Hutt Valley District Health Board

A Report by the

Health and Disability Commissioner

(Case 12HDC00115)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

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Executive summary

Background

1. This report concerns the standard of care provided to Baby B (aged 11 months) during her admission to Hospital 1 in 2010[1]. In particular, it addresses the care provided to Baby B after it was discovered that she had contracted rotavirus gastroenteritis[2] as an inpatient at Hospital 1.

2. The purpose of Baby B's admission to Hospital 1 was to monitor and manage ongoing issues with vomiting, oral aversion[3] and poor weight gain. She was treated with concentrated feeds.[4]

3. After initially gaining weight during her admission, Baby B then developed diarrhoea and increased vomiting.

4. On Day 9 of her admission, Baby B was diagnosed with rotavirus gastroenteritis (rotavirus). Concentrated feeds were continued, with water and Enerlyte[5] being administered to balance fluid losses from diarrhoea and vomiting. The extent of fluid loss and degree of dehydration were not monitored effectively, and the development of hypernatraemia[6] was not detected.

5. On Day 12, Baby B was found unresponsive with acute renal failure and severe hypernatraemia. Sadly, Baby B died the following day at Hospital 2. The direct cause of Baby B's death was cerebral oedema[7] and swelling. Antecedent causes were shock and severe electrolyte abnormalities. The underlying condition was diarrhoeal illness.

Commissioner's findings

6. Hutt Valley District Health Board (DHB) and the teams involved in Baby B's care had a responsibility to take all reasonable steps to ensure that services were provided to her with reasonable care and skill, and that there was adequate communication within the Multidisciplinary Team (MDT) involved in Baby B's care to ensure the quality and continuity of the services provided.

7. A number of service failures led to Baby B receiving sub-optimal care and treatment following her diagnosis with rotavirus. These failings were caused, in part, by poor assessment, monitoring and treatment of Baby B's developing dehydration and inadequate communication within the MDT involved in Baby B's care.

8. District health boards are responsible for the operation of clinical services within hospitals, and can be held responsible for any service-level failures. The failures of the teams involved in Baby B's care were service failures, and are directly attributable to Hutt Valley DHB.

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[1] To maintain privacy, dates of this admission are referred to as Day 1 – Day 13.
[2] Rotavirus gastroenteritis is a contagious diarrhoeal illness, which can also include vomiting, fever and dehydration. It is a common disease amongst children and infants.
[3] Oral aversion is a reluctance, avoidance or fear of eating, drinking or accepting sensation in or around the mouth. A common example of oral aversion is a baby's refusal to breastfeed.
[4] Concentrated feed is an infant formula mixture that has extra calories and protein added for babies who require a higher energy intake.
[5] Enerlyte is an oral rehydration solution.
[6] Hypernatraemia is the presence of an abnormally high concentration of sodium in the blood.
[7] Increase in the water content of the brain.

9. Hutt Valley DHB failed to provide services to Baby B with reasonable care and skill, in breach of Right 4(1) of the Code of Health and Disability Services Consumers' Rights (the Code),[8] by continuing concentrated feeding following her diagnosis with rotavirus gastroenteritis, by failing to assess and monitor Baby B's fluid balance properly following the diagnosis despite ongoing fluid losses, and by not reviewing Baby B medically on the night of Day 11.

10. Hutt Valley DHB also failed to ensure the continuity of services provided to Baby B, in breach of Right 4(5) of the Code,[9] in that members of the MDT failed to communicate adequately with one another regarding Baby B's diagnosis with rotavirus.

11. Adverse comment is made about Dr I, Ms C and RN F.

Complaint and investigation

12. The Commissioner received a complaint from Ms B about the care provided to her daughter, Baby B, at Hospital 1.

13. On 9 January 2013 an investigation was commenced. The following issue was identified for investigation:

> *Whether Hutt Valley District Health Board provided Baby B with an appropriate standard of care in 2010.*

14. Relevant information was received by HDC from:

Hutt Valley DHB	Provider
Dr A	House surgeon
Ms B	Baby B's mother, complainant
Ms C	Dietitian
Dr D	Paediatric consultant
RN E	Registered nurse
RN F	Registered nurse
Dr G	Paediatric registrar
Dr H	Paediatric senior house officer
Dr I	Paediatric consultant

15. Information was also received from the Coroner which included information provided to him by:

DHB 2	Provider
Chief medical officer	

[8] Right 4(1) of the Code provides that "[e]very consumer has the right to have services provided with reasonable care and skill".
[9] Right 4(5) of the Code provides that "[e]very consumer has the right to co-operation among providers to ensure quality and continuity of services".

Paediatric intensive care clinical fellow
Forensic pathologist
Paediatric consultant
General practitioner
Social work supervisor

16. The following parties are also referred to in this report:

Hospital 2	Provider
RN J	Registered nurse
RN K	Community paediatric nurse
Dr L	Paediatric consultant
Ms M	Speech language therapist
Ms N	Social worker
Ms O	Community paediatric nurse
Mr P	Dietitian
Ms Q	Play therapist
Dr R	House surgeon
Ms S	Social worker
Ms T	Visiting neuro-developmental therapist
Dr U	Neonatal paediatrician

17. Independent clinical advice was received from a paediatrician, Dr Philip Moore (**Appendix A**).

18. Independent nursing advice was obtained from a registered nurse, Ms Dawn Carey (**Appendix B**).

Information gathered during investigation

Relevant medical history

19. Baby B had a complex and extensive medical history for her age. She was born in 2009 with an antenatal diagnosis of congenital heart abnormality. She was then transferred to the Hospital 1 Special Care Baby Unit, where concerns were noted about (among other things) her poor weight gain. At around two weeks of age, nasogastric tube (NGT) feeding was commenced.

20. Over her first few months, Baby B had various health issues which required treatment (including two rounds of heart surgery). Baby B continued to experience difficulties with poor weight gain, vomiting and oral aversion.

21. From seven months of age, Baby B was under the care of a paediatric consultant, Dr I, at Hospital 1. Other clinicians involved in her care included a dietitian, Ms C, a speech language therapist, Ms M, and a visiting neuro-developmental therapist, Ms T. Baby B was seen weekly by community paediatric nurses RN K and Ms O. Baby B and her mother were also being supported by Child Youth and Family.

22. In her report to the Coroner, Dr I noted that from the time that Baby B was under her care Baby B's solid food intake, vomiting frequency, quantity of vomiting, and weight gains were "variable and fluctuant". As a result, at approximately nine months, Baby B was admitted to Hospital 1, where she received concentrated feeds via NGT.[10] She was discharged after six days, her weight having increased from 7.35kg to 7.43kg.

23. Baby B lost weight over the two weeks leading up to her second admission.[11] She was then admitted to Hospital 1 to examine her feeding and vomiting patterns and to undertake further investigations.

Monday Day 1

Admission to Hospital 1

24. On Day 1 at 3.30pm, Baby B was admitted to the Children's Ward at Hospital 1. Her progress notes record that, at the time of her admission, Baby B weighed 7.36kg, was afebrile, and was vomiting approximately two to three times per day. Blood tests taken on admission showed normal renal function and electrolytes, including normal sodium levels.

25. At 4.30pm, she was seen by Ms M and Ms T, who recorded in her progress notes that they had observed a "[h]appy little girl, smiles & babbling".

Concentrated feeding plan

26. Upon admission, Ms C recorded that this was "… an elective admission re growth faltering and ongoing diarrhoea" and detailed a feeding plan in Baby B's progress notes to establish the nutritional requirements for "catch up growth". In particular, Ms C recorded that Baby B was to have:

> "concentrated Karicare 17% + polycal 2 blue scoops to every 100mls of Karicare 17% — aim 210mls x 5 per day plan in notes, aim for 1080mls, 1027kcals & 20g protein. Via NGT."

27. Concentrated feeds are made by reducing the amount of water, relative to the amount of powder, to prepare each feed. Baby B's NGT feeds form dated Day 1 recorded that her formula was to be concentrated to 17% by adding 5 scoops of Karicare Infant Formula 1 powder per 200mls of water.[12] Polycal is a high energy supplement, which when added to concentrated feeds (such as those which Baby B was receiving) creates a hyperosmolar[13] mixture.

28. Baby B had been receiving concentrated feeds under the care of Ms C prior to this admission to Hospital 1.

[10] Baby B's care plan dated [first admission] records a concentrated feeding plan of "17% Karicare at 175ml 6 feeds per day + 2 scoops of polycal + oil".
[11] Information collected in weekly nursing visits indicated that Baby B weighed 7.5kg two weeks before second admission, 7.42kg a week before second admission and 7.32kg on admission.
[12] The ordinary concentration of Karicare Infant Formula 1 is made by mixing 1 scoop of powder per 50mls of water.
[13] Hyperosmolarity pertains to an abnormal increase in the solute concentration of fluids.

Further tests

29. On Day 1, Dr I recorded in Baby B's progress notes that a "pH study [was] to be set up" and that a "referral [had] been sent for consideration of gastronomy".[14] A dietary plan was stated "as per dietician", with nurses being required to supervise, observe and document Baby B's feeds and any vomiting. Dr I also recorded that Baby B was to be weighed twice a week.

Paediatric Department — staffing

30. At the time of Baby B's admission, the Paediatric Department at Hospital 1 was staffed by seven paediatricians, a number of whom (including Dr I) worked part-time. The Hutt Valley DHB advised that the following arrangement was in place for children admitted under a part-time consultant:

> "The part-time consultant would review the child regularly when rostered to work; the part-time consultant would formulate a comprehensive management plan for the child which could be followed by junior and, as required, other senior medical staff; the junior medical staff would contact the 'on-call' consultant of the day if there were any acute concerns which required attention."

31. Dr I was employed part-time by the Hutt Valley DHB in general paediatrics and part-time by another service.

Tuesday Day 2 to Saturday Day 6

Baby B's condition improves

32. Between Day 2 and Day 6 Baby B remained in Hospital 1. Her vital signs were stable.[15] During this time, Baby B's vomiting largely settled and her solid intake also increased.

33. On Day 4, dietitian Mr P reviewed Baby B's progress.[16] He noted that she was "managing five feeds" and recorded a treatment plan to "continue feeds as per plan". On Day 5, Mr P recorded in Baby B's progress notes that her weight had increased since admission by 0.27kg to 7.63kg.

Feeding and fluid balance monitoring and assessment

34. From Day 2, Baby B's feeding and fluid balance was assessed daily and recorded in a paediatric fluid balance chart for each day. The charts recorded the total millilitres of oral intake over the course of a day, alongside output (which included urine, faeces and vomitus). Inputs were recorded by entering the time at which the listed food or fluid was given, the amount supplied and the amount taken, together with a total for the day. Outputs were recorded by marking a "tick" in the appropriate column. The "ticks" entered in Baby B's fluid balance charts were sometimes accompanied by a handwritten descriptor, such as "large", "medium" or "small". On occasion, descriptors relating to consistency, such as "loose" or "diarrhoea", were recorded. However, weight and measured volume were not recorded.

35. Hutt Valley DHB advised:

[14] A pH study is a procedure that involves placing a probe in the distal oesophagus to evaluate acid reflux and the need for medical or surgical therapy.
[15] Observation charts record that Baby B's temperature remained below 37°C, her pulse ranged between 120 and 148 beats per minute, and her respiratory rate ranged between 30 and 40 breaths per minute.
[16] Ms C was on leave between Day 2 and Day 8.

> "Each shift nurse documented on the fluid balance chart the stool frequency and an estimate of volume and also commented in the progress notes on additional fluids given to replace vomits or diarrhoeal losses."

Sunday Day 7

Development of diarrhoea — assessment, stool sample and treatment plan

36. At 2am on Day 7, Dr H, the paediatric senior house officer (SHO) on duty, examined Baby B after a "large loose yellow offensive smelling bowel motion" and possible bile aspirated in her NGT. A stool sample was sent for testing. Dr H recorded in his notes that Baby B was "unsettled" and "not going to sleep as she usually would" but otherwise "look[ed] well". Baby B was afebrile, with a temperature of 36.8°C and stable vital signs.

37. Dr H undertook various assessments and recorded a treatment plan in Baby B's progress notes to continue observations and "replace fluid lost" through diarrhoea with "water or enerlyte via NGT".

38. At 11am, Baby B was assessed by paediatric consultant Dr L, who recorded in Baby B's progress notes that she appeared to be "alert and well". Observation charts indicate that her vital signs were largely stable over the course of the day. She remained afebrile, and her respiratory rate was stable at around 38 breaths per minute. Her pulse increased from 129 beats per minute to 165, with a note indicating that she was "crying" at the time, but otherwise remained between 130–150 beats per minute. There was no documented review of the concentrated feeding in response to the increased diarrhoea.

Feeding plan and fluid balance assessment

39. Concentrated feeds were continued over the course of the day. Baby B received 1050mls of "Karicare 17% + polycal".

40. The fluid balance notes indicate that Baby B received 110mls of water[17] over the course of the day to replace five bowel movements (including two "small", one "small loose" and one "large diarrhoea") and one vomit (described as "large"), each indicated by ticks in the output column.

Monday Day 8

Assessment by Dr I and Ms C

41. On Day 8, Baby B was assessed by Dr I, together with Ms C. Dr I recorded in Baby B's progress notes that the results of Baby B's pH study and stool sample had not yet been received, and that she appeared to be "[h]appy sitting, clapping, babbling". Dr I also recorded that Baby B's weight had increased to 7.94kg since admission. Dr I told HDC that this was "the most interactive I had ever seen her".

42. Ms C advised HDC:

> "Given [Baby B's] history of having variable bowel habit, reflux and the reduction in her vomiting frequency there was no clinical reason to suggest a cause for concern at that time therefore her treatment plan was continued."

[17] A further entry of 20mls is included in the chart, but the food or fluid is not specified.

43. At around 1pm the progress notes record that Baby B was "irritable and upset ? in pain", and that paracetamol was given. Over the course of the day, Baby B's recorded pulse rate increased from 120–148 beats per minute to 160–170 beats per minute, and her respiratory rate increased from 30–40 breaths per minute to 50–65 breaths per minute.

Stool sample results

44. At 2.58pm, the results of the stool sample collected the preceding day were reported. The microbiology report recorded that there was "no clostridium detected". In her report to the Coroner, Dr I stated that this is "the most common bacteria to cause gut infections in those hospitalised for more than three days. Rotavirus was not tested for at that time."

Feeding plan and fluid balance assessment

45. Concentrated feeds were continued over the course of the day. Baby B received 1050mls of "Karicare 17% + polycal".

46. Fluid balance notes indicate that Baby B received 260mls of water over the course of the day. She urinated once, and had four bowel movements and one vomit (described as "small"), each indicated with a tick in the output column. No descriptors were used in Baby B's fluid balance chart in respect of her bowel movements. Nursing notes record "loose stools x2".

Tuesday Day 9

Further stool sample

47. On Day 9, RN J began her morning shift by changing Baby B's nappy, at which point she discovered a "very offensive smelling nappy […] more 'offensive' and slightly different to other bowel motions". At approximately 9am, a stool sample was sent for testing and Baby B was given 80mls of water via NGT to replace lost fluids.

48. Over the course of the morning, Baby B continued to experience vomiting and diarrhoea, with rehydration being provided via NGT.

Diagnosis of rotavirus gastroenteritis — assessment and treatment plan

49. At 12 noon, paediatric registrar Dr G examined Baby B. He recorded in her progress notes that the stool sample taken that morning had shown that she was "rotavirus positive". This finding was circled in Baby B's progress notes. Dr G, in a full-page written assessment, further recorded that Baby B appeared "alert and active" with normal skin turgor[18] and no sunken eyes.[19] He considered that Baby B had "mild dehydration".

50. Baby B's temperature was noted as 37.9°C, with a heart rate of 160 beats per minute, respiratory rate of 65 breaths per minute, and capillary refill time of two seconds. Dr G recorded a treatment plan to continue concentrated feeding, with "7ml/kg of enerlyte in one hour if [she] has huge diarrhoea/vomit" and continue twice weekly weighs. Dr I was not rostered to Hospital 1 on Day 9.[20] She told HDC that she "do[es] not recall receiving any calls regarding Baby B that day".

[18] Turgor pertains to the normal fullness or tension produced by the fluid content of blood vessels, capillaries and cells.
[19] Major assessment criteria for hydration status include alertness, sunken eyes and skin turgor.
[20] Dr I advised HDC that she was out of town at an outreach clinic for another service.

51. In her response to my provisional opinion, Ms C noted that she "was not informed of the diagnosis or consulted in respect of the decision to continue concentrated feeding". Ms C noted that "all inpatient nutrition plans included the pager details of the dietician for immediate contact during dietetic working hours".

52. Ms C further explained that, to the best of her knowledge, all Hutt Valley DHB specialised feed recipe instruction sheets for caregivers in community use at the time contained a directive regarding intolerance symptoms and action steps required in the event of those symptoms appearing, including referral to the child's GP or dietitian. However, Ms C noted that "the inpatient nutrition plans did not include such a directive, as inpatients were (and are) managed by medical staff who can change feeding plans based on their own medical assessment".

Medical and nursing gastroenteritis guidelines

53. Hutt Valley DHB advised that "[i]n 2010 the Children's Ward was following the nationally accepted [Hospital 2] Guidelines for the management of children with gastroenteritis". These guidelines provide:

> "The best way to find out [if the child is dehydrated] is to measure weight loss, but a recent weight is seldom available. Clinical estimate of the degree of dehydration is unreliable. Doctors usually overestimate the deficit, and may underestimate if there is hypernatraemia."

54. Although the Hospital 2 guidelines state that the best way to establish if a child is dehydrated is to measure weight loss, Hutt Valley DHB advised:

> "These guidelines do not contain a recommendation for the frequency of weights in children receiving oral or naso-gastric rehydration. The guidelines do recommend daily weights (or even more frequent) for children requiring intravenous rehydration; but [Baby B] was not on intravenous fluids hence the recommendation did not apply to her."

55. Hospital 1 also had in place an acute gastroenteritis care plan, which listed various nursing actions alongside patient concerns. In respect of a "fluid volume deficit related to vomiting and diarrhoea", the prescribed actions included "daily weight".

Feeding plan and fluid balance assessment

56. Concentrated feeds were continued over the course of the day. Baby B received 1050mls of "Karicare 17% + polycal".

57. The fluid balance chart records that Baby B received 160ml water and 210ml Enerlyte over the course of the day. She urinated twice, and had six bowel movements and two vomits. No descriptors are recorded alongside the "ticks" marking the number of bowel movements. One vomit is described as "large".

58. Baby B's progress notes record "1x large vomit" in the morning shift, and "3 diarrhoea, 2 large in volume" in the evening shift. Nursing notes record that in the evening Baby B was "very irritable". Her heart rate had increased to 172 beats per minute, although she remained afebrile at 37.3°C.

Wednesday Day 10

Multidisciplinary Team Meeting (MDT meeting)

59. At 10.15am, an MDT meeting with Child Youth and Family was attended by Dr I, Ms C, Ms O, RN K, Ms T, Ms S (CYFS), Ms Q (play therapist) and Ms N (social worker).[21]

60. Dr I was not rostered to the Children's Ward at Hospital 1 on Day 10. She was working at another service. However, she told HDC that she attended this meeting because "it was important for the future care of [Baby B] that all professionals involved in Baby B's ongoing care were present at the meeting when planning her discharge".

61. Baby B's progress and her discharge planning were discussed, including a number of "current concerns" relating primarily to social issues. It was noted that "[Baby B] has successfully taken solids and vomited a small amount while in [hospital]" and that no medical reason had been discovered yet for her feeding issues. The meeting notes entered into Baby B's progress notes were written by the attending social worker. No reference is made in the meeting notes to Baby B having been diagnosed with rotavirus, or to her increased vomiting and diarrhoea over the preceding days.

62. Dr I and Ms C advised, in response to my provisional opinion, that the purpose of this meeting was to plan for Baby B's discharge and to ensure that Baby B and her mother had adequate support in the community. Dr I noted that "the focus of the meeting was to address possible social issues which might impact on Baby B's ability to maintain her progress on discharge".

63. Dr I further stated:

> "Clearly [Baby B's] current clinical progress was relevant to a discussion and review of arrangements for discharge, which would have been effected by knowledge of new information. In hindsight, if there had been time to take the opportunity to review and read the notes or prior notification of the rotavirus information ahead of the meeting, this would have led to further discussion and review."

Ms C's knowledge of the positive rotavirus result

64. Ms C told HDC that she was not aware of Baby B's gastroenteritis at the time of the MDT meeting, and stated:

> "As the medical notes show I was not informed of the gastroenteritis and I do not recall anything to dispute those notes. I am unable to comment [as] to why this information was not shared with me either directly or otherwise."

65. HDC asked Ms C whether she reviewed Baby B's progress notes during her admission, including prior to the MDT meeting. In response, Ms C told HDC:

> "I completed a touch base review on [Day 8]. This was a clinic day therefore given the time constraints it would not have been usual practice to read her full progress notes. She was not due for a full dietetic review by me until [Day 12] when her progress notes would have been read in their entirety."

[21] A CYFS student was also in attendance.

66. In her response to my provisional opinion, Ms C confirmed that she did not review Baby B's progress notes in advance of the MDT meeting. Ms C advised that as she had not been informed of the rotovirus diagnosis and a dietetic review was not due, she "had no reason to read the medical notes" and, as a result, she was not involved at any stage in reviewing the continuation of the concentrated feeds.

67. Ms C's referral letter to Hospital 2 dated Day 11 stated:

> "I'm not sure what has happened — last touched base on Wednesday[22] and [Baby B] was doing well — had developed rotavirus but tolerating feeds and diet."

68. Ms C explained in her response to my provisional opinion that the referral letter was incorrectly dated owing to a typing error. Ms C further stated that to the best of her recollection, she became aware of the positive rotavirus result after Baby B's collapse in the course of preparing her referral letter to Hospital 2 on Day 12.

69. Ms C also told HDC that "acute management of babies in hospital with diarrhoea/gastroenteritis who are less than 12 months old is directed by physicians".

Dr I's knowledge of the positive rotavirus result

70. Dr I told HDC:

> "I cannot recall when I became aware of the positive rotavirus result. I do not recall being informed by the children's ward staff, either medical or nursing. No mention was made of the rotavirus positive result during the multidisciplinary meeting with CYFS on [Day 10]."

71. Dr I further recalls that upon leaving the MDT meeting, she asked nursing staff to ensure that Baby B was reviewed by the Resident Medical Officer and to call if there were any concerns.[23] Dr I told HDC:

> "I don't recall receiving any calls and I recollect checking by phone with the ward before I left the hospital, at which time no concerns were raised to me or to the on-call paediatrician."

72. At 8.42pm on Day 10, Dr I signed off a microbiology report which records that Baby B was "positive" for rotavirus. Dr I is listed on the report as the "ordering provider" for the report.

73. In her response to my provisional opinion, Dr I explained:

> "These labels are used for all requests while an inpatient and does not indicate who actually ordered the test, or that the 'ordering provider' has knowledge of the request. At 8.42pm on [Day 10] I reviewed the result and 'signed it off', via my computer. Given the time I viewed the result it is clear that I would have looked at it from my home computer. I acknowledge in hindsight that this may not be appropriate, as out of the normal working hours situation, I did not appear to take this information on board. This also led to what

[22] Day 10, the date of the MDT meeting.
[23] Baby B's next medical review took place shortly after midnight on Day 11 at RN E's request.

appears to be an assumption that [Ms C] would have been made aware of the results by other means."

Feeding plan and fluid balance assessment

74. Concentrated feeds were continued over the course of the day. Baby B received 1050mls of "Karicare 17% + polycal".

75. The fluid balance chart records that Baby B received 320ml of Enerlyte over the course of the day. She urinated three times, and had four bowel movements (two large, one small and one medium) and five vomits (three large).

76. Nursing notes record "1x large diarrhoea […] 3x moderate vomits" in the morning and "vomits x3 and LBM [loose bowel movements] x2" in the afternoon.

Thursday Day 11

77. During the night shift of Day 10/Day 11, Ms B told RN E that "[Baby B's] breathing was faster". RN E examined Baby B and found that her respirations and oxygen saturation rates were "at the lower end of the acceptable range at midnight".[24] RN E therefore requested that the SHO on duty assess Baby B's condition.

Assessment by Dr H

78. At 12.15am, the SHO, Dr H, examined Baby B. His full-page assessment records that Baby B was "a bit irritable" with "warm and dry" skin. Her weight, state of hydration and heart rate are not recorded. Dr H recommended further observations in an hour's time, followed by four-hourly observations "if no change or better".

79. Dr I noted in her statement to the Coroner that the impression was of a viral respiratory tract infection. Dr H recorded in the clinical notes: "Imp [impression]: LRTI [lower respiratory tract infection] ? bronchiolitis."

Nursing assessment overnight

80. Nursing notes indicate that Baby B "slept well" and her vital signs were stable. RN E advised that observations were made at 1am and 4am, and that Baby B's "temperature was within normal range and her pulse was 160–162 and respirations were 40–42". Observation charts indicate that Baby B's vital signs were monitored overnight as described by RN E.

Baby B's temperature begins to spike

81. At 9.30am, nursing notes indicate that Baby B's temperature had spiked to 38°C. Nursing notes for the morning shift further record that she was "miserable ++ today, alert and interactive at times. Not tolerating feeds well, had 3x large vomits + 3x diarrhoea."

82. Baby B's medical record indicates that at 11.30am, she had a temperature of 37.3°C, a pulse of 165 beats per minute and a respiratory rate of 39 breaths per minute.

Assessment by Dr G

83. At 12.15pm, Baby B was assessed by Dr G. He recorded that Baby B "look[ed] alert" with "normal skin turgor". No further reference was made to Baby B's hydration status in the

[24] Baby B's respirations were 28 breaths per minute, and her oxygen saturation was 96%.

notes. In his written response to this complaint, Dr G noted that skin turgor and alertness, as well as the presence of sunken eyes, are "important criteria for the assessment of hydration status". Dr G told HDC: "I recollect that [Baby B's] eyes looked normal at the time of my assessment during which she was playing actively with her toys in her cot."

84. Baby B's weight, temperature, respiratory rate and pulse are not recorded in the progress notes made at 12.15pm. Dr G told HDC: "[A]s part of my clinical assessment during a ward round, I always check each child's vital signs as recorded by the nursing staff." Dr G also told HDC:

> "I believe I noted [the parameters at 11.30am] during my assessment […] Even though my written record in the notes on [Day 11] at 12:15 was not as comprehensive as the written record made on [Day 9], this does not mean that I did not examine [Baby B] as thoroughly as I did on [Day 9]. I believe that based on the objective assessment I made at 12:15 on [Day 11] it was reasonable for me to conclude that [Baby B] did not show any clinical evidence of moderate or severe dehydration."

85. Dr G recorded in the progress notes that Baby B had "just had big vomit" and to "[w]eigh tomorrow. Cont. feeding regime and enerlyte replacement for diarrhoea/vomit."

86. No further tests were undertaken. Dr G told HDC that he did not understand it to be "usual or best practice to order blood tests in a child who do[es] not show any sign of sepsis or moderate or severe dehydration especially one who does not need any intravenous fluid for rehydration". Dr I told HDC that "as there were no specific triggers raising alert, there was no consideration for blood tests". Similarly, Hutt Valley DHB told HDC that blood tests are a "stressful and significant intervention" for children, and are undertaken only where it is "obviously indicated".

Telephone call with Dr I

87. Following his assessment of Baby B, Dr G paged Dr I (who was out of the hospital that day as it was her day off). Dr I then contacted him by telephone. Dr I stated that this is her "first recollection of a conversation regarding the management of [Baby B] post Rotavirus result".

88. In her statement to the Coroner, Dr I recalls:

> "[Dr G] recounted his assessment and the assessment earlier in the night by [Dr H]. I recall that he was happy with [Baby B's] current status and was asking further questions regarding the pH study and social issues. I recall indicating that I was out of the hospital, that the pH study and social issues were in hand and that the current main issue was ensuring there were no acute issues from the Rotavirus."

89. In response to my provisional opinion, Dr I advised that her understanding at the time was that either she or the consultant on call would be alerted by Dr G or other ward staff if there was a change in Baby B's condition that might require a change in her management plan. Dr I noted that in the information she was provided with there was "no trigger for consideration of significant dehydration, including hyperosmolar dehydration, and therefore no call for re-evaluation or consideration of change to feeding plan".

90. Dr I further advised that as it was her day off, Baby B was under the care of the medical staff rostered to the Children's Ward that day, and she did not review Baby B herself. As a result, she was "unaware that the dietician had not been made aware of the positive rotavirus result, and therefore no discussions regarding changes to [Baby B's] feeding regime were had with her".

91. Dr I similarly noted that the on-call paediatrician was not contacted, stating that "[d]uring the morning, afternoon and night shifts on [Days 11-12] no concerns were raised by staff to me or to the consultant on call that prompted a medical review of [Baby B] after she developed a fever and deteriorated".

Feeding plan and fluid balance assessment

92. Concentrated feeds were continued over the course of the day. Baby B received 1050mls of "Karicare 17% + polycal".

93. The fluid balance chart records that Baby B received 400mls of Enerlyte over the course of the day. She urinated five times, and had six bowel movements (one large) and five vomits (three large, one small). Each output is recorded with a tick. Four of the 15 ticks recorded are accompanied by a descriptor, either "large" or "small".[25]

94. Nursing notes record that Baby B had "3x diarrhoea" in the morning shift and "1x vomit and diarrhoea" in the evening shift. No further information as to volume or consistency is recorded in either the fluid balance sheet or nursing notes.

Monitoring of Baby B's vital signs

95. Between 2.45pm and 11.15pm, RN F attended to Baby B. At 3.45pm, RN F checked Baby B's vital signs, which she found to be "not dissimilar to observations over the previous few days and therefore there was nothing to suggest at that time that [Baby B] required more frequent monitoring". Clinical notes record that her temperature was 38.2°C and her heart rate was 152 beats per minute, and that paracetamol was given.

96. Baby B's vital signs were not checked again until 9.35pm, by which point she was noted to be febrile, miserable and quiet with a temperature of 39.2°C and an increased heart rate of 172 beats per minute.

97. RN F acknowledged to HDC that the duration between these checks "falls outside the expected parameters of 4 hourly observations". She stated that she had "visually observe[d]" Baby B over the course of the afternoon, and that "there was nothing in these visual observations that gave cause for concern".

Discussion with doctor regarding Baby B's condition

98. At 9.45pm, RN F administered paracetamol to Baby B for her increased temperature. RN F advised HDC that "due to the obvious deterioration in [Baby B]", she recalls speaking with "[Dr A]" about Baby B's condition and "assumed that the doctor had reviewed [Baby B] in light of our conversation". In a further response to HDC, RN F advised that she "may not

[25] The fluid balance chart records 16 outputs, marked with 15 ticks, one of which is accompanied by a note reading "x2".

have specifically requested [Dr A] to review [Baby B] but I did advise her of [Baby B's] condition". This discussion was not recorded in the nursing records.

99. Dr A was the house surgeon on duty during the evening of Day 11. She advised HDC that she has no recollection of any such discussion with RN F.[26]

Night shift handover

100. Hospital 1's normal practice at the time was for the Associate Clinical Nurse Manager (ACNM) or shift co-ordinator to hand over the care of all inpatients to the oncoming staff for the afternoon and night shift.

101. RN F told HDC that in the handover that occurred that evening, "[she] updated the nurse who was to take over the care of [Baby B] during the night shift" and that she also "advised the handover nurse of [Baby B's] presentation".

102. In her response to my provisional opinion, RN F advised:

> "Whilst it was not required on the ward at the time it was my usual practice, in addition to performing the usual handover with the coordinating handover nurse, to speak with the nurse actually taking over the care of the patient. You never knew how accurate the coordinating handover nurse would be in relating the information third hand and by speaking to the nurse myself that nurse could ask questions. I am certain that on [Day 11] I did this with [RN E]."

103. RN E was the nurse taking over Baby B's care for the night shift. In her written response, she advised HDC:

> "I cannot recall from that shift handover that night whether we were told of any warning signs or about [Baby B's] temperature […] That particular nurse [RN F] did not give the handover to the night shift. The individual nurse who gives the patient care tells the nurse doing the handover what to report."

104. Baby B's temperature readings that evening had been documented on the observation chart and recorded in her progress notes as "febrile 38^{2}–39^{2}". It was also noted that Baby B was "[q]uiet today, miserable". There was no specific reference to RN F's stated concern that there was an "obvious deterioration in [Baby B]".

Friday Day 12

105. At midnight, RN E examined Baby B and found that her temperature had reduced to 37.6°C and that her heart rate was 160 beats per minute. RN E advised:

> "I assessed this to reflect that [Baby B] had responded to the panadol that had been administered on the afternoon shift. I also think that I must have attributed her evening increase in temperature and response to panadol by midnight to the possible diagnosis of LRTI and bronchiolitis of [Day 10] by the SHO."

[26] Hutt Valley DHB told HDC that Dr R was also on duty that night, but that "[Dr R] is currently working in the UK and we have been unable to contact him".

Ms B expresses concern with Baby B's condition

106. At approximately 1.30am, Ms B recalls that she found Baby B "laying there completely still with her eyes rolling back and forth in her head". In her complaint to HDC, Ms B stated that she asked "a nurse" to check Baby B. The nurse and a male doctor then "flashed a light in her eyes" and "said she was ok".

107. There is no contemporaneous record of this incident in the progress notes. RN E told HDC that she could not recall "[Ms B] asking me to assess [Baby B] or to call any doctor at any point […] I also have no recall of a doctor being in attendance at 0130hrs with the nurse and flashing a light in [Baby B's] eyes."

108. Dr D was the consultant paediatrician on call at Hospital 1 on the night of 22/Day 12. Dr D told HDC:

> "[Baby B's] mother told me that at 01.30am, she had noticed that [Baby B's] eyes were rolling back and looked vacant. This was said to last for approximately 5 minutes. She did not see any associated jerking movements. [Baby B's] mother told me that these movements were seen by a member of the nursing staff 'who felt they were normal pre-sleep movements'. I do not know the name of the member of nursing staff to whom [Baby B's] mother had been referring. I am unable to comment further about this assessment."

109. Dr D's comments are based on notes made by her retrospectively (at approximately 4am) following a discussion with Ms B after Baby B's collapse. Dr D recalls "asking [Baby B's] mother about events leading up to [Baby B's] collapse" and that "this was the first time I became involved with her [Baby B]".

110. In her response to my provisional opinion, Ms B noted that she recalls that Baby B's eyes stopped rolling back only "when the light touched them" and that she "never heard or talked to someone about pre-sleep movements". Ms B also said that after Baby B collapsed she went "straight into shock and denial" and cannot recall speaking with Dr D or being asked about Baby B's collapse.

Baby B found unresponsive

111. At approximately 3.30am, RN E heard "grunting" as she passed Baby B's room. Upon inspection, she found Baby B "not responsive, eyes rolled back, all extremities cold to touch". RN E made an emergency "777" call, which was attended by Dr D and Dr H. Retrospective progress notes made by Dr D record that Baby B was in "significant respiratory distress", had "mottled" extremities and "equal but sluggish" pupils, and was febrile at 39.2°C.

Transfer to Intensive Care Unit

112. At 5am, Baby B was transferred from the Children's Ward to the Intensive Care Unit at Hospital 1. At 7.22am, blood test results showed that Baby B had abnormally high sodium levels of 172mEq/L.[27] At 8.45am, Baby B's progress notes record that she was identified as having "hypernatraemia — severe dehydration" with acute respiratory distress and renal failure.

[27] The normal range of blood sodium levels is 135 to 145 milliequivalents per litre (mEq/L).

113. At 11.45am, the Hospital 2 Paediatric Intensive Care Retrieval Team arrived and Baby B was transferred to Hospital 2.

Saturday Day 13

114. Baby B had multiple organ failure and significant swelling in her brain, causing brain damage. On Day 13 at approximately 5.50pm, Baby B was taken off life support. She was declared deceased shortly afterwards.

Cause of Baby B's death

115. Tests conducted on Baby B following her collapse confirmed acute renal failure and severe hypernatraemia. The Coronial autopsy report recorded that the direct cause of Baby B's death was cerebral oedema and swelling. Antecedent causes were shock and severe electrolyte abnormalities. The underlying condition was diarrhoeal illness.

Actions undertaken by Hutt Valley DHB

116. Since this incident, Hutt Valley DHB has made a number of changes to relevant aspects of its practice.

Hospital 1 policy — treatment of children with gastroenteritis

117. At the time of Baby B's admission, Hospital 1 was following the Hospital 2 Guidelines for the management of children with gastroenteritis. These guidelines do not contain a recommendation for the frequency of weighing children receiving oral or nasogastric rehydration.[28]

118. Hospital 1 has now adopted the Melbourne Royal Children's Hospital clinical practice guideline for management of gastroenteritis, which includes instruction on regular weighing of children and monitoring of electrolytes.

119. In October 2011, Hutt Valley DHB issued its Children's Ward Policy for gastroenteritis. Assessment protocols now require blood tests "(eg sodium)" for patients receiving "fortified feeds (concentrated feeds or calorific additives)", with senior doctor review also being required. Assessment of the degree of dehydration is to involve "weigh[ing] child and compar[ing] with any recent weight recordings".

120. Hospital 1's nursing care plan for gastroenteritis has also been revised in accordance with the new management guidelines. Fluid balance charts have also been reviewed and standardised.

Instruction sheets for concentrated feeds

121. Hutt Valley DHB's instruction sheets regarding the use of concentrated feeds for both in-patients and out-patients now contain the following:

> "If your baby develops diarrhoea, change back to the standard recipe on the formula can immediately and contact your dietician. If vomiting is severe or diarrhoea does not improve contact your general practitioner for advice."

[28] The Hospital 2 Guidelines do provide for daily (or more) weighing of children with gastroenteritis who are receiving intravenous rehydration. As Baby B was not receiving intravenous rehydration, this guideline did not apply to her.

Further staff training

122. All inexperienced junior doctors are now required to attend a Newborn Life Support course in the first week of their attachment and a Paediatric Intermediate Life Support course in the second week of their attachment. Eighty percent of the Children's Ward nursing staff have attended the Paediatric Intermediate Life Support training, and all of the nursing shift co-ordinators have attended this training. The training includes a lecture and scenarios on recognising sick or deteriorating children.

Staffing levels

123. A programme known as "Trendcare" has recently been implemented throughout Hospital 1. The programme provides an indication of safe staffing levels, and is designed to help ensure staffing levels are appropriate for the patient mix and acuity on the Children's Ward.

124. Hospital 1's system for placing emergency calls has also been reviewed to ensure that paediatric consultants are called early for any paediatric arrest.

125. Hutt Valley DHB advised HDC that it has made a number of further changes in terms of infection control and isolation procedures, surveillance of rotavirus in in-patients, raising public awareness of childhood gastroenteritis, and CYFS liaison. Hutt Valley DHB also advised that it is considering the introduction of an Early Warning Score system, and that a group will be meeting to progress implementation.

Nursing handover

126. The Hutt Valley DHB has advised that ACNM or shift co-ordinator handover remains common practice throughout its inpatient services.

Response to provisional opinion

127. In response to my provisional opinion, Hutt Valley DHB agreed that "[d]aily weights may well have been a useful step to have taken", but submitted that neonatal paediatrician Dr U, who provided advice to ACC with regard to Baby B's treatment, did not consider that daily weights would have formed part of accepted practice in Baby B's case.

128. In his report to ACC, Dr U stated:

> "I personally have an expectation […] that children with gastroenteritis have daily weighs recorded while their diarrhoea continues. This is quite useful in creating some objectivity around fluid losses and can act as a trigger for electrolyte measurement. However, I accept that this standard of care from our hospital is not universally accepted."

Opinion: Hutt Valley DHB

Overview

129. Baby B was admitted to Hospital 1 for supervised feeding and observation for poor weight gain and ongoing health and social issues. She had a complex medical and social history with a range of significant risk factors. As such, Baby B was under the care of a multidisciplinary

team (MDT) comprised of various clinicians, who worked alongside the nursing team involved in Baby B's day-to-day care. As I have previously stated:[29]

> "The complexities of modern medicine require that clinicians work in highly organised, multidisciplinary teams, with each team member responsible for directing their specialist capability towards achieving common goals for patients. It is essential that teams consistently communicate well with one another to ensure that a safe and seamless service is provided to the patient. It is also essential that clear communication is accompanied by accurate documentation. Clear communication and accurate documentation form two layers of protection that operate to deliver seamless care. When one or more of those layers do not operate optimally, there is potential for the patient to be harmed."

130. Hutt Valley DHB and the teams involved in Baby B's care had a responsibility to take all reasonable steps to ensure that services were provided to her with reasonable care and skill,[30] and that there was adequate communication within the MDT to ensure the quality and continuity of the services provided.[31]

131. I consider that a number of service failures led to Baby B receiving sub-optimal care and treatment following her diagnosis with rotavirus. These failings were caused, in part, by poor assessment, monitoring, and treatment of Baby B's developing dehydration, and poor communication within the MDT involved in Baby B's care.

132. In my view, Hutt Valley DHB staff did not provide adequate care to Baby B. District health boards are responsible for the operation of clinical services within hospitals, and can be held responsible for any service-level failures. The failures of the teams involved in Baby B's care were service failures which I consider are directly attributable to Hutt Valley DHB.

133. I find that Hutt Valley DHB failed to provide services to Baby B with reasonable care and skill, in breach of Right 4(1) of the Code, by continuing concentrated feeding, by failing to assess and monitor Baby B's fluid balance properly following her diagnosis with rotavirus despite ongoing fluid losses, and by not reviewing Baby B medically on the night of Day 11.

134. I also find that Hutt Valley DHB failed to ensure the continuity of services provided to Baby B, in breach of Right 4(5) of the Code, in that members of the MDT failed to communicate adequately with one another in relation to Baby B's diagnosis with rotavirus.

135. The above breaches, as well as other relevant aspects of the care provided to Baby B, are addressed in further detail below.

Diagnosis of rotavirus gastroenteritis — No breach

136. On Day 7, Baby B began to experience diarrhoea and was assessed by paediatric SHO Dr H. A stool sample was taken that day, which showed "no clostridium". Baby B was not tested for rotavirus at that time. She continued to experience diarrhoea and vomiting.

[29] 10HDC00419. Published 10 June 2013.
[30] Code of Health and Disability Services Consumers' Rights, Right 4(1).
[31] Code of Health and Disability Services Consumers' Rights, Right 4(5).

137. On Day 9, a further stool sample showed that Baby B was "rotavirus positive". My independent expert advisor, paediatrician Dr Philip Moore, advised me that rotavirus is a commonly acquired illness in hospital settings. I note that Dr Moore considered the standard of care provided in this regard to be appropriate, the diagnosis having been made promptly, and early clinical assessments being "thorough and well-documented". I am satisfied that adequate and appropriate care was taken with regard to Baby B's diagnosis with rotavirus gastroenteritis.

Assessment, monitoring and treatment following diagnosis of rotavirus gastroenteritis — Breach

138. I consider that there were a number of failings in the standard of care provided to Baby B in the period between her diagnosis with rotavirus and her ultimately fatal collapse three days later. These matters relate mainly to the continuation of concentrated feeds and inadequate monitoring and assessment during this period. I expand on each of these matters below.

Continuation of concentrated feeds

139. Baby B received concentrated feeds throughout her admission to Hospital 1. Dr Moore advised me that these were hyperosmolar feeds, and that:

> "[w]hen a child is well and has normal renal function the higher solute load can be managed. But when there is loss of fluids (eg diarrhoea and vomiting) and possibly reduced or inadequate water intake, hypernatraemia and uraemia[32] can result."

140. Dr Moore further advised that Baby B's hyperosmolar feeds should have been stopped when the rotavirus infection was diagnosed. However, no changes were made to Baby B's feeding regimen following her diagnosis with rotavirus.

141. I note that since this complaint, Hutt Valley DHB's instruction sheets for caregivers of children requiring concentrated feeds now all include a directive to "change back to the standard recipe on the formula can **immediately**" [emphasis in original] if their child develops vomiting or diarrhoea.

142. It does not appear that the risks of continuing with concentrated feeds in Baby B's circumstances were specifically considered by any Hutt Valley DHB staff, either at the time of diagnosis or subsequently. In particular:

- On Day 9, Baby B was assessed by Dr G, who noted that Baby B was "rotavirus positive" and that concentrated feeds were to be continued. It appears that the diagnosis and the decision to continue with concentrated feeds were not raised with Dr I or the on-call paediatrician that day.

- The rotavirus diagnosis was not raised at an MDT meeting on Day 10, which was attended by Dr I and Baby B's dietitian, Ms C, and neither Dr I nor Ms C read the clinical notes, where the diagnosis was clearly documented.

[32] Uraemia is a toxic condition accompanying kidney failure, in which there is a raised level in the blood of urea and other nitrogenous waste compounds which are ordinarily eliminated by the kidneys.

- At 8.45pm on Day 10, Dr I signed off a microbiology report which showed that Baby B was rotavirus positive. However, there is no evidence that Dr I considered reviewing Baby B's feeding plan at that time.

143. On Day 11, Baby B developed a fever and was assessed by Drs H and G respectively at 12.15am and 12.15pm. Dr H suspected a viral infection and did not review the feeding plan. Dr G assessed Baby B's hydration status and recorded in the notes: "Weigh tomorrow. Cont. feeding regime and enerlyte replacement for diarrhoea/vomit." In relation to a subsequent telephone call with Dr I, it was noted that "the current main issue was ensuring there were no acute issues from the Rotavirus", but again no steps were taken to amend the concentrated feeding.

144. Despite there having been a number of opportunities to address the concentrated feeding issue, Baby B's feeding plan was not altered. Dr I advised that there was "no trigger for consideration of significant dehydration, including hyperosmolar dehydration, and therefore no call for re-evaluation or consideration of change to feeding plan". Baby B's existing feeding regimen supplemented with Enerlyte was continued unchanged until her collapse on Day 12.

Inadequate measurement of fluid loss

145. Fluid balance assessments require measurement of both fluid intake and output. Throughout Baby B's admission, her fluid balance was assessed daily and recorded by the nursing team in a paediatric fluid balance chart for each day. The forms recorded the total millilitres of oral intake over the course of a day, alongside output (which included urine, faeces and vomitus). Inputs were recorded by entering the time at which the listed food or fluid was given, the amount supplied and the amount taken, together with a total for the day. Outputs were recorded by marking a "tick" in the appropriate column.

146. The "ticks" entered in Baby B's fluid balance charts were sometimes accompanied by a handwritten descriptor, such as "large", "medium" or "small". On occasion, descriptors relating to consistency, such as "loose" or "diarrhoea", were recorded. However, objective data such as Baby B's weight and measured output volume were not recorded, nor does it appear that there was any expectation that such information would be collected. Hutt Valley DHB advised that each shift nurse would estimate output volumes.

147. This approach to fluid balance assessment continued unchanged following Baby B's diagnosis with rotavirus. Dr Moore has advised me that "there should have been attempts to more accurately measure losses of both stool and urine (with nappy weighs etc), rather than estimates, to ensure adequate replacement". Similarly, my independent nursing advisor, Ms Dawn Carey, noted that while the initial management of Baby B's fluid balance was appropriate, "an attempt to calculate her actual losses should have been instituted once she was diagnosed with rotavirus gastroenteritis". Ms Carey considered that this could have been achieved through instituting daily weights and by weighing soiled nappies.

148. Of particular concern to me is the use of subjective descriptors rather than objective measurement in Baby B's fluid balance charts after her diagnosis. I am also concerned by the inconsistent and intermittent use of such descriptors. Some entries have no accompanying descriptor, and others are accompanied by descriptors relating to volume or consistency or both. Nursing notes sometimes contain further detail as to volume and/or consistency, but this

information is also provided in subjective terms and does not always correlate with the information recorded in the fluid balance charts. It appears that there was no single, comprehensive record kept of Baby B's actual fluid output following her diagnosis with rotavirus. I am therefore satisfied that the steps taken to measure Baby B's actual fluid output after Day 9 were sub-optimal in the circumstances.

Failure to re-weigh

149. Weight is a key indicator of fluid loss. Baby B's treatment plan during her admission provided for twice-weekly weighing. This was not altered following her diagnosis with rotavirus.

150. Baby B was weighed on Day 8, prior to her diagnosis with rotavirus. Her weight was recorded as 7.94kg, an increase of 0.58kg since admission. Baby B was next due to be weighed on the day of her collapse on Day 12. Despite ongoing vomiting and diarrhoea and a number of significant changes in her condition, including her diagnosis with rotavirus on Day 9 and spiking temperatures on Day 11, she was not re-weighed as part of the assessments undertaken. It does not appear that the need for more frequent weighing was discussed or considered.

151. In response to my provisional opinion, Hutt Valley DHB agreed that "[d]aily weights may well have been a useful step to have taken", but submitted that neonatal paediatrician Dr U, who provided advice to ACC with regard to Baby B's treatment, did not consider that daily weights would have formed part of accepted practice in Baby B's case.

152. I note that Dr U stated in his report that this standard of care is "not universally accepted". However, Dr U also stated that he has a personal expectation that children with gastroenteritis have daily weights recorded while they are experiencing diarrhoea. In particular, he stated that "[t]his is quite useful in creating some objectivity around fluid losses and can act as a trigger for electrolyte measurement".

153. Dr Moore considered Dr U's advice and noted, "I believe that our two opinions share similar concerns but perhaps express them differently." Dr Moore advised:

> "In the case of an infant admitted for poor weight gain and supervised feeding, who then develops rotavirus gastroenteritis with significant ongoing losses of vomit and stool, a daily weight would have been part of the expected standard of care in 2010. Other Paediatric units (including my own and [Dr U's]) would have performed a daily weight as the 'best means available to determine fluid loss'."

154. Baby B was at increased risk of becoming dehydrated and of developing hypernatraemia due to her particular circumstances. Ms Carey also advised me that an attempt to calculate Baby B's actual losses after her diagnosis could have been achieved through daily weights.

155. I acknowledge that, at the time, Hospital 1 had adopted Hospital 2's guidelines in relation to gastroenteritis management. While those guidelines provided for daily (or more frequent) weighing of children receiving intravenous rehydration, they did not provide for daily weighing of all children with gastroenteritis. As Baby B was receiving rehydration via NGT, the daily weight guideline did not apply to her.

156. Although on the face of it this aspect of Baby B's treatment appears to have accorded with the guidelines in place at Hospital 1 at the time, the Hospital 2 protocol adopted by Hospital 1 did not provide for an infant in Baby B's circumstances. As stated, my expert has advised that daily weight would have been the expected standard of care in 2010 in other paediatric units for an infant admitted for poor weight gain and supervised feeding, who then developed rotavirus gastroenteritis with significant ongoing losses of vomit and stool. Furthermore, compliance with existing guidelines is never determinative of the matter, and I agree with Dr Moore's comment that "following a guideline is not necessarily appropriate in every situation". As I have previously commented,[33] it is inappropriate for a DHB to adopt and implement a protocol without first reviewing the protocol to ensure it is appropriate to the particular operating environment at that DHB.

157. I note that other accepted guidelines in existence at the time, such as the Melbourne Royal Children's Hospital guidelines, did provide for daily weighing of children with gastroenteritis. I note that Hospital 1 has now accepted these guidelines and requires daily weighing of children with gastroenteritis. Whilst it does not diminish the identified deficiencies in Hospital 1's systems, I note that Hutt Valley DHB has acted appropriately in acknowledging its shortcomings, taking responsibility, and putting in place measures to ensure that such an event does not recur.

158. I am also concerned by the apparent discrepancy between the medical and nursing guidelines in place at the time for the management of gastroenteritis. The medical guidelines recommended daily weighing only for those children receiving intravenous rehydration. In contrast, the nursing care plan provided for "daily weight" where there was a concern as to "fluid volume deficit related to vomiting and diarrhoea", with no specification as to the means of rehydration being provided. Ms Carey advised me that although Dr G did not request more frequent weighing, in light of Baby B's diagnosis on Day 9 and the nursing care plan, she "would have expected a registered nurse to query whether they should be commenced for [Baby B]".

159. Having carefully considered Hutt Valley DHB's submission with regard to this point, I remain of the view that in these circumstances, given Baby B's particular risk factors and condition, the failure to re-weigh fell outside accepted standards of care irrespective of the guidelines Hospital 1 had in place at the time.

Failure to arrange a further medical review of Baby B's condition on the evening of Day 11

160. On Day 11 at 9.35pm, RN F found that Baby B was febrile, miserable and quiet with a temperature of 39.2°C and an increased heart rate of 172 beats per minute.

161. Ms Carey advised me that "the nursing staff should have been concerned about [Baby B's] fever and sought a clinical review". There is no clinical review of Baby B's condition recorded in her progress notes for the night of Day 11, prior to her collapse. RN F told HDC that she recalls speaking with Dr A regarding Baby B's condition at the time. Dr A has no recollection of any such discussion. In a further response to HDC, RN F advised that she "may not have specifically requested [Dr A] to review [Baby B] but [she] did advise her of [Baby B's] condition".

[33] 11HDC01434. Published on 21 January 2014.

162. I am unable to make a factual finding on the information available as to what communications, if any, took place between RN F and Dr A. In any event, Baby B's notes indicate that there was no medical review of her condition in light of her increased temperature. I am satisfied that this falls short of accepted standards of care in the circumstances.

163. I am also unable to make a factual finding as to whether Baby B was assessed by a doctor at 1.30am on Day 12 as stated by Ms B. There is no record of this event, and HDC has been unable to identify any persons involved in Baby B's care who can recall this event.

Summary

164. I consider that there were a number of significant shortcomings in the assessment, monitoring and treatment provided to Baby B at Hospital 1 following her diagnosis with rotavirus. In particular:

- The continuation of concentrated feeding following Baby B's diagnosis despite ongoing vomiting and diarrhoea was inappropriate.

- The steps taken to measure Baby B's fluid loss (including the failure to institute daily weight) were suboptimal given Baby B's particular risk factors and condition.

- There was no medical review of Baby B's condition after she spiked a temperature of 39.2°C at 9.35pm on Day 11.

165. In my view, Hutt Valley DHB failed to provide services to Baby B with reasonable care and skill, in breach of Right 4(1) of the Code.

Failure to obtain blood tests — No breach

166. Blood tests taken on admission showed that Baby B had normal renal function and electrolyte levels (including normal sodium levels). No further blood tests were taken until her collapse on Day 12, at which point she was identified as being hypernatraemic with a sodium level of 172.

167. On Day 9, Baby B was identified as having "mild dehydration" using major hydration assessment criteria, which include alertness, skin turgor and the presence or otherwise of sunken eyes. Dr G told HDC that he did not consider it to be "usual or best practice" to obtain blood tests from a child, such as Baby B, who is not receiving intravenous rehydration and does not show signs of moderate or severe dehydration. Similarly, Hutt Valley DHB told HDC that blood tests are a "stressful and significant intervention" for children, and are undertaken only where it is "obviously indicated".

168. On Day 11 at 12.15pm, Baby B was re-assessed by Dr G. No specific finding in respect of hydration was recorded in her progress notes, but it is clear from those notes that the same hydration assessment criteria were used.[34] Although it is not recorded in the notes, Dr G told HDC that he concluded that there was "no clinical evidence of moderate or severe

[34] Dr G recorded in Baby B's progress notes that she "look[ed] alert" with "normal skin turgor". In respect of the presence of sunken eyes, Dr G told HDC that although it was not recorded in her notes, he recalls that "[Baby B's] eyes looked normal at the time of my assessment".

dehydration". On that basis, he did not consider that blood tests were clinically indicated. Dr I also advised that in her view there were no specific triggers raising an alert, and there was therefore no reason to consider blood tests to assess dehydration.

169. I agree with Dr Moore's view that earlier blood tests may have been of assistance in identifying an "evolving problem", which may have led to changes in Baby B's treatment plan. In Dr Moore's view, the new finding of fever on Day 11 ought to have prompted consideration of blood tests.

170. Dr Moore advised me that in the context of hypernatraemia, dehydration can be "subtle and difficult" to assess, and that "the usual signs of dehydration can be masked". The medical guidelines in place at the time note that "doctors usually overestimate the [hydration] deficit, and may underestimate if there is hypernatraemia". Dr Moore also noted that "hypernatraemic dehydration is clinically recognised by experienced paediatricians less than half the time".

171. In Dr Moore's view, the clinical assessment findings on Day 11 were misleading owing to the likely development of hypernatraemia at that stage. However, Dr Moore acknowledges that given the information known to the clinicians at the time, there was "no clear-cut indication" as to whether blood tests were required. In light of this, I am satisfied that the decision not to obtain blood tests was reasonable in the circumstances.

Communication within the Multidisciplinary Team — Breach

172. During Baby B's admission to Hospital 1, she was under the care of an MDT led by part-time paediatric consultant Dr I. In keeping with Hospital 1 practice at the time, Dr I prepared a management plan for Baby B, which was to be implemented by junior staff and (as required) other senior medical staff. Junior medical staff were to contact the "on-call" consultant if there were any acute concerns.

173. Given Baby B's complex medical history, there was also input from a number of different health professionals, both prior to and during her admission to Hospital 1. This included dietitian Ms C, who formulated Baby B's feeding plan upon admission, reviewed Baby B's progress alongside Dr I on Day 8, and attended an MDT meeting on Day 10 to discuss Baby B's discharge planning. The management of Baby B's care therefore required a high degree of communication and co-ordination within the MDT so as to ensure the continuity of services provided. I am concerned that in this case that did not happen, for the reasons set out below.

174. In particular, paediatric registrar Dr G became aware of the positive rotavirus result on Day 9. He recorded a detailed, full-page assessment of Baby B's condition in her progress notes, which clearly stated that she was "rotavirus positive". Dr I, who was away from the paediatric ward between Day 9 and Day 11,[35] told HDC that she was not advised of the diagnosis by medical or nursing staff on Day 9. The on-call paediatrician was also not contacted on Day 9 in relation to the diagnosis. There was no clinical assessment of Baby B by a consultant following the diagnosis of rotavirus. Ms C was also not informed of the diagnosis at this stage.

[35] Dr I was rostered with another service on Day 9 and Day 10. Although she was not rostered with the Hutt Valley DHB, she attended the MDT meeting on Day 10. Day 11 was Dr I's day off.

175. On Day 10, an MDT meeting was attended by Ms C, together with Dr I and other health professionals involved in Baby B's care. Dr I and Ms C both told HDC that no mention was made of the positive rotavirus result prior to or at the MDT meeting. The notes of that meeting make no reference to Baby B's diagnosis the previous day. Neither Dr I nor Ms C reviewed Baby B's progress notes (which clearly stated that she was "rotavirus positive") in advance of the meeting. Ms C told HDC that she had "no reason" to review Baby B's progress notes. Dr I told HDC that "[i]n hindsight, if there had been time to take the opportunity to review and read the notes or prior notification of the rotavirus information ahead of the meeting, this would have led to further discussion and review".

176. The MDT meeting notes record that Baby B was described as having "vomited a small amount while in hosp[ital]" and that no medical reason had been discovered for her feeding issues. This account sits at odds with Baby B's progress notes, which indicate that she had been experiencing vomiting and diarrhoea since Day 7, and had been identified as "rotavirus positive" on Day 9.

177. In her referral letter to Hospital 2 dated Day 11,[36] Ms C stated:

> "I'm not sure what has happened — last touched base on Wednesday and [Baby B] was doing well — had developed rotavirus but tolerating feeds and diet."

178. Ms C's reference to having "touched base on Wednesday" relates to the MDT meeting on Day 10. In her response to my provisional opinion, Ms C clarified that her referral letter was incorrectly dated owing to a typing error. Ms C further stated that "to the best of [her] recollection, [she] became aware of the [rotavirus] result after Baby B's collapse [on Day 12] in the course of preparing [her] referral letter to [Hospital 2]". I am concerned that in the evening following the MDT meeting, Dr I signed off a microbiology report which indicated that Baby B was rotavirus positive. However, it does not appear that any steps were taken to discuss this with Ms C, whose role related to the management of Baby B's feeding. I am also concerned by Dr I's comment that she did not know that Ms C had not been made aware of the diagnosis.

179. I am concerned that Baby B's diagnosis does not appear to have been promptly communicated to the MDT, and there does not appear to have been a co-ordinated approach to reviewing Baby B's treatment plan on the basis of that diagnosis. As a result, a number of important opportunities were missed for Baby B's feeding regimen to be reviewed. In my view, this inadequate communication and care co-ordination falls short of accepted standards of care. I consider that Hutt Valley DHB failed to ensure the continuity of care provided to Baby B, in breach of Right 4(5) of the Code.

Management of Baby B's collapse — No breach

180. On Day 12 at approximately 3am, RN E heard "grunting" as she passed Baby B's room. Upon inspection, she found Baby B "not responsive, eyes rolled back, all extremities cold to touch". RN E made an emergency "777" call. Retrospective progress notes record that Baby B was in "significant respiratory distress", had "mottled" extremities and "equal but sluggish" pupils, and was febrile at 39.2°C. She was later identified as having

[36] Although the letter is dated Day 11, it records Baby B's discharge date as Day 12. Baby B was not transferred to Hospital 2 until Day 12. It therefore appears likely that the letter was prepared on Day 12.

"hypernatraemia — severe dehydration" with acute respiratory distress and renal failure. At 11.45am, the Hospital 2 Paediatric Intensive Care Retrieval Team arrived and Baby B was transferred to Hospital 2 where, sadly, she died the following day.

181. Dr Moore advised me that "after [Baby B's] collapse the management [was] exemplary, with excellent documentation, a clear plan and good monitoring". I am satisfied that the care provided to Baby B following her collapse was consistent with expected standards and in accordance with the requirements of the Code.

Conclusion

182. On Day 9, when Baby B was diagnosed with rotavirus, a number of key changes should have been made to her treatment plan. In particular, the need for continued concentrated feeds should have been reviewed, and the MDT and the nursing team should have recognised the need for, and carried out, closer monitoring of her fluid output so as to ensure that adequate replacement was being provided.

183. On the evening of Day 11, when Baby B developed a fever of 39.2°C and increased heart rate of 172 beats per minute, the nursing team should have taken further steps to ensure that adequate and appropriate care was provided. In particular, the nursing team should have arranged a medical review of Baby B's condition.

184. A combination of inadequate care co-ordination and communication led to a failure by both the MDT and the nursing team to assess and monitor Baby B's condition properly during her illness. In particular:

- The MDT continued Baby B's concentrated feeding regimen unchanged and without review, despite Baby B being diagnosed with rotavirus and having ongoing fluid losses.
- Members of the MDT failed to communicate promptly and adequately with one another following Baby B's diagnosis with rotavirus.
- The MDT and nursing team failed to recognise the need for more frequent weighing and closer monitoring of Baby B's fluid balance following her diagnosis with rotavirus.
- The nursing team failed to record Baby B's fluid losses adequately. The records kept were subjective and inconsistent, the result being that there was no comprehensive record kept of Baby B's fluid loss measured in objective terms.
- The nursing team failed to respond to Baby B's change in condition adequately on the evening of Day 11, in that a medical review was not arranged effectively.

185. District health boards are responsible for the operation of clinical services within hospitals, and can be held responsible for any service-level failures. The individual health professionals involved in Baby B's care do bear some responsibility for the failures that occurred. However, in my view, the failures of the MDT and nursing team were service failures and are directly attributable to Hutt Valley DHB.

186. Accordingly, I find that Hutt Valley DHB breached Right 4(1) of the Code for failing to provide services to Baby B with reasonable care and skill, and Right 4(5) for inadequate communication within the MDT, which resulted in poor continuity of care.

187. I note that further blood tests may have assisted in identifying an "evolving problem", which could have led to changes in Baby B's management. However, I acknowledge Dr Moore's advice that, given the complexities involved in identifying hypernatraemic dehydration, there was no "clear-cut indication" that blood tests were required in light of the information available at the time. For completeness, I note that I am satisfied that the decision not to arrange further blood tests was reasonable in the circumstances.

Adverse comment — Dr I

188. Dr I, as a part-time paediatrician, was not rostered to the Children's Ward at Hospital 1 between Day 9 and Day 11. This time period was significant in Baby B's admission. I accept that Dr I was not present when Baby B was identified as being rotavirus positive on Day 9. In her absence, the ordinary practice on the Children's Ward was for junior medical staff to contact the on-call consultant should there be any acute concerns.

189. I accept that Baby B was under the care of the medical staff rostered to the Children's Ward between Day 9 and Day 11 (which did not include Dr I). Nevertheless, I note that Dr I made herself available on her day off and while she was not rostered to the Children's Ward to discuss Baby B's care. To the extent that Dr I continued to participate in these discussions, I consider that she retained responsibility to ensure that she did so in an informed and effective manner.

190. On Day 10, Dr I attended an MDT meeting to discuss Baby B's progress and discharge planning. No mention was made of Baby B's diagnosis with rotavirus or of her having experienced diarrhoea over the preceding days. Rather, Baby B was described as having "vomited a small amount while in hosp[ital]" and it was noted that no medical reason had been discovered for her feeding issues.

191. I remain concerned by this, given that the information about Baby B's condition recorded at the meeting is at odds with Baby B's progress notes, which indicated that she had been experiencing vomiting and diarrhoea since Day 7, and had been identified as "rotavirus positive" on Day 9. Regardless of the purpose of the meeting, I would have expected Dr I, as the consultant paediatrician responsible for Baby B's care, to familiarise herself with recent entries in Baby B's progress notes in advance of an MDT meeting, and to ensure that the MDT was aware of Baby B's diagnosis, irrespective of whether she was rostered to the relevant ward on that particular day. As noted by Dr I, "Clearly [Baby B's] current clinical progress was relevant to a discussion and review of arrangements for discharge …"

192. Later that evening, at 8.42pm, Dr I reviewed Baby B's test results from her home computer and assumed that Ms C would have been made aware of the results. The following day, on Day 11, Dr I discussed Baby B's condition by telephone with Dr G, who reported his earlier assessment of Baby B. Dr I recalls that the main issue at the time was ensuring that there were no acute issues arising from the rotavirus diagnosis, and that she understood that either

she or the on-call consultant would be alerted if there was a change in Baby B's condition that might require a change in her management plan. Dr I stated that no concerns were raised with her or the on-call consultant, and that she was also not aware that Ms C had not been advised of the diagnosis.

193. While I do not consider that Dr I has breached the Code, I remain concerned that she did not ensure that Ms C had been advised of the positive rotavirus result, and, by continuing to participate in discussions about Baby B's care, I consider that Dr I retained responsibility to ensure that she did so in an informed and effective manner.

Adverse comment — Ms C

194. On Day 10, dietitian Ms C attended an MDT meeting to discuss Baby B's progress and discharge planning. Ms C advised that she cannot recall being informed of Baby B's recent rotavirus positive result. When asked whether she had reviewed Baby B's progress notes, Ms C told HDC that Baby B "was not due for a full dietetic review by me until [Day 12] when her progress notes would have been read in their entirety". In her response to my provisional opinion, Ms C stated that she had "no reason" to review Baby B's medical notes.

195. I note that it was clearly recorded and circled in Baby B's progress notes from the preceding day that she was rotavirus positive. I would have expected Ms C, as Baby B's dietitian, to take some responsibility for familiarising herself with Baby B's recent progress in advance of an MDT meeting. Had she done so, the information would have been clearly available from a brief review of the most recent entries in Baby B's notes. However, I am satisfied that the diagnosis was not specifically discussed with Ms C prior to or at the MDT meeting. In her response to my provisional opinion, Ms C stated that she did not become aware of the diagnosis until after Baby B's collapse on Day 12.

196. Ms C's response concerns me, as clinical notes are not only a record of the care and treatment that has been provided, but a vital communication tool between staff. The failure of clinicians to read patients' notes is an issue that all too frequently comes to my attention. However, it is also critical that when there are issues of particular importance, staff take appropriate steps to ensure that relevant colleagues are aware of those issues.[37]

Adverse comment — RN F

197. RN F told HDC that on the evening of Day 11, she recalls discussing Baby B's condition with "Dr A" and that she "assumed that [Dr A] had reviewed [Baby B] in light of our conversation". Dr A has no recollection of any such discussion. I am unable to make a factual finding as to what communications, if any, took place between RN F and Dr A.

198. However, I am concerned that RN F did not record the conversation in Baby B's notes or follow up this matter with Dr A or any other doctor. Instead, she simply assumed that the

[37] C09HDC01932. Published on 5 August 2013.

review had been undertaken. While I consider this to be unsatisfactory, I note the following comment by RN F: "I have learnt that I must not assume that an assessment has been carried out however busy I am."

Recommendations

199. I acknowledge that since these events Hutt Valley DHB has taken a number of steps to improve its systems. In my view, this investigation has identified some further areas for improvement. Accordingly, I recommend that Hutt Valley DHB undertake the following:

- Apologise in writing to Ms B for its breaches of the Code. The apology is to be sent to HDC within two weeks of this report being issued, to be forwarded to Ms B.
- Meet with Ms B and relevant Hutt Valley DHB personnel to discuss Baby B's care and subsequent changes made to Hutt Valley DHB's practice as a result, and report the outcome of that meeting to HDC.
- Review and implement regular audits of its nursing handover systems (including documentation practices) to ensure that the current practice is appropriate and effective.
- Review the level of support and oversight available to paediatric registrars and house officers.
- Review the paediatric fluid balance charts and ensure that these include space to document measured output (such as nappy weight) and daily weight in appropriate circumstances.
- Report to HDC with regard to the implementation of the Early Warning Score system referred to in Hutt Valley DHB's response to this Office (as set out at paragraph 125 of this report).
- Report to HDC on the progress of the above changes and those that have already been made following Ms B's complaint.
- Provide HDC with an audit of the effectiveness of the new gastroenteritis guidelines.

200. These recommendations are to be completed within three months from the date of issue of this report.

Follow-up actions

201. - A copy of this report with details identifying the parties removed, except the experts who advised on this case and Hutt Valley DHB, will be placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

- A copy of this report with details identifying the parties removed, except the experts who advised on this case and Hutt Valley DHB, will be sent to the College of Nurses Aotearoa (NZ) Inc for educational purposes.

- A copy of this report with details identifying the parties removed, except the experts who advised on this case and Hutt Valley DHB, will be sent to the Royal Australasian College of Physicians for educational purposes.

Appendix A: Independent clinical advice to the Commissioner — Paediatrician Dr Philip Moore

On 21 August 2012, the following expert advice was obtained from paediatrician Dr Philip Moore:

"My name is Philip Peter Charles Moore. I am a Fellow of the Royal Australasian College of Physicians and have eighteen years experience as a Consultant Paediatrician in a district hospital in New Zealand. As an expert adviser to the Health and Disability Commissioner (HDC) I have read the Guidelines for Independent Advisers and agree to follow them.

My apologies for the delay in providing this report. The matter is complex and the notes provided were extensive.

Expert Advice Requested

I have been asked to provide expert advice to the HDC on the case C12HDC00115. The overall advice is to determine if the care provided by the health providers at Hutt Valley District Health Board (HVDHB) was appropriate, or departed from an acceptable standard of treatment.

In particular I have been asked three specific questions:

Is there any evidence that [Baby B's] [condition] should have been more closely monitored from [Day 11]?

Was there evidence sufficient care was taken over ensuring [Baby B's] fluid intake was appropriate?

As [Baby B] was already compromised with her low weight, was sufficient attention taken over the effect rotavirus could have in her circumstances?

The advice is to enable the HDC to determine whether further investigation and action is needed.

Supporting Information Reviewed

In providing this advice I have reviewed in detail a large number of documents and case records provided by the HDC. These include a full set of case notes from HVDHB: including medical, nursing and dietician notes, observation charts, fluid balance records, laboratory results, social work reports and outward and inward correspondence.

The mother's original complaint was seen (dated […]).

I have also seen reports to the Coroner from other Consultant Paediatricians, HVDHB Senior Medical Officer, HVDHB Chief Executive, Ministry Of Social Development staff and Paediatric Intensive Care Unit medical staff. I have also reviewed a copy of the final Post Mortem report.

I have also reviewed the literature around management of rotavirus gastroenteritis but give my advice based on what I consider appropriate management in a New Zealand setting without the benefit of hindsight.

Summary of Case

[Baby B] was born [in 2009] after an antenatal diagnosis of complex congenital heart disease. Pulmonary artery banding was performed [the following month] because of congestive heart failure not treatable medically. Her final corrective surgery was performed [four months later].

Prior to, and subsequent to, her surgery there were ongoing concerns about poor weight gain and vomiting, developmental progress and oral aversion. There were significant social concerns relating to mother and baby. All of these concerns are extensively documented and appropriately managed.

A detailed time line of these early life events is contained in the report from [a] ([DHB 2] Paediatrician) to the Coroner (03/04/11) and in the letter from [Dr I] (HVDHB Paediatrician) to the Coroner (18/02/l1). This letter also contains a good summary of her last admission.

[Baby B] was electively admitted to [Hospital 1] [in 2010] to address ongoing concerns about poor weight gain, vomiting and social concerns. During this final admission she contracted rotavirus gastroenteritis. She was found *in extremis* in the early hours of [one morning] and despite aggressive resuscitation and transfer to tertiary care she died in [Hospital 2] [the following day].

This advice is limited to her care during this final admission.

Detailed Time Line of Care [during admission]

In the month prior to her last admission [Baby B] had lost 320 gms in weight. In the four months prior to admission she had dropped from a weight percentile of 25% to less than the 3%. Despite tube feeding and dietician involvement she was still vomiting.

Admission on the Monday [Day 1] was planned to tube feed under direct supervision, further investigation including pH study to look for acid reflux, blood tests and twice weekly weighing. Social concerns were to be reassessed and managed. Weight was 7.36 kg.

Her blood tests on admission show normal renal function (creatinine 19) and normal electrolytes (sodium 140 and potassium 4.8). Feeding was continued as previously with Karicare Infant Formula made up to 1¼ strength with added Polycal, to give a total of 1050 ml/day (or 1027 kcal/day). **This is a hyperosmolar mixture.**

During her six days of admission [Baby B] was reviewed every day by the medical team and comprehensive medical and nursing notes were kept. Vomiting had largely settled. Solid intake was increasing. The notes detail ongoing concern about parenting skills and attitude. **Throughout this period the temperature was less than 37°C, pulse was 120 to 148/min and respiratory rate was 30 to 40/min.** After this first week her weight (on [Day 8] had increased by 580 gm, up to 7.94kg. **This is the last weight recorded in the chart.**

At 0200 hrs on the Sunday [Day 7] the Senior House Officer (SHO) on duty was asked to review [Baby B] after a large, offensive, yellow bowel motion and possible bilious aspirate. A thorough and comprehensive assessment is documented, with no evidence of dehydration found, and an appropriate plan to continue observation and replace subsequent large losses with water or Oral Rehydration Therapy (ORT) i.e Enerlyte.

At 1100 on [Day 7] on the weekend Consultant ward round, [Baby B] is described as 'alert and well'. There is no mention of the assessment 9 hours earlier.

Fluid Balance records from the [Day 7] indicate an intake of 1180 ml (1050 ml of extra-strength Karicare and Polycal, 130 ml water to replace losses). Urine output is not recorded. 5 stools are recorded, including 'large diarrhoea' at 1830 hours. 1 large vomit is recorded at 1830 hours.

At an uncertain time on **Monday [Day 8]** [Baby B] was reviewed by the Paediatric Consultant. The good weight gain from admission is noted. The new problem of diarrhoea is noted. [Baby B] is described as 'happy sitting, clapping, babbling' but no formal assessment of hydration is given.

Fluid Balance records from the [Day 8] indicate an intake of 1310 ml (1050 ml of extra-strength Karicare and Polycal, 260 ml of water). Urine output is recorded as a 'tick' at 0930 hours. 4 stools are recorded but size, volume and consistency are not documented. 1 small vomit is recorded. However, the contemporaneous nursing notes for the morning shift say '80 ml x 2 given to replace loose stool x 2' and 'patient was irritable and upset ?pain'. The afternoon shift notes include plans to 'replace large bowel motions with 80 ml water given by NGT'. **From the morning of [Day 8] the pulse rate recorded increases to 160–170/min and respiratory rate increases to 50 to 65/[min]. SaO2 remained normal throughout admission.**

At 1200 on Tuesday [Day 9] [Baby B] was reviewed by a Paediatric Registrar. It is noted that she is 'rotavirus positive' on a stool specimen sent that day. Ongoing loose stool are noted. A very thorough examination is documented, including temperature of 37.9°C, pulse 160/[min], Respiratory Rate 65/[min], and capillary refill time of 2 seconds, moist mucus membranes, no sunken eyes and normal skin turgor. She was not weighed.

[Baby B] was alert and reactive, according to both the medical record and the Play Therapist's notes. The overall impression was 'rotavirus gastroenteritis with mild dehydration'. The plan made was to continue the extra strength milk formula feed and replace ongoing losses with Enerlyte. The volume suggested was 7ml/kg for 'huge diarrhoea/vomits'.

Fluid Balance records from the [Day 9] indicate an intake of l210ml (840ml of extra-strength Karicare and Polycal, 160 ml of water and 210 ml of Enerlyte). Urine output is recorded as 2 'ticks'. 6 stools are recorded with again no comment on size, volume or consistency. 3 vomits are recorded. The nursing notes include a description of 'very offensive nappies' and patient showing 'little interest in oral intake'. The afternoon nursing notes include '3 diarrhoea, 2 large in volume'.

On the Wednesday [Day 10] the notes contain a detailed report of the Multidisciplinary Team Meeting called to discuss the social issues. There is no record of medical review that day. The nursing notes for morning and afternoon shifts indicate ongoing vomiting and diarrhoea. The observation chart for that day reveals a temp of less than 37°C, pulse of 160 to 170/[min] and respiratory rate is unrecorded.

Fluid Balance records from the [Day 10] show a total of 1370 ml intake (1050 ml of extra-strength Karicare and Polycal, 320 ml of Enerlyte). Urine output is recorded as 3 ticks but no volumes are estimated. 4 stools are recorded (2 'large', 1 'moderate' and 1 'small'). 5 vomits are recorded (1 'large').

At 0015 hrs on Thursday [Day 11] [Baby B] was reviewed by the SHO on duty because of increased respiratory rate and work of breathing. The documented assessment includes normal temp, respiratory rate of 28/min, rhinorrhoea and mild subcostal recession. Skin was 'warm and dry' and capillary refill was less than 3 seconds. No pulse rate or other evidence of hydration state is recorded. [Baby B] is said to be 'a bit irritable'. She was not weighed. The clinical impression was 'LRTI ?bronchiolitis' and plans made to continue observations.

At 1215 on [Day 11] she was reviewed by the Paediatric Registrar. She was described as 'alert' but had just had a 'big vomit' and note made that '[Baby B] still had few vomits and diarrhoea yesterday'. 'Normal skin turgor' is the only observation that relates to hydration status. By that time of the day two boluses of Enerlyte had been given for a large stool and a large vomit, but no comment is made. It is decided to weigh her the next day as planned.

Fluid Balance records from the [Day 11] show a total of l450ml intake (1050 ml of extra-strength Karicare and Polycal, 400 ml of Enerlyte). Urine output is recorded as 5 'ticks' but no volumes are recorded. 6 stools are recorded (1 'large' but no other descriptors). 5 vomits are recorded (3 'large'). The nursing notes [Baby B] as 'miserable ++ today' and 'not tolerating feeds well, 3 x large vomits and 3 x diarrhoea for this shift'. [Baby B] spiked temperatures throughout that day, to 39.2°C at 2135 hours.

At an uncertain time late on the [Day 11] or early [Day 12] mother describes finding [Baby B] in her cot 'completely still with her eyes rolling back and forth in her head'. She 'asked for nurse she check to see what was wrong her then went to go get the doctor both said she was alert they flashed a light in her eyes that's all they did they said she was OK'. I can find no contemporaneous record of this event in the record.

At 0330 hours on Friday [Day 12] the night nurse heard grunting from [Baby B's] room. She found her unresponsive, cold to touch and with eyes rolled back. An Emergency response was activated and breathing support commenced.

The resuscitation team acted swiftly and aggressively. They noted significant respiratory distress (Respiratory rate over 70/[min], grunting) and tachycardia (over 200/[min]) with cold, mottled extremities and poor peripheral perfusion. Central pulses were weak. [Baby B] was only responding to pain, had sluggish pupil responses and was floppy. Initial access was interosseus as intravenous access was impossible until volume had been given. The first available blood gas confirmed a severe metabolic acidosis with pH of 7.02 and BE of –21. **This is a picture of critical illness with hypovolaemic shock.**

The resuscitation over the next few hours included assisted ventilation, central venous access, arterial access, aggressive fluid volume support (more than 85ml/kg of saline and blood products), antibiotics, inotropic support and careful, slow correction of metabolic abnormalities. Management of this emergency is of high standard.

Despite this her first available biochemistry test results at 0622 confirm acute renal failure (creatinine 166, urea 19.7) and severe hypernatraemia (sodium 172). Low calcium and high phosphate were in keeping with the renal failure. Disseminated Intravascular Coagulopathy developed and was treated with blood products. An Echocardiogram confirmed moderate/severe left ventricular dysfunction. There was no evidence of bacterial or viral sepsis.

[Baby B] was transferred to [Hospital 2] later that day and despite ongoing aggressive support she **died on [Day 13]**.

Coronial Autopsy Report [Day 14]

This report indicates a direct cause of death of CEREBRAL OEDEMA AND SWELLING (HYPOXIC ENCEPHALOPATHY). Antecedent causes are given as SHOCK AND SEVERE ELECTROLYTE ABNORMALITIES. The underlying condition is DIARRHOEAL ILLNESS. Congenital Heart Disease is noted but not related to the death. No bacterial pathogens were found in blood or spinal fluid. Vitreous fluid biochemistry was grossly abnormal with high sodium and urea.

Overall Advice

[Baby B] was infected with rotavirus while an inpatient in [Hospital 1]. Rotavirus is a commonly acquired infection in hospital settings. HVDHB have reviewed their infection control procedures and made a number of positive changes to practice. In my opinion the standard of care in this regard was appropriate.

The diagnosis of rotavirus infection was made promptly. Early clinical assessments were thorough and well documented. The initial management plan to continue milk feeds and replace losses with water, and later Enerlyte, was appropriate (but see below). The decision not to perform any initial blood tests at that stage is also appropriate.

It is accepted practice to review hydration state regularly when managing rotavirus gastroenteritis. The last documented complete assessment of hydration was performed by the Paediatric Registrar on [Day 9]. Clinical signs of hypernatraemia can be subtle or difficult to interpret, for instance there is preservation of the extracellular fluid volume and signs of dehydration can be masked. I note that there was no clinical assessment of [Baby B] by a Consultant after the [Day 8]. I also note that, since this case, HVDHB have instituted regular tutorials for junior medical and nursing staff about ‘recognition of the sick child’ and are considering adopting an ‘Early Warning Score’ system.

As well, it was already recognized that [Baby B] was underweight and her ongoing losses were significant (On both [Days 10 and 11] [Baby B] received more than 45 ml/kg of fluid to replace estimated losses). In my opinion there should have been attempts to more accurately measure losses of both stool and urine (with nappy weighs etc), rather than estimates, to ensure adequate replacement. Replacing large stools and vomits with 80ml

of Enerlyte would be at the lower end of the recommended range of loss replacement (although in step with some recommendations) and might have represented inadequate replacement of water losses. In my opinion daily weighing was indicated and might have given information that led to a change in management. [Baby B] was not weighed after the [Day 8] before her death 5 days later.

In my opinion the concentrated hyperosmolar feeds should have been discontinued early in the illness. Osmolality is an important characteristic of any enteral feed or formula mixture. It is primarily a function of the number and size of molecular and ionic particles in a given volume of solute. Karicare formula, when made up to 1¼ strength with added Polycal, is a hypertonic mixture with an osmolality of approximately 380 mOsm/kg (compared to plasma at 300 mOsm/kg). When a child is well and has normal renal function the higher solute load can be managed. But when there is loss of fluids (eg diarrhoea and vomiting) and possible reduced or inadequate water intake, hypernatraemia and uraemia can result. In my opinion the decision to continue the concentrated feed at full volumes increased the risk of hypernatraemia developing. The written advice to parents of babies on concentrated feeds, contained in the HVDHB notes, clearly states 'If your baby vomits or develops diarrhoea, change back to the standard recipe on the formula can **immediately** and contact your dietician.'

No blood tests were performed after [Day 1] (when renal function and electrolytes were normal) until after her collapse on [Day 12] (when she was in acute renal failure with severe hypernatraemia). Clearly earlier blood tests are likely to have indicated an evolving problem. However, there are no clear guidelines relating to electrolyte monitoring in children with gastroenteritis who continue with hyperosmolar feeds. It is tempting to look back at some of [Baby B's] reported symptoms (eg intermittent irritability, warm and dry skin) as evidence of hypernatraemia but this is conjecture and done with the benefit of hindsight. There are other observations suggesting periods of good social interaction.

However, observation records, nursing notes and medical notes indicate that from the morning of [Day 8] the pulse rate recorded increases to 160–170/min and respiratory rate increases to 50 to 65/min. She began spiking temperatures on the morning of the [Day 11]. In my opinion these major changes in her previous state, particularly in the hours before her collapse, should have led to a more thorough reevaluation of her condition and management, including body weight, full clinical assessment and probably blood tests.

Before her collapse the extensive documentation around social and parenting concerns was entirely appropriate and of high standard.

After her collapse the management is exemplary, with excellent documentation, a clear plan and good monitoring. Despite the finding of brain swelling at autopsy the rate of correction of the metabolic abnormalities was appropriate and judicious.

Specific questions

It follows from my overall advice …

- Is there any evidence that [Baby B's] [condition] should have been more closely monitored from [Day 11]?

Yes. In my opinion there is evidence of a significant change in her condition from the morning of [Day 8]. Closer monitoring should have included daily weighing, more

accurate measurement of fluid losses and clinical assessment of hydration. I consider this departure from expected standard to be **moderate**.

[Baby B] began spiking temperatures at 0930 on [Day 11] after being afebrile since admission. In my opinion this should have prompted the staff assessing her at 1215 to fully assess hydration status and consider blood tests. I consider this departure from expected standards to be **mild**.

- Was there evidence sufficient care was taken over ensuring [Baby B's] fluid intake was appropriate?

No. Despite significant ongoing losses from both vomiting and diarrhoea [Baby B] was continued on a hyperosmolar feeding regime. As well, her losses were not accurately measured and replacement fluid volumes may have been inadequate. In my opinion the only reasonable explanation for [Baby B] developing severe hypernatraemic dehydration, renal failure and shock while in hospital is that insufficient care was taken over her fluid intake, both in terms of amount and type of fluid. Hypernatraemia in this setting usually results from ingestion of hypertonic fluids and inadequate water intake during diarrhoeal illnesses. I view these departures as **severe**.

- As [Baby B] was already compromised with her low weight, was sufficient attention taken over the effect rotavirus could have in her circumstances?

No. Rotavirus infection in a compromised child should be managed with even more care and closer fluid monitoring than in normal cases. I regard this departure from expected standards as **mild**.

Conclusion

[Baby B] was electively admitted to [Hospital 1] to address ongoing concerns about poor weight gain, vomiting and social concerns. During this final admission she contracted rotavirus gastroenteritis. She was found *in extremis* in the early hours of [Day 12] and despite aggressive resuscitation and transfer to tertiary care she died in [Hospital 2] on [Day 13].

In my opinion a review of the available records suggests that the management of her last illness departed from expected standards. These departures relate to clinical assessment, fluid balance assessment, failure to reweigh and decision to continue hyperosmolar feeds despite significant ongoing fluid losses. In my opinion these departures led to severe hypernatraemia, renal failure and shock.

The HDC may well wish to seek further advice on these issues.

Yours Faithfully

Dr Philip Moore FRACP, General Paediatrician"

On 17 June 2013, further clinical advice was obtained from Dr Philip Moore as follows:

"My name is Philip Peter Charles Moore. I am a Fellow of the Royal Australasian College of Physicians and have nineteen years experience as a Consultant General Paediatrician in a district hospital in New Zealand. As an adviser to the Health and Disability

Commissioner (HDC) I have read the Guidelines for Independent Advisers and agree to follow them.

Further Expert Advice Requested
I have been asked to provide **further** expert advice to the HDC relating to Case Number C12HDC00115 — the late [Baby B].

I have been asked to review the Hutt Valley DHB response (07/03/13) to my earlier advice (21/08/12) and in particular to advise whether the response causes me to 'confirm, change, amend, add to, qualify or depart from (my) preliminary expert advice in any way'.

The purpose is to assist the HDC to determine if further investigation or action is needed.

Conflict of Interest
At the time of writing my preliminary expert advice, and at the time of drafting this further advice, I had no Conflict of Interest to report. Since then I have completed a one week locum position with the Hutt Valley DHB. I do not believe this locum position has any bearing on my advice.

Information Reviewed
In providing this further advice I have reviewed in detail all the original material provided by the HDC (including copies of all case records, nursing observation records, fluid balance records, laboratory results and Post Mortem report).

I have also reviewed new material including the DHB responses (07/03/13 and 17/05/13) and all attachments and enclosures. A key aspect of the DHB response is a much earlier opinion (05/01/11) from [Dr U] (Neonatal Paediatrician), written as a report to the ACC.

The DHB draw particular attention to differences between our two reports. The DHB include the submission that 'the Commissioner ought to be cautious in placing too much reliance on the strong criticism made by Dr Moore when there is equally strong, and in many instances, conflicting opinion put forward by [Dr U]'.

To assist the HDC it is appropriate, in light of this, to review this complex and difficult case again in some detail. Although an ACC report and expert advice to the HDC are from different perspectives, apparent differences in opinion do need to be reviewed.

As instructed I am limiting this report to the care provided by physicians.

Background, Summary and Detailed Time Line of Care [Days 1-13]
There is no disagreement as to the basic facts of this case. All opinions are based on the same written material. The DHB response includes further statements from individual clinicians which are helpful.

I have reviewed my preliminary advice (21/08/12) and see no need to alter or amend my Summary or the Detailed Time Line of Care.

DHB response (07/03/13)
(1) Overall Conclusion

My preliminary advice (21/08/12) was that the management of [Baby B] during her last illness departed from expected standards. These departures related to clinical assessment, fluid balance assessment, failure to reweigh and decision to continue hyperosmolar feeds despite significant ongoing fluid losses. It was my opinion that these departures led to severe hypernatraemic dehydration, renal failure and shock.

The DHB prefer the conclusion from [Dr U's] report (05/01/11) which was of 'imperfection in the context of generally and overwhelmingly excellent care'.

However, [Dr U] *was* critical of the electrolyte management of the case — in particular the decision to continue hyperosmolar feeds with high solute and sodium content, and the failure to then measure serum electrolytes. He suggested that it is 'unlikely that the clinical team was alert to this high sodium intake, as if they were they would have been mindful of the need to measure her electrolytes.' [Dr U] also expresses a 'personal expectation' that 'children with gastroenteritis have daily weighs recorded while their diarrhoea continues'.

I believe that our two opinions share similar concerns but perhaps express them differently. I will therefore review my preliminary opinions, in light of the DHB response, in relation to the standards I judged were departed from previously.

(2) Clinical Assessment

[Baby B] was infected with rotavirus while an in-patient in the children's ward at [Hospital 1]. Rotavirus is a commonly acquired infection in hospital settings. The DHB can not be criticised for this and in fact have made a number of recent positive changes in practice to minimize cross-infection still further.

The diagnosis of rotavirus was made promptly. Early clinical assessments were thorough and well documented. The initial management plan to continue hyperosmolar milk feeds and to replace losses with water, and later Enerlyte, was appropriate at that time. The decision not to perform blood tests at this early stage is also appropriate.

It is accepted practice to review hydration status regularly when managing gastroenteritis in the hospital. The last *documented complete* assessment of hydration was performed by the Paediatric Registrar on [Day 9]. I have reviewed a later statement from this Registrar (20/01/13) and I accept that further assessments *were* made and were more thorough than the documentation suggests. [Baby B] was not weighed after the [Day 8] however.

I accept the Registrar's statement that [Baby B] 'did not show any clinical evidence of moderate or severe dehydration'. However, both [Dr U] and I point out that in the setting of hypernatraemic dehydration clinical evidence can be subtle or difficult to interpret — for instance there is preservation of the extracellular fluid volume and the usual signs of dehydration can be masked. As it was already recognized that [Baby B] was underweight and her ongoing losses were significant it remains my opinion that, in addition to the assessments that were made, [Baby B] should have been weighed daily (see later).

I accept the Registrar's comments about the significance of changes in her vital signs after the [Day 8]. I am not critical of his assessment at the time that these changes were in keeping with rotavirus infection. It is easy to be critical in retrospect, knowing the

outcome of the case. Given the information the Registrar had to hand his actions were reasonable.

However, [Baby B] did not begin spiking temperatures until 0930 on [Day 11] after being afebrile since admission. It is this *new* finding of fever, even in the context of known rotavirus infection present for the previous 4 days, which should have led to a fuller assessment of hydration (including weight) and consideration of blood tests (for evidence of other pathology such as bacterial infection). It is not possible to know whether clinical assessment by a more senior doctor (there was no consultant review after the [Day 8]) would have led to any further action.

(3) Fluid Balance Assessment

The ongoing management of fluid balance is one critical issue in this case. In [Dr U's] report he concludes that 'from a fluid balance point of view it seems that the care was quite reasonable'. The DHB believe that 'the clinical records, as summarized by [Dr U] in the graph on Page 4 of his report, do support [Dr U's] opinion that there was attention to [Baby B's] hydration status throughout the illness.'

I have used the same information and data in my preliminary advice, summarized in words rather than graphically, and have a number of comments.

(1) The graph created by [Dr U] is accurate and in agreement with the fluid intake values in my preliminary report. What is missing, because the information was never collected, is the equally important measure of fluid output or losses.

(2) It is clear from the records that these losses were significant (e.g. descriptions of large stools and large vomits, statements of 'not tolerating feeds well' and 'little interest in oral intake', and the fact that on the [Day 10] and [Day 11] [Baby B] received more than 45 ml/kg of extra fluid to replace estimated losses) but they were not measured (e.g. with nappy weighs, collection of vomit etc). [Dr U] indicates that 'the clinical team were not particularly attentive to urine output …'

(3) The fact that fluid intake did increase during the admission, in response to the ongoing losses, does *not* prove 'quite reasonable' care of fluid balance if the overall balance is negative. Although it is impossible now to be certain that it was negative, without a daily weigh and an attempt to measure losses the assessment was incomplete.

(4) The DHB and [Dr U] agree that there are a 'number of subsequent indicators' that suggest [Baby B] was dehydrated at the time of her collapse on [Day 12]. As [Dr U] states 'it is generally expected that an episode of hypernatraemia in an infant with gastroenteritis is associated with dehydration'. These include the understanding that she was at high risk (gastroenteritis on a background of poor weight gain), recognition of significant ongoing losses and her ultimate collapse with shock, hypernatraemia and renal failure. Although there is a lack of accurate weight data after a known weight of 7.94 kg ([Day 8]) the fact that she weighed less than this at Post Mortem, even after large volumes of fluid in resuscitation, is indication of a fluid deficit at the time of collapse.

(5) The DHB and [Dr U] also suggest indicators that [Baby B] was *not* dehydrated. These include the fact that some extra fluid was being given, that she was 'not thought to be dehydrated until after the sodium level was reported to be high', that dehydration was not part of the initial differential diagnosis after the collapse, that she passed urine on 'at least five occasions' in the day prior to her collapse and that the post mortem report did not mention any evidence of dehydration. In my opinion these are circular arguments.

Firstly, I have indicated previously why giving extra fluid to avoid dehydration is no guarantee of good fluid management unless intake *and* losses are considered.

Secondly, I have indicated previously that, in hypernatraemia, clinical assessment of hydration can be difficult and the usual signs misleading. [Dr U] also points out the possibility that signs of dehydration may not be 'reliably present'. In fact the literature is clear; hypernatraemic dehydration is clinically recognized by experienced paediatricians less than half the time. I agree that 'weight assessment is the best means available to determine fluid loss'.

Thirdly, it is clear from the notes that [Baby B's] collapse was totally unexpected and traumatic for all concerned. The physicians reacted extremely quickly and expertly to the emergency they were confronted with. The differential diagnosis at the time was wide, and appropriately so. A number of possible causes for collapse were considered. Empiric treatment was given (e.g. antibiotics). As more information from blood tests (delayed owing to extreme difficulties in getting samples) came to hand the clinical picture became clearer. At 0845 hours on [Day 12], 5 hours after the collapse, the attending paediatricians documented the following diagnostic formulation …

'— Acute Resp Distress — with increased RR ?LRTI
— Rotavirus
— Hypernatraemia — severe dehydration
— Decompensation
— ?Aspiration

Resulted

— Renal Failure
— CNS changes secondary to dehydration
— DIC

Need to exclude sinus thrombosis and hypoxic damage

Sepsis not excluded'.

It is clear that very soon after the collapse the attending doctors included dehydration as a major factor.

Fourthly, I am not necessarily reassured by a report of five episodes of passage of urine on the day before collapse. In the setting of acute gastroenteritis with ongoing

diarrhoea it can be difficult to distinguish between stool and urine losses — hence the usual procedure of weighing nappies for total stool and urine losses.

Fifthly, at the time of her admission [Baby B] had normal serum creatinine of 19 and normal serum sodium of 140. Three hours after her collapse, and even *after* initial aggressive fluid resuscitation with over 60ml/kg of normal saline, [Baby B] had severe renal impairment with serum creatinine of 166 and severe hypernatraemia with serum sodium of 172. The first urine at the same time by catheter is described as 'v. concentrated'.

Finally, although the post mortem report makes no specific comment about dehydration the pathologist gave the antecedent cause of death as 'Shock and Severe Electrolyte Disturbance' with the underlying cause of 'Diarrheal Illness'. The known cardiac lesion (repaired) is noted as *not* related to the death. Also, there is no evidence found for aspiration pneumonia or sepsis.

Although this case is complex and difficult, and all staff made reasonable decisions with the information they had at the time, it remains my opinion that [Baby B] was developing hypernatraemic dehydration in the time before her collapse.

(4) Failure to reweigh

At the time of this event there were guidelines in existence (eg the [Hospital 2] Guidelines) that did not include daily weighing of all gastroenteritis patients with ongoing losses. Other guidelines did include daily weighing (eg Royal Children's Hospital, Melbourne).

In my opinion, in the case of an infant admitted for poor weight gain and supervised feeding, who then develops rotavirus gastroenteritis with significant ongoing losses of vomit and stool, a daily weight would have been part of the expected standard of care in 2010. Other Paediatric units (including my own and [Dr U's]) would have preformed a daily weight as the 'best means available to determine fluid loss'.

I believe it is very likely that daily weighing would have provided earlier information that would have led to changes in management.

Just as failure to follow all aspects of a guideline is not proof of poor practice, following a guideline is not necessarily appropriate in every situation. I note the DHB have now changed their gastroenteritis policy and that this now includes daily weighing.

(5) Decision to continue hyperosmolar feeds despite ongoing losses

The electrolyte management is another critical issue in this case.

[Baby B] was admitted with poor weight gain for supervised hyperosmolar feeding and was initially gaining weight well. Her baseline blood tests were normal. She then developed rotavirus gastroenteritis with vomiting and diarrhoea.

Usual practice in this situation would be to review the need for continued hyperosmolar feeds. This was not done and does not appear to have been considered. At the multidisciplinary meeting (MDT) on [Day 10] the team dietician was not informed of the new diagnosis of gastroenteritis. This is despite the DHB's own written advice to parents in this situation that 'if your baby develops diarrhoea change back to the standard recipe

of the formula and immediately contact your dietician'. This advice was current at the time of the event.

In my opinion the continuation of hyperosmolar feeds is an important factor in the development of severe hypernatraemia in this case. [Dr U's] analysis suggests a sodium intake of 3 or 4 times the recommended daily intake in the last few days of [Baby B's] life. In fact the literature suggests that it is the total solute load of the calorie dense formula, not merely the sodium intake, that matters in such cases.

He suggests 'two broad possibilities' to explain the hypernatraemia … an excessive solute intake or excessive water losses. There is a third possibility; … that *both* of these occurred. Although the DHB suggest that 'most children would have been able to cope with a high solute load' that is *not* true if the child receives insufficient water.

In patients with any dehydration, dehydration results from a child having negative water balance (losing more water than is replaced). Most commonly, diarrhoea causes water loss, and vomiting prevents intake of water. If the child is also losing more salt than he or she is receiving (negative sodium balance), the plasma concentrations of sodium may remain stable. For hypernatraemia to develop, the water loss must exceed any loss of salt, or salt intake must be excessive. The patient's history usually reveals causative factors. This condition was common in the 1960s and 1970s, when infant milks were more calorie dense than they are today. In [Baby B's] case the combination of a calorie dense milk formula and water losses is the most likely cause of the hypernatraemia.

Furthermore, in patients with infective diarrhoea, undigested proteins and carbohydrates reach the colon, where bacteria metabolise them to small, osmotically active molecules that draw water but not sodium from the plasma into the colon; this makes the plasma hypernatraemic.

A very useful paper discussing these issues is Coulthard et al, BMJ. 2003 January 18; 326(7381): 157–160.

[Dr U] states that 'It is unlikely that the clinical team was alert to the sodium intake, as if they were, they would have been mindful of the need to measure the electrolytes'. In my opinion it is the new finding of fever on the [Day 11] that should have led to consideration of blood tests. The DHB acknowledge that 'in hindsight it would have been preferable to have considered undertaking blood tests'. It remains my opinion that earlier blood tests *are* likely to have indicated an evolving problem but there are no clear guidelines in this situation and, based on the assessments the staff had made, I think the decision not to perform blood tests was understandable.

In my opinion the hyperosmolar feeds should have been stopped when the rotavirus infection was diagnosed. Failure to do so contributed to the development of hypernatraemia.

(6) Cause of Collapse

It remains my opinion, despite some uncertainties because of lack of data (e.g. daily weights, blood tests), that the most likely cause of her collapse was hypernatraemic dehydration, leading to shock, renal failure and acidosis. The hypernatraemia was due to

the common combination of dehydration (water loss) and excess solute intake (hyperosmolar milk feeds). This situation has been extensively described in the medical literature for over 40 years.

The DHB believe the cause of collapse is uncertain. [Dr U] lists a number of other possible causes but there is no evidence for them, either clinically or at post-mortem. [Dr U] also states that although he is 'not certain about the collapse episode … there is reason to suspect that it would not have happened if the sodium level was normal'.

It remains my opinion that the overall clinical picture here is compelling. Dehydration, with ongoing excess solute intake and possible negative water balance, is the likely cause of the subsequent collapse with hypernatraemia, acidosis, shock and renal failure. No other explanation seems credible.

Overall Advice
Having reviewed this case again in detail, and having considered the DHB response, my overall advice remains largely unchanged (see preliminary report 21/08/12). I now believe that clinical assessment was carried out on a daily basis, and was more complete than the documentation suggested … albeit without daily weighing. I also accept the DHB position relating to the change in vital signs after the [Day 8] … although the new fever on [Day 11] should have prompted more investigation.

Specific Questions
In view of the above, and in light of the DHB response, I would like to amend my preliminary expert advice.

- Is there any evidence that [Baby B's] condition should have been more closely monitored from [Day 11]?

Yes. In my opinion this clinical situation should have prompted the attending team to reweigh [Baby B] on a daily basis and to attempt a measurement of ongoing fluid losses. These steps should have been taken from the [Day 8]. Certainly with the new finding of fever on the [Day 11] the staff who assessed her should have considered a full assessment including weighing and blood tests.

The staff were following local guidelines for gastroenteritis at that time, based on their clinical assessment findings. In my opinion these findings were misleading owing to the likely development of hypernatraemia but that is a retrospective judgment. Although earlier blood tests would probably have led to a change in management I accept that, given the information known to the team of clinicians, there was no clear-cut indication.

I view these departures from expected standards with **mild** disapproval.

- Was there evidence sufficient care was taken over ensuring [Baby B's] fluid intake was reasonable?

No. [Baby B] was continued on an inappropriate high solute feed. Her losses were estimated rather than measured. She was not reweighed after she developed gastroenteritis.

I view these departures from expected standards with **moderate** disapproval.

- As [Baby B] was already compromised with her low weight, was sufficient attention taken over the effect rotavirus could have in her circumstances?

No. Gastroenteritis in a compromised child should be managed with even more care and closer fluid monitoring than in normal cases.

I view this departure from expected standards with **mild** disapproval.

Conclusion
[Baby B] was electively admitted to [Hospital 1] to address ongoing concerns about poor weight gain, vomiting and social concerns. During her admission she contracted rotavirus gastroenteritis. She was found *in extremis* in the early hours of [Day 12] and despite expert resuscitation and transfer to [Hospital 2] PICU she died on [Day 13].

My review of the available records, earlier report to ACC, and later response from the DHB, suggests that her management in this last illness departed from expected standards. These departures relate to clinical assessment, fluid balance assessment, failure to reweigh and continuation of hyperosmolar feeds despite ongoing losses of vomit and stool.

Yours Faithfully

Dr Philip Moore, FRACP, General Paediatrician"

Appendix B: Independent nursing advice to the Commissioner — Dawn Carey

On 26 September 2012, the following expert advice was obtained from registered nurse Ms Dawn Carey:

"1. Thank you for the request that I provide clinical nursing advice in relation to the complaint from [Ms B], about the care provided to her late daughter, [Baby B], whilst she was an inpatient [Hospital 1] (HVDHB). In preparing the advice on this case to the best of my knowledge I have no personal or professional conflict of interest. I have read and agree to follow the Commissioner's Guidelines for Independent Advisors. I have reviewed the information on file: complaint from Ms B; responses and clinical notes from HVDHB; responses to the Coroner; and Post Mortem report. My advice is limited to the nursing management of [Baby B].

In particular I have been asked to focus on the two admissions to the HVDHB Children's ward [at nine months] and [eleven months]; and to respond to the following questions:

(i) Whether the nurses were given clear instructions on the purpose of each admission and whether these were followed?
(ii) Whether nurses were provided with clear instructions regarding making up the formula feeds and whether these were followed?
(iii) Whether nurses were appropriately documenting food and fluid intake and outputs both before and after the diagnosis of rotavirus gastroenteritis?
(iv) Whether nurses' assessment and monitoring following the diagnosis of rotavirus was appropriate?
(v) Whether the nurse's assessment of [Baby B] on the night of [Day 11] was adequate?
(vi) Whether nurses were appropriately raising concerns and whether these were appropriately addressed?

2. [On both occasions] [Baby B] was electively admitted to HVDHB due to concerns about her failure to gain weight and maintain weight gain. Her management plans for both these admissions are available in the HVDHB clinical notes and there is evidence of other practitioners — dietician, nursing and medical — adhering to the plans and reiterating them through their documentation.

Comment: **In my opinion the clinical management plan and purpose of [Baby B's] [two admissions] was known by the nursing staff.**

In my opinion there is consistent evidence that the nursing staff fulfilled the management plan requirement of observing and documenting [Baby B's] intake, output and positioning. There is also evidence that staff attempted to comply with observing [Ms B] making up [Baby B's] NGT feed and raised concerns about the difficulties that they were having.

3. Within the HVDHB clinical documentation there is a medication chart and nutrition and dietetic service (NDS) instruction sheet detailing how to make up [Baby B's] concentrated NGT feed. Within the nursing documentation there are also references to

the quantities of Polycal Powder and Karicare Infant formula being used by staff when making up the NGT feed. The volumes and quantities referred to in these entries concur with the medication chart and NDS instruction sheet guidelines. There is a pen entry that has been added to the NDS instruction sheet that clarifies the ratio of Polycal Powder to volume of Karicare formula when concentrating it.

Comment: I note that the HVDHB response refers to amending their concentration feed instructions to ensure that there is a consistency in the volumes referred to. In my opinion this would be valuable and appropriate.

In my opinion there is consistent evidence that the nursing staff followed the dietician and medication guidelines when making up [Baby B's] NGT feeds for both admissions.

4. There are fluid balance (FB) charts and nursing documentation entries which detail [Baby B's] general intake and output during her admission on [Day 1]. Following the diagnosis of rotavirus gastroenteritis, [Baby B's] losses were replaced with 10mls/kg water or Enerlyte administration via her NGT. Her fluid losses via vomit, urine and diarrhoea are consistently represented by subjective terms and or 'ticks' throughout this admission.

   Comment: **In my opinion [Baby B's] initial management of her fluid intake and output was appropriate. However, an attempt to calculate her actual losses should have been instituted once she was diagnosed with rotavirus gastroenteritis and mild dehydration on [Day 9]. This could have been achieved through instituting daily weights and weighing her soiled nappies. I view the failure to gain a more accurate calculation of [Baby B's] losses as a failure to assess [Baby B] adequately. In my opinion this is a moderate departure from the expected standard of nursing practice as set by Nursing Council of New Zealand (NCNZ)[38].**

5. [Baby B's] written care plan on [Day 9] identified that she was having loose stool and vomits which required replacement with fluids and that a FB chart needed to be maintained also. Within the HVDHB clinical notes there is also an Acute Gastroenteritis care plan which lists *daily weight; 4 hourly TPR or more frequently if required, Add 10mls/kg per large diarrhoeal stool …* as nursing actions. The replacement advice on this care plan is asterisked and circled and based on nursing documentation entries seem to have been followed. The Acute Gastroenteritis care plan also advises that nurses *assess the child for signs of dehydration* and goes on to offer guidance about this assessment. On [Day 9] following a Registrar review, [Baby B's] replacement regime changed to *7ml/kg of Enerlyte over 1 hour if has huge diarrhoea/vomit.* This review also included *continuing with 5x feeding regime* and to *weigh 2x/week.*

   I note that an entry in the dietician notes on [Day 9] acknowledges an awareness of [Baby B's] losses; *stools loose over last day, x5 yesterday + x1 vomit.* I am unaware if

[38] Nursing Council of New Zealand (NCNZ), *Competencies for registered nurses* (Wellington: NCNZ, 2007).

the dietician was informed that [Baby B] had rotavirus gastroenteritis when they attended the Multidisciplinary Team professionals meeting on [Day 10].

I note that [Baby B's] documented normal parameter range for respiration rate (RR) was 30–50 and heart rate (HR) 100–170 at rest. This range is broader than the actual trend of observations recorded from [Baby B's] admission to [Day 9]. Between these dates her HR trend was 122–162, RR 22–44 and she was consistently apyrexial. There is a note signifying that [Baby B] was crying when the HR 162 was recorded.

Comment: The Acute Gastroenteritis care plan has no date or nursing signature completed on it. Therefore it is difficult to know when this care plan was commenced for [Baby B]. In my opinion daily weights as advocated by the HVDHB Acute Gastroenteritis care plan should have been implemented for [Baby B] from [Day 9]. Whilst I accept that the Registrar did not ask for more frequent weights, I would have expected a Registered Nurse to query whether they should be commenced for [Baby B] or to have implemented an intervention that would have contributed to the nursing assessment of [Baby B's] clinical and fluid volume status. **I view this as a moderate departure from the expected standards of assessment skills as set by Nursing Council of New Zealand (NCNZ)[39].**

I note that in general an assessment of [Baby B's] vital signs was completed at least 4 hourly from [Day 11]. It is unfortunate that on [Day 11] when the nursing entries reflect a *miserable* and *quiet* child who is pyrexial that [Baby B's] vital signs were not monitored between 3.45pm and 9.35pm. In my opinion the broad range of acceptable HR and RR parameters for [Baby B] minimised the ability to interpret them accurately. From [Day 8] [Baby B's] high respiration rate and heart rate were seen as 'normal' although they had increased from her baseline trend over the preceding week. Unfortunately her ongoing pyrexia did not seem to raise any concerns from those involved in her care.

In my opinion the nursing assessment and monitoring of [Baby B] following the diagnosis of rotavirus was suboptimal. In my opinion I view this as a moderate departure from the expected standards of nursing practice as set by Nursing Council of New Zealand (NCNZ)[40].

6. Within the complaint from [Ms B] there is a description of finding her daughter at some stage during '… the night where everything went wrong … lying completely still with her eyes rolling back and forth in her head … asked for a nurse she check … then went to go get the doctor both said she was still alert they flashed a light in her eyes that's all they did'.

   Comment: I can find no contemporaneous record of this event or nursing assessment so cannot comment on the adequacy of the nursing assessment on [Day 11] in relation to [Ms B's] observation. However, based on the information within the clinical notes, I am of the opinion that a further medical review of [Baby B] should have been sought on the [Day 11] based on her vital signs as recorded at 9.35pm. At this time [Baby B's] HR was above the accepted parameter range and her temperature was 39.2°. I

[39] Nursing Council of New Zealand (NCNZ), *Competencies for registered nurses* (Wellington: NCNZ, 2007).
[40] Nursing Council of New Zealand (NCNZ), *Competencies for registered nurses* (Wellington: NCNZ, 2007).

would have also expected that the registered nurse would have commenced more frequent observations from this point onwards.

In my opinion the registered nurse should have been concerned about [Baby B's] fever and sought a clinical review. I view the failure to seek a review as a moderate departure from the expected standards of nursing practice (NCNZ, 2007).[41]

7. General Advice: I note that following a review of this case, HVDHB have reviewed their infection control policies; commenced an educational programme for junior medical and nursing staff; are considering developing an Early Warning Scoring system; and are ensuring a consistency in how concentrated NGT feeds are prescribed and documented. In my opinion all of these steps are appropriate and valuable. I would like to suggest that HVDHB also consider including 'weight' on the daily Fluid Balance Summary chart. In my opinion this would fit with the advice on the Acute Gastroenteritis care plan and help clinicians build a more robust clinical assessment of fluid status at a glance. It may also prompt nursing staff to advocate for daily weights in children with gastroenteritis as recommended by the said care plan.

   I would also like to suggest that the HVDHB Nutrition and Dietetics Service review their printed advice about concentrated NGT feeds. In my opinion this complaint highlights the inherent dangers when delegating treatments across different disciplines. I note that within the HVDHB clinical notes there is a printed advice sheet which warns that concentrated Karicare formula must be discontinued should the child vomit or have diarrhoea. Unfortunately the nutrition plan for [Baby B], dated [Day 1], does not contain the same information.

8. In conclusion, I have been asked to review the nursing care and assessment of [Baby B] as it relates to the complaint by her mother, [Ms B]. I have been asked to specifically answer:

   (i) Whether the nurses were given clear instructions on the purpose of each admission and whether these were followed?

   Yes. In my opinion the clinical management plan and purpose of [Baby B's] [two admissions] were known by the nursing staff. In my opinion there is consistent evidence that the nursing staff fulfilled the management plan requirement of observing and documenting [Baby B's] intake, output and positioning. There is also evidence that staff attempted to comply with observing [Ms B] making up [Baby B's] NGT feed and raised concerns about being unable to.

   (ii) Whether nurses were provided with clear instructions regarding making up the formula feeds and whether these were followed?

   Yes. In my opinion there is consistent evidence that relates to both admissions, that the nursing staff followed the dietician and medication guidelines when making up [Baby B's] NGT feeds.

[41] Nursing Council of New Zealand (NCNZ), *Competencies for registered nurses* (Wellington: NCNZ, 2007).

(iii) Whether nurses were appropriately documenting food and fluid intake and outputs both before and after the diagnosis of rotavirus gastroenteritis?

In my opinion [Baby B's] initial management of her fluid intake and output was appropriate. However, an attempt to calculate her actual losses should have been instituted once she was diagnosed with rotavirus gastroenteritis and mild dehydration on [Day 9]. This could have been achieved through instituting daily weights and weighing her soiled nappies. I view the failure to gain a more accurate calculation of [Baby B's] losses as a failure to assess [Baby B] adequately. In my opinion this is a moderate departure from the expected standard of nursing practice.

(iv) Whether nurses' assessment and monitoring following the diagnosis of rotavirus was appropriate?

No. In my opinion the nursing assessment and monitoring of [Baby B] following the diagnosis of rotavirus was suboptimal. I view this as a moderate departure from the expected standards of nursing practice.

(v) Whether the nurse's assessment of [Baby B] on the night of [Day 11] was adequate?

No. In my opinion the nursing staff should have been concerned about [Baby B's] fever and sought a clinical review. I view the failure to seek this as a failure to adequately assess [Baby B]. I view this as a moderate departure from the expected standards of nursing practice.

(vi) Whether nurses were appropriately raising concerns and whether these were appropriately addressed?

No. See response to question (v).

Dawn Carey (RN PG Dip)
Nursing Advisor
Health and Disability Commissioner
Auckland"

On 22 May 2013, further nursing advice was obtained from registered nurse Ms Dawn Carey as follows:

"1. Thank you for the request that I provide additional clinical advice in relation to the complaint from [Ms B] about the care provided to her late daughter, [Baby B] whilst she was an inpatient at Hutt Valley DHB (HVDHB). In preparing the advice on this case to the best of my knowledge I have no personal or professional conflict of interest. I have read and agree to follow the Commissioner's Guidelines for Independent Advisors. This advice is to be read in conjunction with my preliminary advice, prepared 26 September 2012.

2. I have reviewed the responses from HVDHB including statements from [RN F] and [RN E].

3. In light of the additional information from the provider, I have been asked to consider my preliminary advice and opinion.

4. In my preliminary advice I concluded that there were departures from the expected standard of nursing care. Namely,

   — The failure to gain a more accurate calculation of [Baby B's] losses from [Day 9] was a failure to assess [Baby B] adequately. In my opinion this was a moderate departure from the expected standard.
   — That the nursing assessment and monitoring of [Baby B] following the diagnosis of rotavirus was suboptimal, which was a moderate departure from the expected standard of nursing care.
   — That there was a failure to adequately assess [Baby B] on the night of [Day 11] which was a moderate departure from the expected standard.

5. In response to my preliminary advice HVDHB reports:

   ... Each shift nurse documented on the fluid balance chart the stool frequency and an estimate of volume and also commented in the progress notes on additional fluids to replace vomits or diarrhoeal losses ...

   Nursing staff were making regular assessments of [Baby B's] clinical condition and activity level as documented by the entries and comments in the progress notes for each shift. Prior to [Day 11] there were no documented findings about her general condition or activity level that suggested there was any cause for concern about her overall clinical status.

   ... On the evening on [Day 11] observations were not recorded as frequently as would have been expected ... The nurse involved states that she maintained regular observations in accordance with the notes and protocol. She has acknowledged that there were oversights in the documentation.

   ... Appropriate monitoring of fluid balance is necessary when managing children with gastroenteritis. Losses of both urine and stool can be estimated from weighing nappies, although it is difficult in a child with gastroenteritis to distinguish between urine output and fluid losses due to diarrhoea ...

   [RN F] reports:

   I agree with Miss Carey that daily weights should have been gained for [Baby B] from [Day 9]. I would have carried these out if they had been started. With the benefit of hindsight I wish that I had questioned the decision that my colleagues had made in determining that actual weighing of [Baby B's] soiled nappies was not required.

   ... I understand that the duration between observation recorded at 3.45pm and 9.35pm falls outside the expected parameters of 4 hourly observations. Although I cannot recall events exactly my only belief as an experienced paediatric nurse is to think that I was busy with other patients and did not have time to carry out the required observations within the four hour period. ... during the time period I did

visually observe [Baby B] and there was nothing in these visual observations that gave concern … Based on the vital signs recorded at 9.35pm I spoke to a doctor. I should have followed this up with the doctor. Handover took place less than one hour later and I advised the handover nurse of [Baby B's] presentation … I have learnt that I must not presume that an assessment has been carried out however busy I am and everything wherever possible should be noted.

[RN E] reports:

On night shift of [Day 11] I recorded [Baby B's] observations at midnight and her temperature was back down from during the morning and afternoon shifts … I cannot recall from the shift handover that night whether we were told of any warning signs or about [Baby B's] temperature … That particular nurse did not give handover to the night shift. The individual nurse who gives the patient care tells the nurse doing the handover what to report … The recording I took at midnight was 37.6 I assessed this to reflect that [Baby B] had responded to the Panadol that had been administered on the afternoon shift. I also think that I must have attributed her evening increase in temperature and response to Panadol by midnight to the possible diagnosis of LRTI and bronchiolitis of [Day 10] by the SHO … I believe that I maintained four hourly observations in accordance with the notes and protocol. The account recalled by [Ms B] that she 'asked for nurse to check to see what was wrong with her and get the doctor' suggests that a further medical review was sought at 1.30am on [Day 12]. I have no knowledge or recall of this event.

6. Comments

Following a review of the provider's responses and my preliminary advice, I am of the opinion that:

(i) The Nursing Council of New Zealand (NCNZ) requires registered nurses to undertake a comprehensive and accurate nursing assessment of their patients within their scope of practice. The NCNZ also holds registered nurses accountable for ensuring that all health services they provide are consistent with their education and assessed competence. In my opinion, New Zealand nursing competencies, accepted nursing education concerning fluid status assessment and the guidance within the HVDHB 'acute gastroenteritis care plan'; all advocate that accurate fluid balance monitoring should have been instituted for [Baby B] on [Day 9]. Whilst I acknowledge that the outcome for [Baby B] might have still been the same, I remain of the opinion that from [Day 9] the nursing assessment of her fluid status — subjective ticks on fluid balance sheet — was inadequate and a moderate departure from the expected standards of nursing assessment and monitoring of a child with rotavirus gastroenteritis.

(ii) I accept that an experienced RN gains pertinent assessment knowledge from visual observation and the performing of interventions, such as observations, is dependent on the workload at that time. Whilst delays cannot be condoned, they are the reality of contemporary nursing practice. I note that HVDHB report that Trendcare has now been implemented throughout the hospital, which gives an indication of the patient acuity and safe staffing levels. Programmes such as this will hopefully facilitate timely nursing assessments and delivery of care. [RN F] reports that her — visual —

observation of [Baby B] prior to 9.35pm did not indicate any change in her condition or alert her to checking [Baby B's] vital signs earlier. I note that at 9.35pm [RN F] noted and treated [Baby B's] high temperature with paracetamol, assessed [Baby B's] response to the anti-pyretic and documented the same in her contemporaneous documentation. These actions were appropriate and expected of a RN.

I accept that on [Day 11], [RN E] did maintain clinical observations in accordance with instructions and protocols. I also accept her attestation that based on the information available to her — new diagnosis of LRTI and current stable vital signs — that she did not assess these observations as requiring referral to a doctor or more frequent observation of [Baby B] than four hourly. [Baby B's] observations at midnight were within the documented normal parameter range for her.

[RN F] reports that she spoke to [Dr A] about the change in [Baby B's] status and handed it over. Unfortunately [Dr A] has no recollection of being contacted or being asked to review [Baby B]. [RN E] also cannot recall the specifics of the received nursing handover for that night.

Accurate contemporaneous documentation that is reflective of nursing assessment, delivered care, patient progress and response and captures outstanding issues is a challenge to meet. However, for the safe transfer of patient care from one RN to another it is fundamental. It is also a professional and legislative requirement for all health providers. Both [RN F] and [RN E] acknowledge that there were omissions within their clinical notes entries.

Based on the reviewed responses I am of the opinion that there was a failure to adequately assess [Baby B] on [Day 11], which was a mild–moderate departure from the expected standard of nursing care. I base this on the suboptimal clinical documentation and suboptimal nursing transfer of care. Within the responses it is reported that the RN delivering patient care is not the RN who delivers handover to the oncoming shift. I would be very concerned if this practice is still part of HVDHB nursing norms.

7. Clinical advice

In my opinion,

(i) From [Day 9] the nursing assessment of [Baby B's] fluid status was inadequate and a moderate departure from the expected standards of nursing assessment and monitoring of a child with rotavirus gastroenteritis.

(ii) There was a failure to adequately assess [Baby B] on the night of [Day 11], which was a mild–moderate departure from the expected standard of nursing care.

Dawn Carey (RN PG Dip)
Nursing Advisor
Health and Disability Commissioner,
Auckland."

On 11 December 2013, further advice was obtained from my in-house nursing advisor, Ms Dawn Carey, as follows:

"1. Thank you for the request that I review the clinical advice that I have provided in this case and provide some clarification.

2. I have reviewed my previous advice provided on 26 September 2012 and 22 May 2013.

3. There are discrepancies between the statements of [RN F], [RN E] and [Dr A], which relate to the events on [Day 11]. [RN F] reports alerting [Dr A] to [Baby B's] condition after she took [Baby B's] vital signs at 9.35pm and advised the handover RN of [Baby B's] presentation. [Dr A] reports no recollection of being contacted regarding [Baby B] or being asked to review her. [RN E] reports that [RN F] was not the RN who handed over the patients to the night shift staff on [Day 11]. [RN E] cannot recall the specifics of the nursing handover of [Baby B] that night.

4. Clinical Advice:

   (i) Accurate fluid balance monitoring should have been instituted for [Baby B] from [Day 9] when it was confirmed that she had rotavirus gastroenteritis — see section 4 of preliminary advice, 6(i) of my additional advice. I view this failure to constitute a moderate departure from the expected standards of nursing assessment and monitoring.

   (ii) [RN F] provided nursing care to [Baby B] from 2.45pm–11.15pm on [Day 11]. She acknowledges that [Baby B's] vital signs were not checked as frequently as expected. She also reports that her — visual — observation of [Baby B] prior to 9.35pm did not indicate any change in her condition or alert her to checking [Baby B's] vital signs earlier. I accept that an experienced RN does gain pertinent assessment knowledge from visual observation and whilst delays in patient care cannot be condoned, they are the reality of contemporary nursing.

   I am less accepting of [RN F] not checking [Baby B's] vital signs at 10.35pm; one hour after she recorded temperature 39.2°, HR 172. In my opinion, [RN F] retained the responsibility for ensuring that [Baby B] was reassessed, and I am critical of her failure to do this or to hand it over as an outstanding task to [RN E]. I view this failure to constitute a mild–moderate departure from the expected standards of nursing assessment and monitoring.

   (iii) At 9.35pm on [Day 11], [RN F] assessed [Baby B] as being unwell and administered paracetamol elixir to her. I agree with [RN F's] assessment of [Baby B] and consider the administration of paracetamol to be appropriate. If I accept [RN F's] recollection; I consider it clinically appropriate that she requested a review of [Baby B] from [Dr A] on [Day 11], but I am critical of her failure to document this action. Accurate contemporaneous documentation is a professional and legislative requirement for all health professionals. As a RN peer, I consider that [RN F's] standard of clinical documentation was a mild departure from the expected standards.

   (iv) If I accept the recollections of [Dr A] and [RN E]; then I view [RN F's] nursing care to [Baby B] on [Day 11] to demonstrate a moderate departure from the expected standards of nursing care.

(v) In my opinion the range of acceptable heart rate (HR) and respiration rate (RR) parameters for [Baby B] was broad and higher than the range that she had been demonstrating since her admission on [Day 1]. Prior to Day 8, her HR trend was generally 122–150, RR 22–4. There is one HR 162 recorded with a note reporting 'crying'. In my opinion, the broad parameter range normalised [Baby B's] higher HR and RR trend — recorded from [Day 9].

(vi) Supporting a 'transfer of care' system, where the co-ordinating RN hands over all of the patients to the next shift is not uncommon in nursing. However, I do consider that such a system has potential weaknesses that can undermine the safe transfer of patient care. In my opinion, such a system requires additional processes — allowing time for RN–RN to participate in a bedside handover of pertinent observations and any outstanding care needs etc, plus robust clinical documentation practices — to minimise potential risks. I am also of the opinion, that a commitment to auditing documentation practices is crucial for any ward where the 'handover' system minimises RN–RN contact. In my opinion, the safe transfer of [Baby B] was compromised by a suboptimal nursing handover on [Day 11].

Dawn Carey (RN PG Dip)
Nursing Advisor
Health and Disability Commissioner
Auckland"