively late onset of TTTS at a gestation of 28 weeks, I believe that it is most likely that [Mrs A] would have been managed conservatively with admission to hospital, the administration of steroids to increase fetal lung maturity, possibly removal of some fluid from [Twin 1's] amniotic sac, and close monitoring of fetal condition. I am not sure this would have prolonged the gestation of the pregnancy further, but more

intense fetal monitoring could have resulted in a more timely recognition that CS delivery was required. This would have provided an opportunity to administer maternal magnesium sulphate prior to delivery to reduce the risk of neonatal intracerebral bleeding and the delivery would have been attended by senior paediatric staff with time for adequate equipment preparation.

1B. Antenatal management of chronic hypertension.

[Mrs A] had a number of risk factors for the development of hypertension and pre-eclampsia during her pregnancy:

— this was her first pregnancy

— she had a raised BMI

— she had a family history of hypertension

— she had a twin pregnancy

— her booking blood pressure (BP) of 136/83 was higher than usual for a woman of her age.

The relevant standard for assessment and management of hypertension in pregnancy are the guidelines published by the Society of Obstetric Medicine in Australia and New Zealand (Lowe et al, 2014).

Hypertension in pregnancy is defined as a systolic BP of 140 mmHg or above and/or a diastolic BP of 90 mmHg. If these levels are found before 20 weeks of gestation a diagnosis of chronic hypertension is made. Chronic hypertension carries a significantly increased risk of fetal growth restriction, pre-eclampsia and abruption.

At 19 weeks of gestation [Mrs A's] blood pressure was 153/87 mmHg. This BP fulfilled the definition for chronic hypertension. By 27 weeks of gestation her BP was 140/92 mmHg. The guideline recommends the following investigations and management for women with hypertension in pregnancy:

Ongoing investigation of women with hypertension in pregnancy

At each assessment following the detection of hypertension in pregnancy, the clinician should systematically review the woman's symptoms, examination, laboratory investigations and fetal wellbeing.

Further laboratory assessment of women with hypertension in pregnancy should be based on the following recommendations:

Table 2.

Chronic hypertension	*Assess for proteinuria**	*Each visit*
*Preeclampsia bloods***	*If sudden increase in BP or new proteinuria*	

**Urinalysis by dipstick followed by spot urine PCR if ≥1+ proteinuria (see Section 3.)*

*** FBC, Electrolytes and creatinine, LFT and coagulation studies only if indicated*

Given [Mrs A's] chronic hypertension and her significant risk factors for pre-eclampsia I would expect the antenatal notes to contain:

— Risk factors for her pregnancy to be updated to include hypertension with the attendant risks.

— Comment on the presence or absence of symptoms of pre-eclampsia at least at the 27-week visit when [Mrs A's] BP was 140/92.

— Comment on the presence of other signs which might suggest developing pre-eclampsia, for example the degree and location of oedema at the 27-week visit.

— A discussion about the symptoms and signs of pre-eclampsia and what to do should they occur at least once in the notes from 19 weeks onwards.

— Baseline blood and urine investigations at 19 weeks of gestation and repeat investigations at 27 weeks.

— Arrangements made for closer surveillance of [Mrs A's] blood pressure, at least after the 27-week visit.

I cannot find any mention of any concerns about [Mrs A's] blood pressure, or any of the expected observations, management and advice noted above. I believe failure to recognise and appropriately respond to [Mrs A's] hypertension falls below an accepted standard of care. I believe the departure is severe. I believe that my peers would agree.

Reference.
Lowe SA, Bowyer L, Lust K, McMahon LP, Morton MR, North RA, Paech M. Said JM. The SOMANZ Guideline for the Management of Hypertensive Disorders of Pregnancy. https://www.somanz.org/documents/HTPregnancyGuidelineJuly2014.pdf

1C. Antenatal management of raised BMI in pregnancy.

Raised BMI during pregnancy is associated with many increased risks. [Mrs A] has a long history of problems with her weight … However, her BMI at booking was still raised … Recommendations are that a discussion about the importance of avoiding excessive weight gain during pregnancy should occur and some idea of ideal weight gain for this BMI and a twin pregnancy documented.

I believe the departure from an accepted standard of care is mild and that my colleagues would agree.

References.
NZ Ministry of Health. NZ Guidelines for Healthy Weight Gain in Pregnancy, 2014.

RANZCOG Management of obesity in pregnancy, C-Obs 49, 2017.

1D Acute management of [Mrs A's] presentation at 28 weeks and 4 days of gestation.

[Mrs A] presented with moderately severe right sided abdominal pain (7/10 pain score) and vomiting. The most obvious differential diagnoses were:

1. Hypertensive related disorders such as sudden onset pre-eclampsia or an associated condition such as HELLP syndrome or acute fatty liver of pregnancy.
2. Pre-term labour, either simply due to a twin pregnancy or to over-distension of the uterus from TTTS.
3. An abruption — a bleed behind the placenta which usually causes abdominal pain and uterine activity.

When advised of [Mrs A's] admission and blood pressure (110/74) [Dr C] requested blood tests for pre-eclampsia be done while she came into the hospital. Her clinical notes were a brief history and a one-line record of her examination findings:

'OA soft, no tenderness'.

Given the clinical circumstances I would have expected a more detailed record of examination findings, for example, no tenderness over the liver, fundal height appropriate or bigger than expected (suggesting TTTS) for a twin gestation, fetal positions, was the uterus irritable, were contractions palpable.

There is no record of a vaginal examination being done to check for cervical change (after first taking a fetal fibronectin swab to assess the risk of preterm delivery).

[Dr C] gave no suggestions as to what might be causing [Mrs A's] abdominal pain which was severe enough to warrant the prescription of narcotic analgesia. She was concerned that the FHR appearances might reflect fetal compromise secondary to TTTS. The possibility of preterm labour secondary to TTTS distension of the uterus was not mentioned.

If [Dr C] was concerned about the FHR appearance and the possibility of TTTS, I wonder why she did not perform a bedside scan to check fetal lie and liquor volume and to ascertain the best location for the ultrasound transducers to record the FHRs at this time? In retrospect an earlier scan would have confirmed the diagnosis of TTTS and may have resulted in further consultation with [Hospital 2] and possibly even an earlier delivery by CS, thus allowing more time for preparation from a paediatric point of view. It seems that [Dr C] had the technical ability to perform such a scan as she reported her scan findings at the time further FHR changes were noted.

Finally, I note that none of [Dr C's] entries into the notes are timed.

In summary, I am concerned at aspects of [Dr C's] assessment and management of [Mrs A's] acute presentation at 28 weeks and 4 days gestation. Her clinical examination did not include a vaginal examination to check for cervical change, she

did not perform a bedside scan to aid recording of the FHRs and to assess liquor volume as part of her assessment and she gave no differential diagnosis for [Mrs A's] abdominal pain. I regard these departures from an accepted management as moderate and believe my peers would agree.

2. The timing of the decision to perform a caesarean section.

I am unable to assess the CTG records as they have faded too much. However, in retrospect it is likely that [Twin 1's] FHR pattern would have been abnormal as she was the recipient of a twin to twin transfusion which caused progressive deterioration in her myocardial function which resulted in a fall in her heart rate before the CS delivery and a very low heart rate after birth such that CPR was instituted. I am unable to assess whether her FHR pattern was sufficiently alarming that an earlier decision to perform a CS at [Hospital 1] should have been made. [Dr C's] description of the initial fetal heart rate patterns was limited to the variability of the FHR and the baseline rate, with no comment on the presence or absence of accelerations and decelerations. The variabilities noted (twin 1 FHR variability of 5–10 beats and twin 2 FHR variability of 15 beats) are much higher than variabilities usually seen at this gestation. [Dr C] wrote that she had difficulty interpreting the CTG and asked [Dr D] for his opinion. He did not write in the notes but [Dr C] indicated that he agreed with her assessment and management.

I am unsure as to why [Mrs A] was not transferred to [Hospital 2] by 2130. It seems to me that the need to transfer was decided by around 2030. As the transfer was for MCDA twins with an abnormal FHR at 28+weeks of gestation, I would have thought this required a 'red light and sirens' type of transfer. [Dr C] noted that transfer to [Hospital 2] would take 35 minutes. I do not know the logistics of ambulance transfers from [Hospital 1] to [Hospital 2]. I did request Hutt Valley DHB provide information about the time the ambulance was requested but this was not included in the information sent to me on 16 April, 2019.

[Dr C] advised that while waiting for the transfer to occur a further complication occurred with respect to monitoring of the FHRs. There appear to me to be two slightly different versions of the events:

1. In the clinical notes [Dr C] wrote in one place (p45 of pdf of Hutt Valley DHB clinical records) that the variability had reduced to 3–5 bpm. She did not specify which twin she was referring to. She recorded that on scan it was difficult to see the FHR on twin B which appeared squashed. No comment was made about twin A. On page 41 of the same pdf [Dr C] recorded that difficulty developed monitoring twin 2 (which previously had the reassuring FHR pattern) and she could not see the FHR on scan and the head of the twin looked squashed so she called for a crash CS. No comment was made about twin 1. The midwifery notes contained the comment that the crash CS was called because [Dr C] was unable to find the FHR of the second twin on CTG or USS (see lines 177–178 of this report).

2. In the report to the HDC [Dr C] wrote that while waiting for the ambulance twin 1's heart rate variability reduced and became absent and on scan twin 1 had a large amount of fluid surrounding her and her heart rate was bradycardic (slow) and twin 2 was stuck in the right upper quadrant and was difficult to see. As a result, she called for a crash CS.

In accordance with the instructions given to me I will provide advice on the alternative versions of the events noted. In my opinion, these different accounts could indicate one of two scenarios. The first option is that [Dr C] did not recognise the developing bradycardia of twin 1 at the time as her attention was focussed on the inability to hear or see the FHR of twin 2. It is possible that retrospective review of the CTGs at some point after the delivery allowed a more accurate interpretation of the changes seen and this was described in her letter to the Commissioner. If this is the case it may indicate that the decision to perform an emergency CS could have been made earlier than 2200. The second option is that at the time it was difficult to determine which twin was which and [Dr C's] references to twin 2 actually applied to twin 1 and/or in the pressure and urgency of the situation she did not accurately record the presence of a progressive bradycardia in twin 1 nor did she record the scan evidence of TTTS she reported retrospectively. It can be very difficult to scan twins and in a high stress situation of loss of one or both FHRs on the CTG recording, difficulty and confusion is understandable.

The time course of events between significant changes in the FHRs, the scanning by [Dr C] and the decision that CS was required just before 2200 is unknown. However, once the decision was made the response time was very quick. The call for a crash CS was made at 2200 and [Twin 1] was delivered at 2012.

In summary, the lack of a CTG record means that I am unable to determine if there were clear indications that delivery by CS was warranted at any stage before 2200 hours.

3. The preparation of the operating theatre, in particular the resuscitation equipment.

Both [Dr F's] letter and [Dr K's] reported that technical problems occurred with the oxygen supply to [Twin 1] during her resuscitation. The underlying reason given for this was that the theatre staff were not aware that the emergency CS was for twins. This seems to have had two consequences:

a. The usual theatre was used for the CS operation as opposed to a larger theatre which was used for twin CS deliveries. This meant that a second Resuscitaire (special table with equipment required for resuscitating newborn babies) was required but could not get close enough to connect to the theatre wall oxygen and air supply so its portable tank air and oxygen had to be used. Apparently, the configuration of the theatre also led to the second Resuscitaire tank oxygen supply being used to supply oxygen to the in-built Resuscitaire while the oxygen from the in-built Resuscitaire was used for the second Resuscitaire.

b. The need for a second resuscitaire was only realised very shortly before the operation. This resuscitaire was older, heavier and kept on the Postnatal ward one floor above the theatre. It had to be brought down quickly and thus there was very limited time to prepare it before the delivery of the first twin occurred.

The unfortunate result was that the oxygen cylinder on the second Resuscitaire was either not turned on or was inadvertently turned off before the first twin was delivered. This resulted in what appears to me to be a significant delay in providing oxygen to [Twin 1] during … resuscitation.

[Dr K] reported that an informal review of these events occurred within days and was followed by a formal review at a Critical Incident Meeting on 16 [Month5]. I have asked for but not been provided with the document released following that meeting.

[Dr K] reported that two key issues relevant to the technical problems in [Mrs A's] case were recognized:

a. the need to bring an older Resuscitaire down from the Postnatal ward.

b. the theatre and midwifery staff were not familiar enough with the location of equipment.

[Dr K] reported that in response to these events eventually a new Resuscitaire was purchased and four new midwifery posts have been established so that there is always a midwife 'on-call' who is specifically trained to attend all CS operations to assist paediatric staff with resuscitation, which presumably includes equipment set up.

Based on the information given by [Dr F] and [Dr K], preparation of the resuscitation equipment was not at the required standard. This is a very serious departure from an appropriate level of care. I believe that my colleagues would agree.

4. The appropriateness of care given to [Mrs A] during the delivery of the twins.

As far as I can tell from the information sent to me, the actual caesarean section to deliver the twins was uneventful and the care given to [Mrs A] was appropriate.

5. The incorrect recording of the cord blood gas sample by [Dr C].

Both [Dr F] and [Dr K] have commented on this matter and both agree that the cord blood gas sample from [Twin 2's] placenta was mislabelled as coming from [Twin 1]. [Dr C] is most unlikely to have taken the cord gas sample as she would have still been doing the operation.

Cord gas samples are usually taken by the midwife who attends theatre. [Dr C] seems to have realised that an error was made in labelling the sample and ensured that the result was placed in [Twin 2's] notes with an explanation of the error. Both [Dr F] and [Dr K] agree that the cord gas results were in keeping with [Twin 2's] condition and not with [Twin 1]. It is almost certain that no cord gas sample could be obtained from [Twin 1's] cord. This is not surprising given [Twin 1's] condition at birth.

In summary, [Dr C] has intentionally corrected an error made, most likely by another person, in labelling of a cord gas sample.

6. Please comment on the appropriateness of the policy and procedures at Hutt Valley DHB.

I requested and received the Hutt Valley DHB procedures for booking an urgent CS operation. In [Mrs A's] case the relevant document is entitled 'Emergency Move to Theatre for CS or postpartum haemorrhage.' Between the hours of 0800 and 2300 hours the following procedure applied:

a. The midwife or RMO phones [the emergency number] and advises the telephone operator that an emergency move to theatre is required.

b. The telephone operator connects the call to the Theatre Co-ordinator and the midwife or RMO briefs the co-ordinator on the case.

c. The telephone operator sends out an emergency message to a predetermined list of people that an emergency move to theatre is required.

d. The patient is moved to the operating theatre once the Theatre Co-ordinator has been advised of the details of the case.

e. An obstetric doctor calls the on-call anaesthetist directly via mobile phone.

The procedures described appear to have been followed and were clearly effective in quickly assembling the theatre and anaesthetic personnel so that delivery of the first twin occurred only 12 minutes following the emergency call to the operator.

In [Mrs A's] case both [Dr F] and [Dr K] have advised the Commissioner that unfortunately the Theatre Co-ordinator was not advised that twins were being delivered by CS. The consequences of this have been discussed in section 3 above. Presumably the person who made the call to the Theatre Co-ordinator was either not directly aware of the details of [Mrs A's] case and did not know she had a twin pregnancy, or they were not aware of that twin CS deliveries required additional planning and affected the choice of the theatre used for the operation. This scenario is understandable if the labour ward was very busy when the call for the emergency CS occurred. It might have been that the only person free to call theatre was someone not involved in the case, for example a student midwife or a private midwife writing up her notes following a delivery.

[Dr K] advised that the lack of communication was attributed to the lack of a rostered Maternity Co-ordinator 24 hours a day. If a Maternity Co-ordinator was present, that person would take the responsibility for liaising with the Theatre Co-ordinator. There must have already been some concerns about lack of a Maternity Co-ordinator as the CEO was advised that this was a problem in [Month3]. Steps have been taken to remedy this following [Mrs A's] delivery, but [Dr K] has advised that at the time of her letter, 24-hour cover had not yet been achieved. [Dr K] also advised that all CS deliveries now take place in a larger operating theatre.

In conclusion, the DHB does have specific instructions regarding steps to be taken to arrange an emergency CS. These were effective in achieving a delivery of the first twin within 12 minutes of the emergency call to the telephone operator. Unfortunately, the person who spoke to the Theatre Co-ordinator did not communicate that the delivery was for twins which affected the choice of theatre used for the operation and preparation of a second Resuscitaire.

7. Please advise if you consider any aspects of the care provided by [Dr D] warrants comment.

[Dr D] and [Dr C] shared the antenatal care of [Mrs A] so comments about the different versions of the antenatal records and apparent lack of action with respect to [Mrs A's] blood pressure changes relate to [Dr D] as well as [Dr C].

[Dr D's] management and clinical notes which relate to [Mrs A's] acute presentation with abdominal pain on 4 [Month1] are both well within an acceptable standard of care. He recorded the history, detailed his thorough abdominal and vaginal examination, provided a likely diagnosis, offered advice, and prescribed a laxative.

On 22 [Month1] [Dr D] reviewed the CTG recordings between 2040 and 2050 according to [Dr C]. He did not write in the clinical notes. [Dr C] stated [Dr D] agreed with her assessment and management. His failure to document his opinion in the notes is at the minor end of the scale. I cannot review the CTG recordings so it is impossible to determine if the CTG changes at that time were such that it should have been obvious at that stage whether urgent delivery was required or not. [Dr D] left the hospital following this review and did not see the subsequent CTG records.

He only returned to the hospital when he was called back to assist with the CS.

8. Any other matters you consider warrant comment.

There are no other matters which I consider warrant comment.

This concludes my report on this case. Please contact me by email if further comment or opinion is required.

Kind regards

Yours sincerely

Jenny Westgate MD, FRANZCOG
Honorary Associate Professor
University of Auckland"

The following further advice was received from Dr Westgate:

"5 December 2019

…

Hutt Valley DHB
C18HDC00279

Thank you for asking me to provide further advice on this case. I am a Fellow of the Australian and New Zealand College of Obstetricians and Gynaecologists and am on their Expert Witness Register. I work as a general O&G Specialist and I provide medical opinions for the ACC. I have no personal or professional conflict in this case.

I provided a report to the Commissioner in April 2019 based on the documents provided which are listed in your letter of instruction to me (dated 8 March 2019) and the following five documents which I requested and were provided on 16 April 2019:

1. Management of Acute Acute Surgery Policy. Hutt Valley DHB.
2. Emergency Move to Theatre instructions. Hutt Valley DHB.
3. Retrospective note written by [Dr F] 23 [Month1]
4. Letter written by co-Clinical Head of Paediatrics at Hutt Valley DHB to HDC 21 May 2018
5. File note written by [Dr C] dated 14 [Month6].

On November 7, 2019 I received your request to comment on additional information provided in response to my report:

1. Hutt Valley DHB
2. [Dr F]
3. [Dr D]
4. [Dr C]
5. Expert Opinion for Hutt Valley DHB from [Dr J].

Given the number of issues involved, I have chosen to incorporate the information from the documents I received in a rewritten report.

Clinical Summary.

[Mrs A] became pregnant for the first time [in her twenties] in 2015 … A scan done [at] 8 weeks and 4 days of gestation (8w+4) showed a monochorionic diamniotic twin pregnancy (MCDA twins). This means the twins shared a placenta and had separate inner sacs (of the amnion membrane) but shared the outside sac (of the chorion membrane).

[Mrs A] was referred to the [Hospital 1] Antenatal Clinic and was seen there on [date]. She received information on MCDA twins and the need for secondary care. It was

recorded that [Mrs A] had already done first trimester screening bloods and was already taking folate and iodine … A plan was made to review her in 3 weeks. However, [Mrs A] did not attend the next appointment as she had decided to book privately with an obstetric specialist as her Lead Maternity Carer. She was then cared for jointly by [Dr C] and [Dr D] who also held DHB specialist (SMO) appointments at the hospital.

[Mrs A] was first seen in the private antenatal clinic [at] 11 weeks of gestation. The Risk Factors noted for her pregnancy were:

1. …
2. MCDA twins
3. ? von Willebrands.

The notes show that [Mrs A] was given advice about twin pregnancies, their complications and timing of delivery at this visit.

[Mrs A] was seen more frequently than usual due to the increased risks associated with a MCDA pregnancy. Further visits occurred at 15 weeks, 17 weeks, 19 weeks, 23 weeks, 25 weeks and 27 weeks.

[Mrs A] had ultrasound scans at 12 weeks, 17 weeks, 20 weeks, 22 weeks, 24 weeks, 26 weeks and 28 weeks of gestation. None of these scans reported evidence of TTTS. The last scan report at 28 weeks noted that there had been a fall in growth velocity of the estimated fetal weight (EFW) of both twins compared to the scan at 26 weeks.

The scan report at 28 weeks described overall normal liquor volume but stated that no comment could be made about individual sac liquor volume as the dividing membrane was difficult to identify. The umbilical artery Doppler studies were reported as normal for both twins.

The other aspect of note in the antenatal visit records is that [Mrs A's] blood pressure (BP) was higher than usual at the booking visit. The record of her BP recordings and urine protein tests is as follows:

Gestation (wk)	**BP (mmHg)**	**Urine protein**
11	136/83	n/a
15	n/a	n/a
17	132/82	negative
19	153/88	negative
23	144/87	negative
25	143/88	negative
27	140/92	negative

On 4 [Month1] at 26 weeks of gestation, [Mrs A] phoned the hospital to report abdominal pain present since the previous evening. She was asked to come in for

assessment and arrived at 1150 hours. Her BP was 125/86 mmHg, a cardiotocograph (CTG) recording of the twins' fetal heart rates (FHR) was commenced. [Dr D] was phoned and came to review [Mrs A] at 1245. He recorded [Mrs A's] symptoms and the results of an abdominal and vaginal examination. He described the CTGs as being satisfactory. He recorded that his impression was that [Mrs A's] discomfort was due to constipation/bowel pain, gave her advice about oral fluids and prescribed her lactulose. [Mrs A] was seen in the antenatal clinic 8 days later on 12 [Month1]. No mention of abdominal pain was made in the notes of that visit.

On 22 [Month1] at 28w+4 days gestation [Mrs A] again phoned the Delivery Suite of the hospital to advise that she had right sided pain. She had already called [Dr D] who advised her to go to the hospital. She arrived at 1915 hours.

The midwifery staff recorded that [Mrs A] had right sided abdominal pain for two days and had vomited 'all day' on 22 [Month1]. Her pain score was 7/10. She had not had a bowel movement for some days despite use of lactulose. She reported that her fetal movements had not changed; the left twin usually moved less than the right. The midwives attending to her were unable to obtain a CTG recording of the FHRs of either twin. It was noted that this was due to the fact that [Mrs A] was very uncomfortable and found it difficult to tolerate the pressure of the transducers on her abdomen. [Mrs A] had a BP of 110/74, a pulse rate of 89/min and was afebrile. [Dr C] was phoned and requested that an intravenous line be inserted, and bloods be taken from [Mrs A] for pre-eclampsia tests.

[Dr C] made an untimed entry in the clinical notes following the midwifery entry. She noted that the CTG was very difficult to obtain and that twin 1 had a FHR variability of 5–10 beats while twin 2's variability was 15 beats. Baseline 140–150. [Dr C] wrote:

'??indicative of fetal compromise ? TTTS'

In her letter of 27/8/19, [Dr C] provided further information that was not contemporaneously recorded in the notes and a more detailed account of events. She reported that after assessing [Mrs A] she checked the 28-week scan report (which she had not seen) on-line. She noted that the scan reported there was no evidence of TTTS. She watched the CTG for 40 minutes (total recording time by then was over 1 hour) and discussed with [Mr and Mrs A] that she was not happy with the appearance of the CTG pattern for twin 1 and was also not sure that there was time to transfer [Mrs A] to [Hospital 2]. She advised that she would ask [Dr D] to review the CTG. She also contacted the [Hospital 2] obstetrician and neonatologist on call to discuss a possible transfer to [Hospital 2] as [Hospital 1] only had a Level 2 Special Care Baby Unit (SCBU) which catered for babies from 32 weeks up. [Dr C] also requested a steroid injection be administered to [Mrs A] to assist fetal lung maturity. In her October letter [Dr C] reported that she made a second phone call to the obstetrician at [Hospital 2] when the heart rate variability of twin 1 reduced further. She shared her concerns that it might not be safe to transfer [Mrs A] as in reality the total time for transfer from [Hospital 1] to [Hospital 2] was usually around 1.5 to 2.0 hours even

though the actual travel time was only 15 to 20 minutes. I am unsure as to the timing of the second phone call.

In a retrospective note written on 16 [Month5] [Dr C] recorded that she also asked [Dr D] to come in to see the CTGs (2040–2050) and he agreed that the pattern was suspicious/pathological and that [Mrs A] should be transferred to [Hospital 2]. [Dr D's] letter of 10 October, 2019 stated that both he and [Dr C] felt there was time to transfer to [Hospital 2].

The time of these events is not recorded. However, the antenatal steroids requested by [Dr C] were administered at 2035. [Dr C] also said that she had already spoken to [Hospital 2] to arrange the transfer by the time [Dr D] attended. Based on this information it seems likely that referral to [Hospital 2] occurred around 2030 to 2040. In her August 2019 letter, [Dr C] indicated that the ambulance was probably called around 2040 to 2050 hours.

On 22 [Month1] [Dr C] recorded (page 45 Hutt Valley DHB notes) that while waiting for the ambulance, the FHR variability reduced to 3 to 5 bpm and was difficult to interpret. She noted that the FHR variability between 'twin A and B' was different and also different to the CTG done two weeks earlier. She then performed an ultrasound and noted that it was difficult to see the fetal heart for twin B and the head seemed squashed. She suspected TTTS. In view of the fact that the twins were difficult to monitor and the CTG was suspicious to non-reassuring it was not safe to transfer [Mrs A] to [Hospital 2] and the babies required delivery by urgent CS.

[Dr C] wrote (page 41 Hutt Valley DHB notes) that she had difficulty finding the FHR for [Twin 2] on scan and noted that this was the twin with the 'reassuring f'. It is possible that she was going to write fh or fhr for fetal heart/rate.

A retrospective note written by a midwife later that evening gave the following timeline of events:

1940 iv line in and bloods taken

1955 75 mg pethidine given as an intramuscular injection (imi)

2005 10 mg metoclopramide given

2035 dose of Betamethasone administered (to assist with fetal lung maturation)

End of retrospective note

2200 Code 4 called for a 'crash' caesarean section. [Dr C] unable to find second twin FHR on CTG or ultrasound.

In a letter to the HDC written on 10/5/18, [Dr C] provided further details of the events of that evening. She explained that twin 1 had poor FHR variability but twin 2 was OK. While waiting for the ambulance to arrive the FHR of twin 1 deteriorated and then could not be recorded. She did a bedside scan and saw evidence of obvious acute TTTS:

[Twin 1] had a large amount of fluid and was bradycardic (had a low FHR)

[Twin 2] was stuck in the right upper quadrant and was difficult to see.

As a result she had to call for a crash caesarean section.

In her August 2019 letter [Dr C] states that the indication for the CS was both that [Twin 1's] heart rate was becoming bradycardic (slowing down) and [Twin 2's] heart rate activity was difficult to see at all on the scan.

In his October 2019 letter, [Dr D] recalls being called back to the hospital 5 to 10 minutes after leaving as the CTG had deteriorated and an urgent CS was going to be done. Based on the Midwifery entry in the notes referred to earlier, the call for a crash CS occurred at 2200. [Dr D's] recall suggests that he was called back at around this time, which in turn suggests that he reviewed the CTG at around 2140.

No CTG records were included in the notes sent to me. [Dr C] reported in her 10/5/18 letter that the CTGs had been recorded on light-sensitive paper and the recording had faded so much over time that they were now unreadable.

[Mrs A] had an emergency section under general anaesthetic. [Dr D] assisted [Dr C]. [Twin 1] was delivered at 2212 and [Twin 2] at 2214.

No operation note was included in the hospital notes sent to me. In her letter of 10/5/18 [Dr C] reported that at the time of the operation TTTS was confirmed as twin 1 had polyhydramnios (a large volume of amniotic fluid) and twin 2 had no amniotic fluid and was smaller and pale.

The paediatric registrar and Senior House Officer (SHO) were present for delivery. The paediatric specialist (SMO) on call was phoned to attend and arrived in the theatre at 2217.

[Twin 1] was born floppy with no heart rate [and] was resuscitated by the registrar. [Twin 1's] Apgar scores were 2, 2 and 4 at one, five and ten minutes. [Twin 1] weighed 1076 grams. [Dr F], the attending paediatric SMO summarised the events of the resuscitation in her letter to the HDC dated 6/6/18. [Twin 1] was resuscitated with chest compressions and bag and mask ventilation but little improvement was noted. [Twin 1] was intubated by the registrar but no chest wall movement was noted. This indicates that the lungs were not being inflated and usually suggests that the endotracheal tube is not correctly sited. [Dr F] arrived at this stage. She supervised a second intubation but again there was no improvement in [Twin 1's] condition.

[Dr F] then performed the third intubation but used a smaller tube and rearranged the tubing so that gas flow was not dependent on the tubing from oxygen supply. She was able to get both chest wall movement but no improvement in saturations. At this point the registrar checked the oxygen tubing and discovered that the oxygen was not turned on or had been on but was subsequently turned off. The registrar turned the oxygen on and there was an immediate improvement in [Twin 1's] condition. [Twin

1's] oxygen saturations rose to 60% [and the] heart rate rose and was over 100bpm by approximately 12 minutes of age. However, [Twin 1's] oxygen saturations were still lower than expected. A catheter was inserted in one of [Twin 1's] umbilical vessels and fluid and blood were given, and artificial surfactant was administered through the endotracheal tube to help [the] lungs function better. [Twin 1's] saturations improved to 81%. Telephone advice was obtained from the neonatal specialist at [Hospital 2] who advised that it was unlikely that [Twin 1's] saturations would increase further as the endotracheal tube had a small diameter (2 mm). The [Hospital 2] retrieval team arrived when [Twin 1] was approximately 35 minutes of age and as part of their preparations for transfer, [Dr F] reported that they replaced the endotracheal tube with one of a standard size for [Twin 1's] age.

[Twin 2] was born in a good condition with Apgars of 7, 9 and 9 at one, five and ten minutes. [The baby] weighed 802 grams. [Twin 2] required only CPAP to help [with] breathing after birth.

[Dr F] noted that a cord blood gas sample taken from [Twin 2] was incorrectly logged in the hospital system as coming from [Twin 1]. The paper result was filed in [Twin 2's] notes despite being recorded as from [Twin 1]. [Dr C] had written on the paper print out that despite the label, the result did come from twin 2. [Dr F] was very clear that the results of the cord gas were consistent with [Twin 2's] condition and not [Twin 1's] condition at birth. [Dr F] believes that no cord gas sample was taken (or could be taken) from [Twin 1].

[Dr F] noted that the set up in the theatre was unusual as a second Resuscitaire had been brought in to accommodate two babies. She also reported that both the theatre staff and the paediatric staff filed adverse event reports about these events. A critical incident meeting occurred on 16 [Month5]. [Dr F] and [Dr C] were present.

[Mrs A] has advised the Commissioner that a [Hospital 2] paediatrician had advised her that [Twin 1] had not received enough oxygen after birth and had a number of brain bleeds which placed her at risk of being paralysed. [Mrs A] reported that [Twin 1] had cerebral palsy but was 'doing well'.

[Dr F] advised the Commissioner that she and [Dr C] had met with the parents of [Twin 1] and [Twin 2] on 14 [Month6] to have a 'full and frank discussion' about the events related to their birth, the resuscitation and equipment difficulties. This discussion was documented in the notes by means of a File Note that [Dr C] dictated the same day. It does not appear that a letter summarising the discussion was sent to [Mrs A].

Response to specific questions.

1. The appropriateness of [Mrs A's] antenatal care prior to giving birth to the twins by [Dr C] and whether more consideration should have been given to the possibility of twin to twin transfusion syndrome.

1A. Antenatal care with respect to MCDA twin pregnancy.

Twin pregnancies in general carry risks of pre-term delivery, growth restriction of one or both twins, increased incidence of diabetes in pregnancy and hypertension in pregnancy and malpresentation. Twins who share a placenta (mono chorionic twins) have increased risk related mainly to the blood vessel connections within their shared placenta which can lead to an imbalance of blood supply. TTTS is the most well-known of such complications and occurs in 10 to 15% of all MCDA twins. TTTS can occur chronically or acutely and depending on the time course can result in a difference in fetal size and the amount of liquor volume around each twin. The recipient twin can experience complications due to fluid overload including strain on the fetal heart which affects its function and results in hemodynamic instability which can cause ischaemic and haemorrhagic events in the brain (Djaafri et al, 2017). Intrauterine death can also occur. If excessive amniotic fluid accumulates in the sac of the recipient twin, there is a high risk of preterm labour due to overdistension of the uterus.

Reference.
Djaafri F, Stirnemann J, Mediouni I, Colmant C, Ville Y. Twin to twin transfusion syndrome. What we have learned from clinical trials. Seminars in Fetal & Neonatal Medicine 22 (2017) 367e375

a. Expected antenatal information for [Mrs A] regarding her twin pregnancy.

We would expect a mother to be informed of the risks of twins and specifically MCDA twins, to be advised of the warning symptoms and signs of TTTS, preterm labour, symptoms of pre-eclampsia or alternations in fetal movements and to be aware of an overall management plan for her pregnancy.

Two copies of the private antenatal notes were provided to me; one was in the pdf file named 'Clinical Records from Hutt Valley DHB' (page 19 onwards). This copy of the notes was provided along with a letter from [Dr D] [25 weeks of gestation] which advised the hospital that [Mrs A] should be booked for delivery under the private care of [Dr D] and [Dr C] as her obstetricians. The other copy of the private antenatal notes was in the pdf named 'Clinical notes provided by [Mrs A]'. [Mrs A's] copy of the notes understandably contains notes from antenatal consultations that occurred after the notes were sent to the hospital at the time of booking. There are two differences between the two versions of these notes prior to [23 weeks and 1 day of gestation]:

1. [Mrs A's] provided version has a plan for management listed under the section entitled Risk Factors (page 2 of her version). The plan stated was:

Scan every two weeks

Delivery at 36–37 weeks.

In the DHB provided version there is no entry under the heading Plan.

2. [Mrs A's] provided version of her antenatal visit which on 20/7/15 has the following written after the comment 'Scan — MCDA twins':

'IUD Preterm, TTTS etc. Maternal hypertension diabetes. 2 weekly visits discussed.'

This information is not in the DHB provided version.

In his October 2019 letter [Dr D] had no explanation for the two versions of the antenatal notes. In her August 2019 letter, [Dr C] stated that the extra material in the copy of notes that [Mrs A] provided was added to the notes after the notes were sent to the hospital. She stated:

It is not unusual practice for us to update/supplement the notes as the pregnancy develops.

Whilst it is true that Problem Lists, management options, and results of investigations may be updated throughout a pregnancy, in my experience it is not usual to add detail to consultations which occurred many weeks earlier. It is generally accepted that if information is added retrospectively to existing notes the additions should be dated and clearly identified as being added in retrospect (for example RCP, 2007).

Both versions of the notes show that [Mrs A] was provided with some information about the risks and management of her twin pregnancy. [Mrs A's] version of the notes show details of risk factors discussed which included the possibility of TTTS. There is no record as to the advice [Mrs A] was given about symptoms which might suggest acute TTTS, preterm labour or pre-eclampsia and that she should report these immediately.

In his October 2019 letter [Dr D] states that he was confident that he

discussed the risks of twin pregnancy, including TTTS, preterm labour, diabetes, hypertension/pre-eclampsia as we routinely did with all our pregnant mothers with twins. I noted this discussion in the notes of the first consultation — 'Discussed twin pregnancies: complications and timing of delivery'.

In her August 2019 letter, [Dr C] reported:

[Dr D] and I both discussed with [Mrs A] the risks and management of her twin pregnancy, including the risk of TTTS. TTTS or lack of it would have been discussed on every visit after every scan. While there are not always symptoms for acute TTTS, as part of my routine practice, I advise patients to avoid excess weight gain, report sudden weight gain or change in abdominal girth, headaches, visual disturbances or nausea, vomiting or right upper quadrant pain and to report these symptoms immediately. I also advise that acute TTTS may not have any symptoms.

Opinion.

Based on the information provided by [Dr D] and [Dr C] it does appear that [Mrs A] was informed of the risks of and management of her twin pregnancy, even though the notes as to what was discussed were brief.

It appears to me that [Dr C] has acknowledged that she made a retrospective entry in the notes of the antenatal consultation of [date] to add detail of the issues that were discussed. [Dr C] did not label the entry as being retrospective in nature, nor did she date the entry. The importance of making clinical notes as close as possible to the consultation or events is recommended (MCNZ, Good Medical Practice, 2016). The need to date and countersign any deletions or additions to notes is widely accepted as the appropriate practice. For example, it is one of the key recommendations of the generic medical record keeping standards published by the Royal College of Physicians in the UK. These were produced to assist compliance with Information Governance and NHS Litigation Authority (CNST) Standards. Failure to do so is unwise and always raises questions as to why the notes were amended. I believe that the issue of adding retrospectively to notes without indicating such is a departure from an accepted standard of practice and in this particular case would be regarded as mild to moderate by my peers.

RCP. Generic medical record keeping standards | RCP London 2007
https://www.rcplondon.ac.uk/projects/outputs/generic-medical-record-keeping-standards

Medical Council of New Zealand. Good Medical Practice, 2016
https://www.mcnz.org.nz/our-standards/current-standards/good-medical-practice/

b. Expected frequency of ultrasound for MCDA twins.

The recommended management of MCDA twins in 2015 was to perform two weekly scans from 16 weeks of gestation looking for evidence of complications which include TTTS (RANZCOG 2014). [Mrs A] had scans at 17, 20, 22, 24, 26 and 28 weeks of gestation. This indicates that the risk of TTTS was recognised and regular scans were requested. Ideally, [Mrs A] should have had scans at 16 and 18 weeks as opposed to one at 17 weeks. [Dr D] has advised that this was his intention but may not have been possible due to the workload of the scanning services. I believe the departure from the recommended standard is minor and has not adversely influenced [Mrs A's] care.

Reference.
RANZCOG. Management of monochorionic twin pregnancy. C Obs 42. Last reviewed 2014.

c. Expected parameters assessed on ultrasound for MCDA twins.

The RANZCOG recommendations for scans of monochorionic pregnancies are as follows:

Ultrasound examination in monochorionic twins should include growth, amniotic fluid volume in each sac, bladder volume, umbilical artery and, (after 20 weeks) middle cerebral artery Doppler wave forms.

And:

Ultrasound should be undertaken by a centre with sufficient experience to recognise these complications and refer appropriately if they occur. (RANZCOG, 2014).

Most of [Mrs A's] scans appear to have been done in the community by [the radiology service] and were reported by different radiologists. None of the scans reported evidence of TTTS. The scan report at 28 weeks noted a fall-off in growth of both twins. The report described that the overall amniotic fluid volume was normal but the liquor in each sac could not be assessed as the dividing membrane between the sacs could not be identified. Umbilical artery Doppler studies were normal but only twin 2 had middle cerebral artery doppler studies and bladder volume for either twin was not reported. [Mrs A] presented acutely with abdominal pain only a few days after the scan and before her next scheduled antenatal visit at 29 weeks of gestation. In her letter of August 2019, [Dr C] reported that she had not seen the scan report prior to [Mrs A's] acute admission on 22 [Month1].

The scan report did not record any additional efforts to transmit this information to the specialists as had been done, for example, at the time of the 20 weeks scan. That scan ([20 week]) showed some discrepancy in fetal size and amniotic fluid volume and the report was both faxed to [Dr C's] private rooms and their clinic nurse was 'alerted'.

In her File Note of 14 [Month6] [Dr C] recorded that following [Mrs A's] delivery the ultrasound films of the scan done at 28 weeks of gestation were reviewed and it was found that there was evidence of TTTS which was not noted at the time; [Twin 1] had increased liquor volume and [Twin 2] had very little surrounding liquor and [the] bladder could not be seen.

[Dr C] recorded that she told [Mrs A] of this error in the scan report within days of the delivery. [Dr C] recorded that as a result of these events, in future all MCDA twins would have their growth scans done at [Hospital 1] and not with private scan providers in the community.

Comment.

I have not seen any documentation which confirms [Dr C's] report that the scan report was inaccurate although I have no reason to doubt that this was the case. I expect that the Commissioner will obtain specific comment on the scan and report from a radiologist. Failure to identify a dividing membrane between the two pregnancy sacs is a troubling finding and means that the volumes of individual sacs cannot be determined which in turn means that the ability to diagnose or exclude TTTS is compromised. If confirmed, an error in the 28 week scan is the most significant factor in the events which unfolded.

Had the signs of TTTS been identified on the scan I expect that one of her obstetricians or at least their clinic nurse/midwife would have been notified by telephone as a matter of urgency. It is likely that [Mrs A] would have been reviewed by one of her obstetricians and referred to the materno-fetal medicine specialists at [Hospital 2] that day or the following at the latest. There she would have received further clinical and ultrasound assessment by a fetal medicine sub-specialist. Given the relatively late onset of TTTS at a gestation of 28 weeks, I believe that it is most likely that [Mrs A] would have been managed conservatively with admission to hospital, the

administration of steroids to increase fetal lung maturity, possibly removal of some fluid from [Twin 1's] amniotic sac, and close monitoring of fetal condition. I am not sure this would have prolonged the gestation of the pregnancy further, but more intense fetal monitoring could have resulted in a more timely recognition that CS delivery was required. This would have provided an opportunity to administer maternal magnesium sulphate prior to delivery to reduce the risk of neonatal intracerebral bleeding and the delivery would have been attended by senior paediatric staff with time for adequate equipment preparation.

In [Mrs A's] case the RANZCOG advice that ultrasound assessment of monchorionic twins be undertaken in a centre with sufficient experience to recognise the complications and refer appropriately was not followed.

I have worked in a number of DHBs where it is not always possible to follow the RANZCOG advice due to a number of factors; one is the limited availability of ultrasound services in the DHB area to deal with the volume of requests, another is a lack of highly experienced obstetric scanners (sonologists) and radiologists being available in all ultrasound locations at all times. The most experienced obstetric radiology staff may work within the DHB or they may work at a private radiology provider, or a mixture of both. In some areas radiology providers rotate staff through their sites, both regularly and in response to staffing requirements. As a result, the most experienced obstetric scanning staff may not be present on the day that a scan for a woman with a monochorionic pregnancy is scheduled. Many DHBs and private providers have dedicated ultrasound sessions for high risk obstetric scans and forward book scans for women with monchorionic twins to ensure that they are scanned by appropriately experienced personnel. It also has to be acknowledged that in some DHBs with large rural catchment areas it is difficult for women to travel long distances to be seen at a specific site for a scan by a sufficiently experienced obstetric sonologist and radiologist. Most women do try their best to attend the best site for their scan when the reasons are explained to them but this is sometimes not possible. I am not aware of the scanning arrangements in the Hutt Valley DHB but [Dr C] has advised that she now ensures that women with monochorionic twins are scanned at the DHB Radiology Department.

1B. Antenatal management of elevated blood pressure measurements

[Mrs A] had an increased risk for the development of hypertension and pre-eclampsia during her pregnancy by virtue to the following:

— this was her first pregnancy

— she had a raised BMI

— she had a family history of hypertension

— she had a twin pregnancy

— her booking blood pressure (BP) at 11 weeks of gestation of 136/83 was higher than usual for a woman of her age.

The relevant standard for assessment and management of hypertension in pregnancy are the guidelines published by the Society of Obstetric Medicine in Australia and New Zealand (Lowe et al, 2014).

The guideline recommends that the presence of several risk factors (as [Mrs A] had) should lead to special consideration of the woman's risk of developing hypertension in pregnancy. I would expect to see some acknowledgement of [Mrs A's] increased risk, a discussion of the symptoms of hypertension to be aware of and consideration as to whether prophylactic aspirin and calcium should be commenced by 16 weeks of gestation.

Hypertension in pregnancy is defined as a systolic BP of 140 mmHg or above and/or a diastolic BP of 90 mmHg. The definition requires that any elevated blood pressure measures are repeated over several hours to confirm a diagnosis of hypertension. If these levels are found before 20 weeks of gestation a diagnosis of chronic hypertension is made. Chronic hypertension carries a significantly increased risk of fetal growth restriction, pre-eclampsia and abruption.

At 19 weeks of gestation [Mrs A's] blood pressure was 153/87 mmHg and at 27 weeks of gestation her BP was 140/92 mmHg. No comment on these BP measures was made in the notes and no repeat BP measures were recorded.

Given [Mrs A's] significant risk factors for pregnancy induced hypertension and pre-eclampsia I would expect the antenatal notes to contain:

— Comment on the BP recordings and repeat BP recordings made with an appropriate BP cuff to confirm whether a diagnosis of hypertension could be made.

— Advice to [Mrs A] that she was at increased risk of developing hypertension at the 19 week visit, discussion of the symptoms of pre-eclampsia and arrangements for more frequent than usual BP checks. It would also have been reasonable to perform baseline blood and urine investigations.

— Comment on the presence or absence of symptoms of pre-eclampsia at the 27-week visit when [Mrs A's] BP was 140/92.

— Comment on the presence of other signs which might suggest developing pre-eclampsia, for example the degree and location of oedema at the 27-week visit.

— Blood and urine investigations at 27 weeks.

— Further discussion of the symptoms of pre-eclampsia and arrangements made for an increased frequency of BP recordings

With respect to comments on [Mrs A's] booking blood pressure, in his letter of October 2019. [Dr D] stated:

I agree with Dr Westgate's opinion that [Mrs A's] blood pressure of 136/88 was higher than usual for a woman of her age. However, hypertension is defined as a blood pressure of greater than 140/90 — [Mrs A's] booking blood pressure was therefore

considered normal. Because it was not abnormal it did not require any action other than recording at each future antenatal visit as planned.

This view is not consistent with the advice in the NZ Guidelines referenced above. The essence of antenatal care is to identify risk and adjust care accordingly to facilitate identification of the potential complication.

[Dr D] also stated:

At 19 weeks, [Mrs A's] blood pressure was 153/90 which I felt at this stage was white coat hypertension. It was a single reading and a diagnosis of hypertension requires repeated readings over several hours to qualify for a diagnosis of hypertension.

I suggest that the diagnosis of white coat hypertension also requires repeated blood pressure measurements over several hours to ensure that BP falls over time. The Guideline does not say if a BP is elevated on one reading it is probably white coat hypertension, it places the onus on the practitioner to investigate further with repeat BP measurements.

[Dr D] and [Dr C] both noted in their 2019 submissions that [Mrs A's] BP subsequent measurements were all lower than 140/90 (apart from the 27-week visit) and that her BP at 28 weeks and in the postnatal period were not elevated. They conclude that this information shows that [Mrs A] did not have hypertension during her pregnancy.

I agree that in retrospect, we know that [Mrs A] did not develop hypertension, but at 19 weeks and at 27 weeks it was not possible to know that. If we consider a scenario where [Mrs A] did present acutely with complications from severe pre-eclampsia, failure to comment on and follow-up antenatal blood pressure readings of 140/92 at 27 weeks (and 153/90 at 19 weeks) in a woman with her risk factors would undoubtably be criticised as a lost opportunity to safely manage her pregnancy.

My point is that the fact that no harm ensued does not mean that it is acceptable that no action was taken to further investigate and follow-up elevated blood pressure readings in a woman with multiple risk factors for the development of hypertension and pre-eclampsia. [Dr D] and [Dr C] seem to agree as they stated:

[Dr D]:
I accept that it would have been best practice to have repeated the BP readings on 17 [Month1], preferably with a large cuff given her BMI, to determine a more accurate gauge of her blood pressure.

[Dr C]:
I accept that repeat readings should have been done, and in a patient with a [high] BMI … that a large BP cuff should have been used.

I remain of the opinion that failure to recognise and appropriately respond to [Mrs A's] elevated blood pressure readings falls below an accepted standard of care. I believe the departure must be regarded as moderate because this is such a

fundamental aspect of antenatal care. I acknowledge that this did not adversely affect the outcome in [Mrs A's] case. I believe that my peers would agree.

Reference.
Lowe SA, Bowyer L, Lust K, McMahon LP, Morton MR, North RA, Paech M. Said JM. The SOMANZ Guideline for the Management of Hypertensive Disorders of Pregnancy. https://www.somanz.org/documents/HTPregnancyGuidelineJuly2014.pdf

1C. Antenatal management of raised BMI in pregnancy.

Raised BMI during pregnancy is associated with many increased risks … Recommendations are that a discussion about the importance of avoiding excessive weight gain during pregnancy should occur and some idea of ideal weight gain for this BMI and a twin pregnancy documented.

In his October 2019 letter, [Dr D] advised that:

I am confident I would have discussed appropriate weight gain with [Mrs A] as I did this with all women with twin pregnancies … This was not written explicitly in the notes.

Opinion.
Failure to record that a discussion about weight management in pregnancy occurred would be regarded as a minor departure from an accepted standard of care. I believe that my peers would agree.

References.
NZ Ministry of Health. NZ Guidelines for Healthy Weight Gain in Pregnancy, 2014.

RANZCOG Management of obesity in pregnancy, C-Obs 49, 2017.

1D Acute management of [Mrs A's] presentation at 28 weeks and 4 days of gestation.
[Mrs A] presented with moderately severe right sided abdominal pain (7/10 pain score) and vomiting. The most obvious differential diagnoses were:

1. Hypertensive related disorders such as sudden onset pre-eclampsia or an associated condition such as HELLP syndrome or acute fatty liver of pregnancy.
2. Pre-term labour, either simply due to a twin pregnancy or to over-distension of the uterus from TTTS.
3. An abruption — a bleed behind the placenta which usually causes abdominal pain and uterine activity.

[Dr C] requested blood tests for pre-eclampsia be done while she came into the hospital. Her clinical notes were a brief history and a one-line record of her examination findings:

'OA soft, no tenderness'.

Given the clinical circumstances I would have expected a more detailed record of examination findings, for example, no tenderness over the liver, fundal height appropriate or bigger than expected (suggesting TTTS) for a twin gestation, fetal positions, was the uterus irritable, were contractions palpable. I would also expect a vaginal examination to be performed as the severe pain [Mrs A] experienced may be due to preterm labour.

[Dr C] gave no suggestions as to what might be causing [Mrs A's] abdominal pain which was severe enough to warrant the prescription of narcotic analgesia. With respect to the abnormal FHR pattern for twin 1 she wrote:

'??indicative of fetal compromise ? TTTS'

None of [Dr C's] clinical notes are timed which makes it difficult to establish a timeline of events.

In her August 2019 letter [Dr C] reported:

I acknowledge that my note keeping was not as detailed as it could have been. By way of explanation, this was an incredibly busy time and I was focused on viewing the CTG (every 10 minutes), being in the room discussing the findings, arranging transfer and seeking second opinions.

[Dr C] stated that she did perform a thorough examination, decided a vaginal examination was not required as there was no uterine activity, and she did consider all the possible diagnoses I listed in my first report but discounted them based on her observations and only documented the relevant diagnosis at the time.

In my first report I expressed concern that [Dr C] did not perform a bedside scan either to assist placement of CTG transducers to optimise recording of the FHRs or as part of her investigations of [Mrs A] and to follow up her most likely diagnosis of TTTS. [Dr C] responded to this as follows:

I did not consider a bedside scan to exclude chronic twin to twin transfusion was indicated because the scan 3 days prior was reported as normal. This reassured me that chronic twin to twin transfusion was not reported. ***Acute*** *twin to twin transfusion is not seen on scan as the placenta distributes the blood supply to the fetuses unequally acutely i.e. suddenly vs. chronic twin to twin where the placenta distributes the blood to the fetuses unequally over time causing difference in fluid and weight which is apparent on scan (see highlighted text of page 5 — A Systematic Approach to the Differential Diagnosis and Management and complications of monochrionic Twin Pregnancies (****enclosed****)).*

While I did perform a bedside scan, performing one earlier would have not changed my management. A difference in fluid between two twins and a stuck twin is not an indication of immediate birth, if the CTG (x 2) is normal. However, in this case, I knew [Mrs A] needed delivery given the abnormal CTG. The only query I had, was if we needed to deliver her in [Hospital 1] or if we had the time to transfer her to [Hospital 2], the latter is obviously much preferable if the time allows.

However, as it transpired, when [Dr C] did perform a scan in response to an inability to monitor the FHR of [Twin 2] she did find a significant discrepancy between amniotic fluid volume between the twins which indicated a diagnosis of TTTS. The article she referenced stated the following:

TTTS is always a severe condition with a high rate of perinatal morbidity (neurological handicap 40–80%) and mortality (100% before 20 weeks, 80% between 21 and 26 weeks) if left untreated. It always requires urgent therapy because it may progress abruptly and even lead to fetal death in very early stages.

This information suggests that [Dr C's] clinical concern that [Mrs A] may have acute TTTS required an urgent response which in this case was transfer to the base hospital or deliver if this was not safely possible.

Hutt Valley DHB obtained an independent review of [Dr C's] management of [Mrs A's] acute admission from [Dr J]. [Dr J] reported that my criticisms of [Dr C's] initial assessment of [Mrs A] were harsh. He concluded:

[Dr C] arrived in the delivery suite, assessed the patient and organised transfer to [Hospital 2]. She also asked for a second opinion with regard to the transfer and her decision was supported. An earlier bed side scan would not have changed the management of transferring to [Hospital 2]. Regardless of the differential diagnosis of HELLP, pre-term labour or an abruption [Mrs A] still needed to be transferred.

I agree with [Dr J's] conclusion that [Mrs A] needed to be transferred to the base hospital. The problem I have is that despite being present in the hospital from 1915, [Mrs A] had not been transferred by 2200. Furthermore, in effect twin 1 was continuously monitored to near death for 2 hours and 30 minutes before the need for an urgent delivery was recognised. I believe it is reasonable to explore whether the need for transfer or delivery could have been recognised earlier. The only way to do this was to read the notes made by [Dr C]. I hoped to find evidence of a logical and considered approach to the investigation, diagnosis and management of the situation. Given that [Dr C] observed the CTG for at least 40 minutes waiting for an improvement in the heart rate variability of twin 1, I would have thought that she had ample time to record the details of her observations and management. She said that she made the decision to transfer at around 2040 to 2050 and the deterioration in the FHR did not occur until around 2145. There was again ample time to record the events that transpired in that time. We are all taught the expected standard for clinical notes (history, examination, differential diagnosis, investigations and updating of information, all dated and timed) in medical school. I did not invent these expectations. Given the sparse and untimed clinical notes it is difficult to establish a timeline of events or to understand [Dr C's] thought process. For example, as I noted in my summary of the clinical events, [Dr C] has provided three different versions of the indications for the crash CS; couldn't find the FHR of twin 2, FHR of twin 1 fell and then could not be found and lastly in October 2019 a combination of both.

Based on the clinical notes I am unable to advise whether [Dr C's] management of [Mrs A's] acute presentation was or was not of an acceptable standard. The Commissioner will have to decide whether the information provided by [Dr C] in October 2019 in response to my initial report is satisfactory to that end.

I remain of the opinion that [Dr C's] clinical notes relating to the acute admission were below an acceptable standard. I fully appreciate the complexities of the situation and in my view this adds to the importance of careful clinical note keeping. I consider the departure is at least moderate and believe that my peers would agree.

2. The timing of the decision to perform a caesarean section.
The most useful information about the timing of the CS would be the CTG record. Unfortunately, [Dr C] has advised that the CTG records have faded and are unreadable.

The lack of a CTG record means that I am unable to assess whether her FHR pattern was sufficiently alarming to warrant an earlier decision to perform a CS at [Hospital 1].

In addition, the lack of timed entries in the clinical notes, and conflicting information from various sources means that I have some difficulty establishing an accurate timeline of events which also makes assessment of the timing of the decision to perform a CS impossible.

In a retrospective note written on 16 [Month5] [Dr C] recorded that she asked [Dr D] to come in to see the CTGs (2040–2050) after the calls to [Hospital 2] and after the decision to transfer had been made. When he attended he agreed that the pattern was suspicious/pathological and that [Mrs A] should be transferred to [Hospital 2].

[Dr D's] letter of 10 October, 2019 stated that both he and [Dr C] felt there was time to transfer to [Hospital 2]. However, [Dr D's] October letter also reported that he was called back to assist with the emergency CS 5 to 10 minutes after leaving the hospital after giving his opinion on the CTGs. He must have been called back at around 2200, which means he left the hospital at 2150 or so. This could indicate that he attended soon after being called at around 2040 to 2050 and stayed in the hospital for nearly an hour before leaving, or that he only attended around an hour after being called, or that he was only called to provide a second opinion at around 2130.

This also raises a question about the arrangements for transfer to [Hospital 2]. [Dr C] stated that the call to the ambulance service probably occurred at 2040 to 2050 but I note that the ambulance had not arrived by 2200 which is concerning as this was a time sensitive transfer.

I am further confused by this response from Hutt Valley DHB dated 7 October 2019 regarding the timing of events:

'The staff looking after [Mrs A] were monitoring her very closely and liaising between midwife, Senior Medical Officer and [Hospital 2] Neonatal Intensive Care Unit (NICU). The midwife was with [Mrs A] when [Dr C] left the room to call [Dr D] and the

ambulance to transfer [Mrs A] to [Hospital 2]. The midwife remembered calling [Dr C] back to the room as soon as she walked out because she could not get a heart rate for both twins. The midwife was unsure of the time then and we have no record of when the ambulance for initial transfer to [Hospital 2] was called but the decision to birth the babies came very quickly after.

We have asked the ambulance service for their records from that day which state they received a call at 22:23 on 22 [Month1] from [DHB2] to pick up two resuscitaires and proceed to Hutt Valley DHB.'

If this information is correct then it suggests that the ambulance did not arrive to transfer [Mrs A] to [Hospital 2] because it was not called. But it also suggests that [Dr C] only called [Dr D] at around 2140/2145 when the problems recording the FHRs occurred. This is inconsistent with both [Dr C's] and [Dr D's] statements that he reviewed the CTG before the deterioration in the FHR(s) occurred.

However, I am able to confidently state that once the decision was made that a 'crash' CS was required the response time was very quick. The call for a crash CS was made at 2200 and [Twin 1] was delivered at 2012.

In summary, the lack of both adequate contemporaneous notes and a CTG record means that I am unable to determine if there were clear indications that delivery by CS was warranted at any stage before 2200 hours.

3. The preparation of the operating theatre, in particular the resuscitation equipment.

Both [Dr F's] letter and [Dr K] reported that technical problems occurred with the oxygen supply to [Twin 1] during her resuscitation. The underlying reason given for this was that the theatre staff were not aware that the emergency CS was for twins. This seems to have had two consequences:

a. The usual theatre was used for the CS operation as opposed to a larger theatre which was used for twin CS deliveries. This meant that a second Resuscitaire (special table with equipment required for resuscitating newborn babies) was required but could not get close enough to connect to the theatre wall oxygen and air supply so its portable tank air and oxygen had to be used. Apparently, the configuration of the theatre also led to the second Resuscitaire tank oxygen supply being used to supply oxygen to the in-built Resuscitaire while the oxygen from the in-built Resuscitaire was used for the second Resuscitaire.

b. The need for a second resuscitaire was only realised very shortly before the operation. This resuscitaire was older, heavier and kept on the Postnatal ward one floor above the theatre. It had to be brought down quickly and thus there was very limited time to prepare it before the delivery of the first twin occurred.

The unfortunate result was that the oxygen cylinder on the second Resuscitaire was either not turned on or was inadvertently turned off before the first twin was

delivered. This resulted in what appears to me to be a significant delay in providing oxygen to [Twin 1] during … resuscitation.

[Dr K] reported that an informal review of these events occurred within days and was followed by a formal review at a Critical Incident Meeting on 16 [Month5]. I have asked for but not been provided with the document released following that meeting.

[Dr K] reported that two key issues relevant to the technical problems in [Mrs A's] case were recognized:

a. The need to bring an older Resuscitaire down from the Postnatal ward.
b. The theatre and midwifery staff were not familiar enough with the location of equipment.

[Dr K] reported that in response to these events eventually a new Resuscitaire was purchased and four new midwifery posts have been established so that there is always a midwife 'on-call' who is specifically trained to attend all CS operations to assist paediatric staff with resuscitation, which presumably includes equipment set up.

Based on the information given by [Dr F] and [Dr K], preparation of the resuscitation equipment was not at the required standard. This was due to a combination of systemic issues which seem to me to be attributable to multiple factors unique to Hutt Valley DHB. I have not encountered a similar sequence of events elsewhere. This is a very serious departure from an appropriate level of care. I believe that my colleagues would agree.

4. The appropriateness of care given to [Mrs A] during the delivery of the twins.

As far as I can tell from the information sent to me, the actual caesarean section to deliver the twins was uneventful and the care given to [Mrs A] was appropriate.

5. The incorrect recording of the cord blood gas sample by [Dr C].

Both [Dr F] and [Dr K] have commented on this matter and both agree that the cord blood gas sample from [Twin 2's] placenta was mislabelled as coming from [Twin 1]. [Dr C] is most unlikely to have taken the cord gas sample as she would have still been doing the operation. Cord gas samples are usually taken by the midwife who attends theatre. [Dr C] seems to have realised that an error was made in labelling the sample and ensured that the result was placed in [Twin 2's] notes with an explanation of the error. Both [Dr F] and [Dr K] agree that the cord gas results were in keeping with [Twin 2's] condition and not with [Twin 1]. It is almost certain that no cord gas sample could be obtained from [Twin 1's] cord. This is not surprising given [Twin 1's] condition at birth.

In summary, [Dr C] has intentionally corrected an error made, most likely by another person, in labelling of a cord gas sample.

6. Please comment on the appropriateness of the policy and procedures at Hutt Valley DHB.

I requested and received the Hutt Valley DHB procedures for booking an urgent CS operation. In [Mrs A's] case the relevant document is entitled 'Emergency Move to Theatre for CS or postpartum haemorrhage.' Between the hours of 0800 and 2300 hours the following procedure applied:

a. The midwife or RMO (junior doctor) phones [the emergency number] and advises the telephone operator that an emergency move to theatre is required.
b. The telephone operator connects the call to the Theatre Co-ordinator and the midwife or RMO briefs the co-ordinator on the case.
c. The telephone operator sends out an emergency message to a predetermined list of people that an emergency move to theatre is required.
d. The patient is moved to the operating theatre once the Theatre Co-ordinator has been advised of the details of the case.
e. An obstetric doctor calls the on-call anaesthetist directly via mobile phone.

The procedures described appear to have been followed and were clearly effective in quickly assembling the theatre and anaesthetic personnel so that delivery of the first twin occurred only 12 minutes following the emergency call to the operator.

In [Mrs A's] case both [Dr F] and [Dr K] have advised the Commissioner that unfortunately the Theatre Co-ordinator was not advised that twins were being delivered by CS. The consequences of this have been discussed in section 3 above. Presumably the person who made the call to the Theatre Co-ordinator was either not directly aware of the details of [Mrs A's] case and did not know she had a twin pregnancy, or they were not aware that twin CS deliveries required additional planning and affected the choice of the theatre used for the operation. This scenario is understandable if the labour ward was very busy when the call for the emergency CS occurred. It might have been that the only person free to call theatre was someone not involved in the case, for example a student midwife or a private midwife writing up her notes following a delivery.

Hutt Valley have subsequently advised that they have been unable to determine who made the call to theatre and they have confirmed that the Theatre Co-ordinator on duty was aware of the need to use a larger operating theatre room for a twin CS had she been advised of this.

[Dr K] advised that the lack of communication was attributed to the lack of a rostered Maternity Co-ordinator 24 hours a day. If a Maternity Co-ordinator was present, that person would take the responsibility for liaising with the Theatre Co-ordinator. There must have already been some concerns about lack of a Maternity Co-ordinator as the CEO was advised that this was a problem in [Month3]. Steps have been taken to remedy this following [Mrs A's] delivery, but [Dr K] has advised that at the time of her letter, 24-hour cover had not yet been achieved. [Dr K] also advised that all CS deliveries now take place in a larger operating theatre.

In conclusion, the DHB did have specific instructions regarding steps to be taken to arrange an emergency CS. These were effective in achieving a delivery of the first twin

within 12 minutes of the emergency call to the telephone operator. Unfortunately, the person who spoke to the Theatre Co-ordinator did not communicate that the delivery was for twins which affected the choice of theatre used for the operation and preparation of a second Resuscitaire.

7. Please advise if you consider any aspects of the care provided by [Dr D] warrants comment.
[Dr D] and [Dr C] shared the antenatal care of [Mrs A] so comments about the apparent lack of action with respect to [Mrs A's] blood pressure changes relate to [Dr D] as well as [Dr C].

[Dr D's] management and clinical notes which relate to [Mrs A's] acute presentation with abdominal pain on 4 [Month1] are both well within an acceptable standard of care. He recorded the history, detailed his thorough abdominal and vaginal examination, provided a likely diagnosis, offered advice, and prescribed a laxative.

On 22 [Month1] [Dr D] reviewed the CTG recordings between 2040 and 2050 according to [Dr C] and possibly between 2140 and 2150 according to his October 2019 letter. He did not write in the clinical notes. [Dr C] stated [Dr D] agreed with her assessment and management. His failure to document his opinion in the notes is at the minor end of the scale.

This concludes my report on this case. Please contact me by email if further comment or opinion is required.

Kind regards

Yours sincerely

Jenny Westgate MD, FRANZCOG
Honorary Associate Professor, University of Auckland"

Appendix C: Independent advice to the Commissioner

The following expert advice was obtained from Dr David Montgomery:

"Independent Clinical Advice for the Health and Disability Commissioner

[Twin 1] ([NHI]) and [Twin 2] ([NHI])

HDC Refence 18HDC00279

My name is Dr David Michael Barr Montgomery, and I am a paediatrician working at the Counties Manukau DHB and the Whanganui DHB. My qualifications are MBChB (1987) and FRACP (2003). My experience is predominantly in the field of General Paediatrics and Paediatric Emergency Medicine, and as the Clinical Director of Paediatrics in a small provincial hospital, where the responsibilities include the care and management of extremely premature infants prior to transport to a Level III Neonatal Intensive Care Unit.

I have been asked to provide an opinion to the Commissioner on case number 18HDC00279. I have read and agree to follow the Commissioner's Guidelines for Independent Advisors. I have no conflicts of interest in this case.

The request I have received from the Commissioner is to review a large parcel of documentation in relation to this case, and to advise whether I consider the care provided to [Twin 1] and [Twin 2] by Hutt Valley DHB and Doctors [Dr F], [Dr L] and [Dr E], was reasonable in the circumstances, and why.

In particular I have been asked to comment on:

1. The appropriateness of the preparation of the operating theatre, in particular, the resuscitation equipment;
2. The appropriateness of the available equipment, including, but not limited to, the resuscitaire, incubator, and oxygen tanks. I have been asked also to comment on:
   a. The problems with the equipment and the lack of oxygen ventilation for [Twin 1] for a period of time; and
   b. The use of a smaller ETT tube (2.0mm) by [Dr F] and the decision to leave the smaller tube in place until [Hospital 2] NICU team arrived.
3. Any other comments about the appropriateness of the care given to the twins following their birth;
4. Documentation of the birth on 22 [Month1] by Hutt Valley DHB staff;
5. The adequacy of the handover by [Hospital 1] to [Hospital 2];
6. Please comment on the appropriateness of the policy and procedures at Hutt Valley DHB.

7. The timing of the disclosure of the adverse event by Hutt Valley DHB and/or the doctors involved to [the family] and the timing of the documentation of the adverse event report; and
8. Any other matters you consider warrant comment.

For each question I have been instructed to advise:

a. What is the standard of care/accepted practice?

b. If there has been a significant departure from the standard of care or accepted practice, how significant a departure do you consider this to be?

c. How would it be viewed by your peers?

d. Recommendations for improvement that may help to prevent a similar occurrence in future.

Sources of Information:

I have been provided with the following documents upon which to formulate my advice:

1. Record of Complaint from [Mrs A]: The Record I have received is unsigned and undated and appears to be a brief transcript from a verbal or telephonic complaint, rather than a formal Letter of Complaint.
2. Further Information regarding the complaint supplied by [an advocate], on behalf of Mr and [Mrs A], under the auspices of The Nationwide Health and Disability Advocacy Service, date …
3. Hutt Valley DHB's response dated 6 June 2018.
4. [Dr C's] response dated 11 May 2018 and the clinical notes of [Mrs A] provided by her.
5. [Dr F's] response dated 29 June 2018.
6. Clinical records from Hutt Valley DHB on [Mrs A], [Twin 1] and [Twin 2].
7. Clinical records from [DHB2] clinical records of [Twin 1] and [Twin 2].
8. Response by [Dr K], the co-Clinical Head of Paediatrics at Hutt Valley DHB since 2017, dated 31 May 2018.
9. The Management of Acute Acute Surgery Policy and the Emergency Move to Theatre Policy of the Hutt Valley DHB.
10. Guidelines for seeking senior assistance with neonatal resuscitation; Issue Date July 2012, Expiry July 2014 (Hutt Valley DHB)
11. Guidelines for seeking senior assistance with neonatal resuscitation (Paediatric Urgent Attendance at Deliveries); Issue Date July 2016, Expiry July 2019 (Hutt Valley DHB)
12. Acute neonatal resuscitation content list (Hutt Valley DHB).

Summary of Events:

On 22 [Month1] at approximately 6pm [Mrs A] presented to [Hospital 1] with abdominal pain. [Mrs A] was pregnant with twins at 28 weeks and 4 days gestation. The midwives had difficulty with obtaining cardiotocograph (CTG) recordings of the babies' hearts and the consultant obstetrician, [Dr C], was informed and she came in to the hospital.

[Dr C] was able with some difficulty to get CTGs on both babies. The CTG of Twin I had poor variability. After considering the options and obtaining advice she decided to transfer [Mrs A] to [Hospital 2], which has Level III neonatal intensive care facilities. However, while awaiting the transfer, the heart tracing on Twin I deteriorated and subsequently became unrecordable. An ultrasound scan by [Dr C] suggested twin-to-twin transfusion syndrome. A Category 1 Caesarean Section was therefore performed under General Anaesthetic at approximately 10pm.

[Twin 1] was born at 10:10pm and [Twin 2] was born at 10:12pm. Present at the delivery were paediatric registrar [Dr L], and Senior House Officer [Dr E], who were responsible for the resuscitation of the twins.

[Twin 1] was in very poor condition [at birth]. There is only sparse documentation of the resuscitation in the notes which have been made available to me. From these it is clear that [Twin 1] was pale and floppy with no breathing effort at birth, and that [Twin 1's] heart beat was either absent or very slow. [Twin 1] received positive pressure ventilation via mask from the paediatric registrar, and chest compressions were performed. The Paediatrician, [Dr F], arrived from home when [Twin 1] was 7 minutes old. Intubation was performed twice by the paediatric registrar, and when adequate ventilation was not achieved, [Dr F] intubated using a 2.0mm ETT. [Dr F's] notes state 'heart rate > 100 within 3 minutes of intubation and adequate ventilation, at around 12 minutes of age', implying that intubation and adequate ventilation were established by 9 minutes of age, two minutes after her arrival.

[Twin 1] was given APGAR scores of 2 at one minute, 2 at 5 minutes, and 4 at 10 minutes.

There were difficulties with the equipment used for the resuscitation. According to notes written on 14 [Month6] regarding an internal review of the events surrounding the birth of the twins, at the time the Category 1 Caesarean section was notified, the theatre coordinator was not made aware that it was a twin pregnancy, therefore there was only one resuscitaire in theatre. A second resuscitaire was subsequently brought when the theatre coordinator was made aware it was a twin delivery. There was only wall oxygen accessible for one resuscitaire, and therefore the transport incubator oxygen had to be used for [Twin 1]. When [Twin 1] was not responding as expected to resuscitation, it was discovered that the oxygen from the transport incubator had not been turned on, and therefore only air was being used for resuscitation. When the oxygen was turned on, [Twin 1's] saturation increased and cardiac output improved.

[Twin 1] was intubated with a size 2.0mm ETT. After the intubation and initial resuscitation, [a neonatologist] at [Hospital 2] NICU was consulted by telephone and advised that a larger tube would be required. The tube was not changed to a larger tube immediately. Instead, the 2.0mm tube was removed several minutes later by the [Hospital 2] neonatal transport team, who arrived when [Twin 1] was approximately 35 minutes old, and was replaced with a larger 3.0mm tube, with a good improvement in her ventilation.

[Twin 1] was transferred to [Hospital 2] NICU. Unfortunately, her cranial ultrasound examination, performed during the first week of her life, showed that she had intraventricular haemorrhage (IVH) Grade 2 on the right side of her brain, and Grade 4 on the left side of her brain. An IVH is bleeding into the internal ventricles of the brain. Grade 4 is the most severe grade and it is often associated with long term symptoms, including muscular weakness, spasticity, and developmental delay.

[Twin 1] has made good progress since then, but … has motor delays in the form of monoplegia of [the] right leg.

[Twin 2] was born at 10:12 pm and was in good condition at birth. [Twin 2] required very limited resuscitation and did not need to be intubated prior to transport to [Hospital 2] NICU. [Twin 2's] APGAR scores were 7 at one minute, 9 and five minutes, and 9 at ten minutes. [Twin 2] was intubated at [Hospital 2] NICU for the administration of surfactant (a medication to treat respiratory distress syndrome) and then the tube was removed and [Twin 2] was treated with non-invasive respiratory support (CPAP) and … has continued to make very good progress.

Advice:

1. **The appropriateness of the preparation of the operating theatre, in particular, the resuscitation equipment:**

Communication and Organisation of a Category 1 Caesarean Section:

a. The standard of care/accepted practice:

All hospitals which perform Emergency Caesarean Sections should have a policy detailing the communication and organisation process to be followed for a Category 1 (Immediate) Caesarean Section. The goal of such a policy is to bring about the Emergency Caesarean delivery of the baby/babies as quickly as possible, while minimising the risk to the mother and the baby or babies. This requires the rapid coordination of personnel and equipment. To be able to do this accurately and reliably, at any time of the day of night, regardless of other acute and emergency pressures, is a daunting logistical challenge. This is particularly the case in smaller provincial hospitals.

b. Has there been a significant departure from the standard of care or accepted practice, and if so how significant a departure do you consider this to be?

The policies which have been provided by [Hospital 1] in relation to Category 1 Caesarean Sections are The Management of Acute Acute Surgery Policy, and the Emergency Move to Theatre Policy. No policy specifically dealing with the requirements for Caesarean Sections has been provided and I can only assume that there is no policy for emergency Caesarean Section, including Category 1 Caesarean Section, other than these two policies.

Communication with the paediatric team is not part of either of the above policies.

It is not clear from the information provided when the paediatric team became aware of the Category 1 Caesarean Section, but there should be a policy which emphasises the requirement for communication with the paediatric service at the earliest opportunity, and at a senior level.

The neonatal unit did have a policy at the time of the birth of the twins titled Guidelines for seeking senior assistance with neonatal resuscitation; Issue Date July 2012, Expiry July 2014 (Hutt Valley DHB). The policy identifies the need for the RMO to 'contact' the paediatric consultant when a premature birth less than 34 weeks gestation occurs, but does not require the attendance of the consultant; also not included in this (now superseded) policy's list of situations for which the consultant should be contacted, is Category 1 Caesarean section, and the occurrence of a baby with significantly abnormal CTG.

In the months following the birth of the twins, this policy was reviewed, and a revised policy was issued in July 2016, which did identify that the paediatric consultant should be contacted by the paediatric RMO for Category 1 Caesarean Sections, as well as situations where there was a 'significantly pathological CTG trace (eg. sinsusoidal trace, prolonged bradycardia <70/min)'.

The policy in place at the time of this emergency did not adequately address the importance of having the consultant paediatrician present at the delivery of a very high risk infant, in this case a very low birthweight, extremely premature twin, with a severely abnormal CTG. In my opinion, the policy should have ensured that the consultant paediatrician was contacted immediately after the Category 1 Caesarean Section had been declared, and should have been asked to attend in person as quickly as possible particularly because premature twins were involved, and the registrar, even if senior and highly skilled, would not be able to resuscitate two premature infants simultaneously.

The paediatrician arrived when the first twin was already seven minutes old. The paediatrician did not have an opportunity to personally check and prepare the resuscitation equipment, with the result that she had to contend with an inadequate oxygen supply during an acute life-threatening emergency.

The communication with the operating theatre supervisor was inadequate. Had the supervisor been informed at the outset that twins were being delivered, it is possible that a more spacious theatre may have been made available, and better arrangements for two resuscitaires with appropriate access to blended air and oxygen, suction, and electrical connections could have been assured.

The departure from the standard of care is significant. Poor preparation for the emergency delivery of critically ill twins could likely have been avoided had there been a clear and unequivocal guideline regarding the process to be followed for a Category 1 Caesarean Section. In particular, if the late arrival of the consultant paediatrician could have been prevented through the proper application of an appropriate guideline, then this would have most likely reduced the time it took to establish adequate oxygenation of Twin I.

c. How would it be viewed by your peers?

The majority of paediatricians would disapprove of the lack of a clear organisational policy regarding the communication process for Category 1 Caesarean Section, and the lack of clear guidance as to when the consultant paediatrician is required to be present.

d. Recommendations for improvement that may help to prevent a similar occurrence in future.

Hutt Valley DHB should consider developing a policy specifically for Caesarean Section, including Category 1 Caesarean Section, which explicitly includes the process for communication with the paediatric/neonatal team at the earliest opportunity.

The current Move to Theatre process and the Management of Acute Acute Surgery Policy do not include the requirement for paediatric consultation.

The Guidelines for seeking senior assistance with neonatal resuscitation has been amended, however, the amended version does not, in my opinion, adequately address the need for the consultant to attend in person for an emergency such as occurred in this case. I recommend that this guideline should state explicitly that the consultant must be called to attend for all premature twin deliveries less than 34 weeks.

[Dr K], in her report, identified that in spite of the revised policy there were doubts experienced by junior paediatric, maternity and theatre staff as to what constituted a reason to call the Paediatric consultant in to the hospital. The existing policy was on-line but was unfamiliar to midwifery and theatre staff. This had been addressed by printing the policy in colour, laminating it and placing it on the wall by the resuscitaires in theatre.

Preparation of neonatal resuscitation equipment:

This is addressed fully in the next section.

2. The appropriateness of available equipment, including, but not limited to, resuscitaire, incubator, and oxygen tanks. Please also comment on

a. The problems with the equipment and the lack of oxygen ventilation for [Twin 1] for a period of time; and

b. The use of a smaller ETT tube (2.0mm) by [Dr F] and the decision to leave the smaller tube in until [Hospital 2] NICU team arrived.

a. The standard of care/accepted practice:

Standards for Neonatal Resuscitation are determined by expert Committees and Panels. The most widely accepted guidelines on Neonatal Resuscitation in New Zealand are those endorsed by the Australian and New Zealand Committee on Resuscitation (ANZCOR), with the Australian Resuscitation Council and New Zealand Resuscitation Council as the underwriters, and these guidelines are closely aligned with similar guidelines by the International Liaison Committee on Resuscitation (ILCOR), The American Heart Association, and other leading groups.

The ANZCOR Neonatal Resuscitation Guideline 13.1, Page 5 and 6, contains a standard list of equipment and drugs which should be available whenever the requirement for neonatal resuscitation is possible. This list includes access to a source of oxygen and medical air with an air/oxygen blender.

When Twins are being delivered, each twin will require access to oxygen, air and the equipment required to blend the gases.

The widely accepted recommendation is that most babies who require resuscitation should receive air as the initial gas used, with blended oxygen being added if the oxygen saturations do not reach specified targets over the first ten minutes of life.

For a cardiac arrest or severe bradycardia, 100% oxygen should be used.

At the very least, oxygen should be available, but the recommended standard is that both medical air and oxygen are available, with a blender to combine them at different percentages.

Every hospital must have a process for checking and servicing essential equipment and supplies, including resuscitation supplies.

When preparing for the delivery of a baby, the person who is responsible for resuscitating the baby must check that all necessary equipment is present and that it is functioning correctly. This means switching on overhead warmers, checking that laryngoscopes are working, checking and setting the pressure on the suction apparatus, checking the gas supply of the oxygen and air (if available) and calibrating the equipment (such as the Neopuff) if required.

Of course, if the person performing the resuscitation arrives after the baby has been born, then they will not have the opportunity to check and prepare the equipment

prior to use. This highlights the need for anticipation of possible complications, and it means that senior help should be requested to attend early when there is a high probability of advanced resuscitation being required.

The size of Endotracheal Tube (ETT) to be used for neonatal intubation is outlined in the ANZCOR guidelines, as well as many other guidelines.

The sizes recommended by ANZCOR for different weights of baby are as follows:

'Typically, a 2.5 tube is appropriate for infants <1kg weight, a 3.0 tube for infants weighing 1–2 kg, a 3.5 tube for infants 2–3 kg, and a 3.5 or 4.0 tube for infants over 3 kg.'

At a birth weight of 1.076kg, the expected tube size would be a 3.0mm tube.

It is worth noting that many hospitals no longer stock size 2.0mm tubes because they are generally unsuitable even for the smallest premature infants, and none of the current neonatal resuscitation guidelines in use in New Zealand recommend that 2.0mm tubes are stocked on resuscitaires. The Hutt Valley DHB Acute Neonatal Resuscitation Checklist has a list of all the equipment in the neonatal resuscitation trolley, but does not mention any ETT tubes, let alone specify the sizes. I recommend that sizes 2.5mm, 3.0mm, 3.5mm, and 4.0mm are stocked, and that size 2.0mm are no longer stocked, and that Hutt Valley DHB's checklist should be revised accordingly.

b. Has there been a significant departure from the standard of care or accepted practice, and if so how significant a departure do you consider this to be?

The resuscitaires appear to have been adequate, with the exception of a lack of space in the crowded operating theatre, and the lack of suitable supplies of oxygen and possibly of medical air, which meant that the resuscitaire used for twin II had to use oxygen from the resuscitaire for Twin I, and the resuscitaire for twin I had to use oxygen from the transport incubator.

There are no identified problems with the transport incubator itself, and the oxygen tank appears to have been functioning normally but was switched off.

It is not clear whether there was medical air and a mixer available for Twin I, and it is also unclear from the notes whether medical air and a mixer was available for Twin II.

Oxygen was available for Twin I via a cylinder in the transport incubator, but for unknown reasons this cylinder was switched off, therefore during the initial part of the resuscitation, pure oxygen was not available.

Since a neopuff was being used, this also means that positive pressure was not being applied, unless there was medical air available on the transport incubator which could have supplied the neopuff.

After the consultant paediatrician arrived, the difficulties were corrected, but the recognition of the nature of the difficulties appears to have taken at least a few minutes. This delay in the recognition of the difficulties by the paediatrician is understandable under the circumstances.

The failure to provide oxygen during the resuscitation of Twin I, who was severely compromised and bradycardic at birth, is a significant departure from accepted practice.

It is unknown why this occurred. The person who was responsible for resuscitating Twin I was responsible for checking the equipment, including the oxygen supply. In [Dr F's] letter she states that either the oxygen supply had not been turned on, or it had been turned on initially, and then turned off.

The use of the size 2.0mm ETT is a departure from the ANZCOR recommendations, which would recommend a 3.0mm ETT for a baby over 1kg. In some cases a 2.5mmg ETT may be more appropriate for a baby of this weight, however the [Hospital 2] NICU team used a 3.0mm safely and with good effect when they changed the ETT, and when they did so the ventilation was greatly improved.

While the decision to maintain the 2.0mm ETT in place until the arrival for the [Hospital 2] NICU team was contrary to ANZCOR recommendations and contrary to the advice received from the neonatologist in [Hospital 2], it appears that there was a period of approximately 26 minutes from the insertion of the tube, and the arrival of the [Hospital 2] NICU retrieval team. During this time, there were ongoing resuscitation efforts, including the insertion of an umbilical venous catheter and the administration of volume resuscitation. [Twin 1] was improving in terms of … heart rate, colour and tone during this period, and although [Twin 1's] oxygen saturations were lower than what was considered ideal, [Twin 1] was nevertheless stabilising compared with [Twin 1's] condition at birth. The decision to re-intubate [Twin 1] with a larger ETT needed to be balanced against the risks, including the risk of IVH with repeated attempts at intubation, and the other priorities at the time. With the imminent arrival of the NICU transport team, greater expertise at intubation was only minutes away. Therefore, the decision to defer reintubation until the NICU transport team arrived may have been reasonable under the circumstances.

The effect of the oxygen supply problems on [Twin 1's] recovery and … subsequent IVH and delayed motor development is impossible to predict or quantify. [Twin 1] had a significant antenatal insult, as evidenced by [the] poor CTG, evidence of twin to twin transfusion, profound bradycardia, poor muscle tone, pale colour and absent breathing effort at the time of birth. [Twin 1] required full Cardiopulmonary Resuscitation (CPR) after birth … The presence of intrauterine transfusion, perinatal hypoxia, the requirement for CPR, intubation and positive pressure ventilation, and the subsequent development of respiratory distress syndrome of prematurity, are all risk factors for IVH. The failure to correctly deliver oxygen during the first minutes of

resuscitation was a significant departure from accepted standard of care. The degree to which this has affected the outcome is unknown.

c. How would it be viewed by your peers?

The majority of paediatricians would strongly disapprove of the resuscitation of a critically ill infant being attempted without access to a reliable oxygen supply which had been checked prior to use. It is very understandable however that, for the paediatrician arriving at a time when the resuscitation was well advanced, the deficient oxygen supply would not be immediately evident, as they would be focussing on the priority of the airway.

Most paediatricians would view the decision to use a size 2.0mm ETT to have been an error. A 3.0mm ETT would have been most appropriate, and a 2.5mm ETT may have been acceptable.

d. Recommendations for improvement that may help to prevent a similar occurrence in future.

Doctors, nurses and midwives who are performing neonatal resuscitation must be fully trained in the use of the resuscitation equipment, including the necessity to check the equipment fully before use. Neonatal skills such as intubation are difficult to maintain and regular retraining and practice on mannikins, or secondment to a level III neonatal intensive care unit, should be encouraged for paediatricians who are occasionally required to perform intubation on premature infants.

3. Any other comments about the appropriateness of the care given to the twins following their birth

No.

4. Documentation of the birth on 22 [Month1] by Hutt Valley DHB staff.

I have not focussed on the documentation of the actual birth, but I have focussed on the documentation of the resuscitation and the neonatal care at hospital prior to handover to the NICU transport team.

The documentation is sparse. Unfortunately, this often the case when a baby requires intensive resuscitation efforts, and all hands are devoted to practical tasks like the airway, breathing, vascular access, administration of medications, and arranging investigations. In these circumstances, note taking often takes a back seat. This is particularly the case when the resuscitation occurs outside normal working hours, when staffing numbers are fewer.

According to [Dr F's] notes, made retrospectively after the twins left the hospital, the care of the twins was handed over to the NICU retrieval team about 35 minutes after the birth. The subsequent records appear to have gone into the NICU notes, which would be held at the tertiary hospital and not at [Hospital 1].

The discharge summaries are relatively brief but contain all the essential information. Often junior doctors type their notes. If the patient is admitted to the hospital, the notes are printed onto hospital continuation sheet and included in the patient notes in that way. If the patient is discharged or transferred to another hospital, then the notes are pasted into the Discharge Summary or Transfer of Care Letter.

In general, in my opinion the patient notes are of an acceptable standard, although more thorough note-keeping would be preferable.

5. The adequacy of the handover by [Hospital 1] to [Hospital 2]

The handover to [Hospital 2's] NICU retrieval team took place in the operating theatre, and subsequently the twins spent some time in the Special Care Baby Unit at [Hospital 1] while the NICU team stabilised them and prepared them for transport.

The handover summaries are adequately documented in the transfer letters.

[Dr F] appears to have stayed with the retrieval team until they were ready to leave with the twins. Any possible shortcomings in the handover of care would have been addressed during that extended period of stabilisation.

Therefore, no concerns about the adequacy of the handover have been identified.

6. Please comment on the appropriateness of the policy and procedures at Hutt Valley DHB.

The only policies or procedures which are in relation to Category 1 Caesarean Section and which have been made available for review are the Management of Acute Acute Surgery Policy and the Emergency Move to Theatre Policy.

As previously discussed in section 1, these policies/procedures fall short of what is required for the safe and efficient conduct of a Category 1 Caesarean Section. In particular, they do not ensure that there is timely consultation with the Paediatrician on call.

I recommend that a separate Caesarean Section Guideline, which addresses the Communication process, staffing requirements, and equipment requirements for Caesarean Sections and in particular for Category 1 Caesarean Sections, should be developed by Hutt Valley DHB and implemented.

I recommend that the Guidelines for seeking senior assistance with neonatal resuscitation (Paediatric Urgent Attendance at Deliveries); Issue Date July 2016, Expiry July 2019 (Hutt Valley DHB) should be updated to address the situations in which it is expected that the consultant paediatrician will attend in person. For example, extremely premature twin deliveries will always require the presence of two advanced practitioners, for example a registrar and a consultant, and there should be no doubt in these guidelines that the consultant is expected to attend and must be asked to attend before the delivery has occurred, wherever possible.

The Acute neonatal resuscitation content list, which is the list of equipment stocked in the neonatal resuscitation trolley, should be amended to include the types and sizes of ETT tubes to be stocked, and the 2.0mm ETT should be removed.

7. The timing of the disclosure of the adverse event by Hutt Valley DHB and/or the doctors involved to [the family] and the timing of the documentation of the adverse event report.

The disclosure meeting with the family took place in [Month6], over four months since the birth of the twins.

The ideal time to conduct this meeting would have been a lot earlier. For example, in the first week or two after the twins returned to [Hospital 1] from [Hospital 2] in [Month2].

I have not received an 'adverse event report' and I am not aware of the date of that report, and I am therefore unable to comment on the timing of this report.

8. Any other matters you consider warrant comment.

It is worth noting that the situation facing the medical team in this case was extremely challenging. There would be few more difficult situations faced by a general paediatrician in a small regional hospital than this. The paediatrician had to contend not only with a critically ill premature infant, but with an undiagnosed equipment fault which was completely unexpected.

An error was made in the selection of the ETT tube size, but [Twin 1] was successfully and promptly intubated by the paediatrician, the oxygen supply fault was identified and remedied, ventilation was successfully established, umbilical venous access was obtained, and intravenous therapy was given expeditiously. The communication with the level III unit was effective and resulted in expert help arriving within a short timeframe. These tasks required a high level of dedication and skill, and their accomplishment saved [Twin 1's] life. [Twin 1's] relatively good neurological outcome owes much to this.

Systematic improvements, such as a new policy for Caesarean Sections, a revised Guidelines for seeking senior assistance with neonatal resuscitation policy, and a revised equipment checklist, are likely to greatly reduce the possibility of similar errors occurring in the future.

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