Information gathered during investigation

Introduction

11. William Burton was born on 13 July 2013. William was generally a well baby and was being breastfed. On 16 October 2013, when he was 13 weeks old, William developed a fever and, on 21 October 2013, he was diagnosed with *E. coli* meningitis.[2] The facts relevant to the care he received during that period are set out below.

[2] Meningitis is the inflammation of the meninges, the membrane lining of the brain and spinal cord. *E. coli* meningitis is caused by certain strains of *E. coli* bacteria.

GP review on 16 October 2013

[redacted] *Medical Centre*

12. On the evening of 16 October 2013, William's parents, Mrs Wendy and Mr Derek Burton, took him to [redacted] Medical Centre because he had had a fever during the day. William was seen by general practitioner (GP) Dr [redacted].[3] Dr [redacted] recorded in the clinical notes that William had been unsettled overnight, did not feed in the morning, and had had a temperature, which initially had settled with paracetamol,[4] but had then returned. Dr [redacted] noted that William had fed well in the evening, but that Mrs Burton had noticed a red patch in the front of his nappy when changing him.

13. Dr [redacted] recorded that, on examination, William was alert, crying, well perfused,[5] and had no rash. Dr [redacted] noted that William's temperature was 38.3°C,[6] his nose was clear, his ears and throat were normal, his chest was clear, and his abdomen was soft. A urine bag was attached to collect a sample but, by 7.30pm, William had not passed urine, so Dr [redacted] recorded: "[T]o go home and once urine bag full to take it to the [after-hours medical centre] to have it dipsticked … if positive for blood and whites [leucocytes or nitrites] to see a Dr for further advice and treatment."[7]

Wellington Accident & Urgent Medical Centre

14. Mr Burton advised HDC that the urine sample was duly collected, and the family went to the Wellington Accident & Urgent Medical Centre. At approximately 9.30pm, William was seen by GP Dr [redacted]. Dr [redacted] noted: "Assessed William: sleeping on dad. Easily roused. Extremely pale. Temp 38.2. Weight 7kg. [Heart rate] 140 [beats per minute].[8]" Dr [redacted] examined William's abdomen, following which William had a "very large vomit". Dr [redacted] recorded that William appeared drowsy, and that a dipstick urine test was positive for leucocytes and protein. Dr [redacted] recorded his impression as: "UTI [urinary tract infection] — appears to be getting sicker." Dr [redacted] referred William to Wellington Hospital for paediatric assessment.

Wellington Hospital

15. William's parents took him to Wellington Hospital. At 10.15pm, registered nurse (RN) [redacted] triaged William as triage code 2.[9] According to the triage record, William's temperature was 38.9°C, his heart rate 150 beats per minute, his respiratory rate 60,[10] and his oxygen saturation 96%.[11] At 10.55pm, William was reviewed by ED house officer Dr [redacted]. Dr Kirton recorded that he examined William, who was pale with mottled skin[12] but had no rash. Dr [redacted] noted that William's fontanelle was not bulging,[13] and that his impression was: "Febrile illness — SIRS

[3] The clinical records do not record what time Dr [redacted] reviewed William.
[4] Widely used pain relief medication that is also used to reduce fever.
[5] Good blood supply.
[6] The normal body temperature for a healthy baby is between 36–38 °C.
[7] Dipstick analysis of a urine sample is used to test for blood, leucocytes, nitrites and protein, as a diagnostic or screening tool for metabolic or kidney disorders (eg, a urinary tract infection).
[8] The normal heart rate for infants 1–11 months old is 80–160 beats per minute.
[9] Wellington Hospital Emergency Department triages patients by assigning a code on a scale from 1 (life-threatening) to 5 (non-urgent).
[10] Breaths per minute — the normal rate in babies 0 to 6 months is 30–60.
[11] The level of oxygen in the blood. The normal rate in humans should be between 95% and 100%.
[12] Blood vessel changes in the skin that cause a patchy appearance.
[13] The fontanelle, colloquially known as the "soft spot", is the membranous gap between the bones in an infant's skull. The posterior fontanelle is at the back of the head, and the anterior fontanelle at the

[Systemic Inflammatory Response Syndrome].[14]" Dr [redacted] recorded that William should have a midstream urine test (MSU), paracetamol, quarter-hourly review,[15] and await paediatric review.

Paediatric assessment on 16 October 2013

16. At midnight, William was seen by paediatric senior house officer Dr [redacted]

17. Dr [redacted] recorded that she examined William, and that his temperature was 39°C, his heart rate 180 beats per minute, his respiration rate 60, and his oxygen saturation 96%. Dr [redacted] recorded that William did not have a rash, and had warm peripheries and a central capillary refill time[16] of two to three seconds.[17] According to the clinical records, Dr [redacted] obtained a catheter urine sample, which tested negative for blood, leucocytes and nitrites. Dr [redacted] sent the urine sample to the laboratory for further testing,[18] and discharged William. She noted that there were no clinical signs to identify a "focus of infection". Dr [redacted] recorded her impression that William had a viral illness and should be given paracetamol and Brufen[19] as required, and have GP review the following afternoon. Dr [redacted] recorded on William's Discharge Summary that his primary diagnosis was "Fever of Unknown Origin — Probable Viral Illness".

18. Dr [redacted] told HDC that her management of William was based on the "Starship Children's Health Clinical Guidelines — Fever Investigation and Management" (the Starship Guidelines), and that she focused on the advice within the section "Children three months to two years of age, fever > 38.9°C" and the subsection "The child who has a fever without clinical focus, who is not severely unwell".

19. Dr [redacted] stated that, when she examined William, she considered that his tachycardia[20] and tachypnoea[21] were due to, and consistent with, his fever.[22] She stated that she did not identify any clear clinical focus of infection during her examination, and she did not think that William had any cardiovascular compromise. She disagreed with Dr [redacted]'s assessment that William's skin was mottled, and said that she did not record the colour of William's skin because she assessed his skin

front. Fontanelles allow for growth of an infant's brain and skull over the first year of life, and harden over time to become closed, solid bony areas. A bulging fontanelle occurs when fluid builds up in the brain or when the brain swells, causing increased pressure inside the skull.

[14] An inflammatory state affecting the whole body, related to sepsis.

[15] The clinical notes record that RN [redacted] took William's vital signs at 11.47pm, but there is no further record that he was reviewed quarter-hourly.

[16] The time taken for colour to return to an external capillary bed after pressure is applied to cause blanching. This can be measured by holding a hand higher than heart-level, pressing the soft pad of a finger or fingernail until it turns white, and taking note of the time needed for the colour to return once pressure is released. In newborn infants, capillary refill time can be measured by pressing on the sternum for five seconds with a finger or thumb, and noting the time needed for the colour to return once the pressure is released.

[17] For paediatric patients, a capillary refill time of two seconds is considered normal.

[18] Results from the urine culture were reported on 19 October 2013 and showed no growth.

[19] A non-steroidal anti-inflammatory used for pain relief and to reduce fever and inflammation.

[20] Faster than normal heart rate at rest.

[21] Rapid breathing.

[22] Dr [redacted] noted to HDC that, according to the "NICE Guideline: feverish illness in children — assessment and initial management in children younger than 5 years" (discussed further below), which she had not seen at the time she treated William, William's heart rate would have been characterised as an intermediate risk sign for serious illness.

colour as likely to be normal for him as a Eurasian infant. Dr [redacted] acknowledged to HDC that she did not record that she had assessed William's fontanelle, but stated: "I believe that I would have as it was routine for me to do so … I did not assess William as looking irritable or unduly unwell, or as having a bulging fontanelle."

20. Dr [redacted] told HDC that, in assessing William, she considered whether meningitis might be the cause of his fever, whether she should take a blood test, and whether she should admit William for observation overnight. Dr [redacted] stated that she decided, based on the advice in the Starship Guidelines and in discussion with Mr Burton, that "on balance the best approach … was for discharge with a medical review in 12–18 hours". Regarding her recommendation that William be reviewed by his GP, Dr [redacted] told HDC:

> "Identifying William as a child with 'Fever of Unknown Origin' was in my opinion protective as it indicated to the [GP] that while I thought that William's illness was probably viral … a bacterial cause was still possible. Review was required to ensure that signs revealing a serious bacterial infection had not subsequently developed."

21. Dr [redacted] also said that social circumstances are a key consideration in such cases and that, in William's case, she assessed him as having a caring, intelligent and reliable family, who she "could guarantee would take him for a review with his [GP] the following day".

22. Dr [redacted] stated:

> "The consultant paediatrician was not contacted by myself at any stage during my shift and was not aware of William's presentation to Wellington Hospital. I did not contact the consultant on call as I did not feel that William's case met [any of the] criteria for contacting the consultant … From my perspective, I felt certain of the diagnosis of fever of unknown origin and that the management recommended in the Starship Guidelines … gave clear appropriate advice."

GP review on 17 October 2013

23. Mr Burton stated to HDC that, during the following day, William remained feverish and vomited three or four times, so that evening he and Mrs Burton took William back to [redacted] Medical Centre, where William was seen by GP Dr [redacted].[23]

24. Dr [redacted] faxed a referral letter to Wellington Hospital, which states that William had been unwell for 48 hours and his parents had reported that he was getting worse. Dr [redacted] noted that William had had a fever intermittently all day, had blood in his urine, had not fed well that day, and had vomited after almost every feed. The referral letter notes that, on examination, William appeared irritable and "somehow unwell". Dr [redacted] recorded: "[William] settles when on [mother's] arm but his cry is that of an unwell child when on the examination couch." Dr [redacted] noted that William did not have a skin rash, but concluded: "[I]n essence he is worse and in my opinion he needs further ongoing observation and maybe further studies."

[23] The clinical records do not record what time Dr [redacted] reviewed William.

25. Dr [redacted] recorded in the clinical notes: "I have discussed this with the on call [paediatric registrar] and with the parents who are taking [William] to ED for further attention."

Paediatric assessment on 17 October 2013

26. At around 6.30pm that evening, Mr and Mrs Burton took William back to the ED at Wellington Hospital. William was assessed as triage code 3 and sent to the Children's Acute Assessment Unit (CAAU), contrary to the CCDHB's Children's Acute Assessment Guideline (the CAA Guideline), which required review by a registrar prior to transfer to the CAAU from ED (discussed further below).

27. According to the clinical notes, William was irritable and pale on arrival in the CAAU. His temperature was 36.4°C, his heart rate 157 beats per minute, his respiration rate 44 breaths per minute, and his oxygen saturation 100%.

28. Shortly after arrival in the CAAU, William was seen by paediatric senior house officer Dr [redacted]. Dr [redacted] documented her assessment of William on the electronic Discharge Summary. She recorded that he had presented to ED previously with fever and pink discolouration in his nappy and that, since then, he had vomited and had diarrhoea, as well as further episodes of pink discolouration in his nappy. She recorded: "[On examination]: Pale baby sleeping in Mum's arms, [anterior fontanelle] — soft, flat, non-bulging. [Capillary refill time] 2 secs." Dr [redacted] recorded that her impression was of "viral gastroenteritis" and "? Pink substance/blood in nappy". She prescribed Pedialyte[24] and requested urine and stool specimens. According to the clinical record, no stool sample was obtained,[25] and the dipstick urine sample showed protein[26] but no blood or leucocytes. Dr [redacted] sent the urine sample for further testing. She recorded that William was "[t]olerating pedialyte well with one small spill".

29. At 10.03pm, Dr [redacted] discharged William, recording on the electronic Discharge Summary:

> "Given pedialyte and rehydration plan.
> Paracetamol for fevers/[grizzliness].
> Advised to return if unable to keep fluids down with ongoing vomiting and diarrhoea.
> Chase urine culture."

30. Dr [redacted] also made a retrospective handwritten record[27] of this consultation, where she noted that, prior to discharging William, she discussed his case with registrar Dr [redacted] over the telephone. Dr [redacted] recorded: "[Dr [redacted]'s] impression was that blood/discolouration in nappy was secondary to concentrated urine."

31. Regarding what she discussed with William's parents when discharging him, Dr [redacted] documented in the retrospective record:

[24] An oral electrolyte solution used to rehydrate children who have had diarrhea and/or vomiting.
[25] Dr [redacted] told HDC that this was because William "had soiled earlier and the nappy was thrown in the bin before review, and [William] did not provide another dirty nappy while in CAAU".
[26] Protein in the urine can indicate kidney problems.
[27] Dr [redacted] dated the record 22 October 2013, and noted that it was retrospective.

> "I advised William's parent that if ongoing fevers, [diarrhoea and vomiting] & decreased oral intake to return to ED/seek medical advice. I was encouraging of parents to return in spite of being seen twice with me & the previous night in ED."

32. Dr [redacted] told HDC:

> "I explained that my diagnosis at that time was of viral gastroenteritis ... I explained that we needed to rule out a urine infection and that the urine dipstick was clear and we would send it to the laboratory for further testing and if anything grew that I or another member of the Paediatric team would contact them. I explained that a viral illness may take a few days to get over but to return if ongoing vomiting and fevers and seek medical advice."

33. Mr Burton told HDC that, at this consultation:

> "I asked [the doctor] about a blood test, and she dismissed this as being unnecessary because it would be uninformative. She also said, with certainty, that with this gastro bug [William's] fever was likely to continue for five days. She made the diagnosis, gave us a sugar and salt drink for dehydration and made no suggestion to return if things continued."

Further information from Dr [redacted]

34. Dr [redacted] told HDC that she cannot recall specific details of her discussion with Dr [redacted] about William, but stated:

> "From memory ... [William] did not appear unwell to [Dr [redacted]] ... [Dr [redacted]] presented the history to me and reported that the urine dipstick showed no blood, leucocytes or nitrite. The urine culture of sample from the night before was negative. [William] had tolerated pedialyte with one small vomit. Our joint conclusion was probable viral gastroenteritis (based on the recorded history of fever, vomiting and diarrhoea and the absence of any significant examination findings), with red discolouration probably being urates due to concentrated urine. The main focus was to prevent dehydration. I was happy with discharge if baby was able to tolerate oral fluids, advice to be given on frequent intake of fluids and low threshold for review if vomits and/or diarrhoea would increase or if baby was unable to adequately feed/take pedialyte. No specific advice was given about continuing fevers, as I would expect fevers to continue for some days with this viral illness."

35. Dr [redacted] stated that she was aware that William had returned to the ED after being reviewed the previous night, but was not alarmed by that because she "understood the main reason for re-presentation was concern about blood in the nappy and a UTI had been ruled out, now twice". Dr [redacted] further stated that, knowing that a UTI had been ruled out, all the information she had been given about William from Dr [redacted] "fitted in [her] mind with the probable diagnosis".

36. Dr [redacted] told HDC: "On this night it was not busy at all and I would have been able to review [William] promptly if there was any concern or doubt about his condition ... I considered [Dr [redacted]] competent to assess whether the patient needed review and I didn't feel the need to review [William] if [Dr [redacted]] felt it wasn't necessary."

Diagnosis of *E. coli* meningitis

37. Mr Burton told HDC that, for the next three days (from Friday to Sunday), William was feverish but did not vomit and, on the morning of Monday 21 October 2013, Mrs Burton took him back to the ED.

38. At 9.08am, RN [redacted] assessed William as triage code 2 and noted that he was very pale with "grunting breathing", and his neck appeared stiff. The clinical notes record that William was tachycardic, with a "sluggish" capillary refill time of three to four seconds, and a bulging fontanelle. William was diagnosed with *E. coli* meningitis and septic shock.[28] He was admitted to the Paediatric Ward, then to the Intensive Care Unit. William was later transferred to Starship Hospital (Auckland) with *E. coli* cerebral empyema,[29] which required drainage and resulted in multiple cerebral infarctions,[30] hydrocephalus,[31] significant neurological injury, and permanent disability.

39. Mr Burton stated:

> "If they had have diagnosed meningitis, or kept [William] in for observation, or not have misdiagnosed him, or even simply not have made a diagnosis (we would have brought him in again the next day) then Will's outcome would have been far far different to the terrible prognosis he now has. Time is of the essence in meningitis … It is very difficult to accept that in the first instance, a specialist paediatrician and then secondly, another doctor responsible for assessing sick children presenting to the children's ward did not pick up on these symptoms."

Adverse Event Review Report

40. Capital & Coast District Health Board (CCDHB) conducted an Adverse Event Review (the Review) into the care provided to William. The Review was conducted by a Review Team comprised of senior paediatric and ED clinicians and a Quality Manager. The Review involved reviewing William's clinical records and conducting interviews with staff and William's parents.

41. Regarding William's first paediatric assessment on the night of 16 October 2013, the Review found that Dr [redacted] acted appropriately and in accordance with the Starship Guidelines, which state that a full blood count (FBC)[32] and C-reactive protein (CRP)[33]

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[28] A patient becomes septic when he or she is suffering from sepsis. Sepsis is a complication from infection, when chemicals released into the bloodstream to fight an infection trigger an inflammatory response throughout the body. The response can trigger a cascade of changes in the body that can damage multiple organs, causing them to fail. When a patient goes into septic shock, his or her blood pressure drops dramatically, which may lead to death.

[29] A cerebral empyema is a collection or gathering of pus within the brain.

[30] A cerebral infarction is a type of ischaemic stroke resulting from a blockage in the blood vessels supplying blood to the brain. A cerebral infarction occurs when a blood vessel that supplies a part of the brain becomes blocked or leakage occurs outside the vessel walls. This loss of blood supply results in the death of that area of tissue.

[31] Hydrocephalus is a condition that occurs when fluid builds up in the skull and causes the brain to swell. Brain damage can occur as a result of the fluid build-up. This can lead to impaired developmental, physical, and intellectual functions.

[32] A blood test that is used to obtain information about the cells in a patient's blood.

[33] A protein found in blood plasma, the levels of which rise in response to inflammation. CRP levels are measured by doing a blood test.

(ie, blood tests) are not useful in determining the risk of bacterial sepsis in a child of three months to two years presenting acutely with fever. However, the Review noted that there is a low threshold for septic work-up[34] in infants under three months,[35] and that, at 13 weeks of age (or three months and three days), William was "at the cusp of the age at which some more senior clinical discretion should have been applied regarding further investigations".

42. The Review Team noted that, at the time of these events, paediatric house officers were not required to discuss their clinical assessments or plans of care with a more senior doctor (ie, a registrar or consultant) prior to discharging a patient. In addition, the Review Team noted that the Starship Guidelines that Dr Ryland followed do not include any specific recommendations with reference to tachycardia in assessing a child of three months to two years. The Review noted that the "NICE [National Institute for Health and Care Excellence] Guideline: feverish illness in children — assessment and initial management in children younger than 5 years" (the NICE Guideline) recommends a "more comprehensive clinical management process" that factors in tachycardia. The NICE Guideline was released on 17 September 2013 and, according to the Review, had not been distributed amongst the paediatric medical staff at the time William was treated.

43. Overall, the Review concluded that the lack of explicit recommendations in the Starship Guidelines with reference to tacychardia, and the lack of policy requiring confirmation of the proposed clinical management and plan with a more senior clinician, meant that "an opportunity was lost to consider or implement a septic work up or consider a longer period of observation".

44. The Review Team noted that, according to the clinical records, on the second occasion William's parents took him to the ED he was triaged as code 3 and sent straight to the CAAU, whereas he should have been assessed by a paediatric registrar or senior ED registrar prior to transfer to CAAU, in accordance with the most recent version of the CAA Guideline introduced in September 2013. The Review stated:

> "The Review Team have ascertained that while [the CAA Guideline] was introduced in September, the ED staff had concerns regarding this, staffing and process, and subsequently it had not been fully implemented. However it is the Review Team's opinion that it is unlikely a brief review in ED for the purposes of assessing fitness to be transferred to CAAU would have had any impact on the subsequent clinical assessment."

45. Regarding William's second paediatric assessment on 17 October 2013, the Review found:

> "[T]he impression formed by [Dr [redacted]] that this was viral gastroenteritis was a possible diagnosis in the circumstances, but … the possibility of sepsis was not

[34] A range of tests to determine whether a patient has sepsis (whole body inflammation as the result of an infection), including a chest X-ray, FBC, blood and urine cultures, and cerebrospinal fluid studies.
[35] The Starship Guidelines state that children from six weeks to three months of age presenting with a fever should have a full sepsis screen if the child "looks unwell". If the child looks well and feeding is satisfactory, he or she should have a blood culture, a urine test, and a chest X-ray if indicated by respiratory signs.

given due weight and consideration. The concern from the GP that the child had deteriorated and was irritable and unwell, the persisting tachycardia, irritability and fever, and the vomiting in the absence of diarrhoea all pointed to sepsis as a diagnosis that needed excluding prior to the alternative diagnosis of viral gastroenteritis being made. The Review Team notes the diagnosis of gastroenteritis and the plan was discussed and agreed with the Registrar.

The Review Team consider that given this child had represented for a second time, had elevated temperature for more than 48 hours, appeared unwell and was referred to Wellington Hospital for further studies, an opportunity for further investigations and potentially earlier interventions was missed [at this presentation]."

46. Overall, the Review concluded the following:

"[A]s a consequence of more senior clinical discretion not being engaged in this sequence of events the opportunity for earlier intensive diagnostics, diagnosis and treatment was missed. …

The Review Team do not consider individual clinicians directly responsible for the lack of more senior clinical engagement. Rather the Review Team consider the main contributing factor to this incident is a lack of formal processes regarding more senior paediatric medical staff oversight of paediatric junior medical staff clinical assessments and discharge planning. The Review Team consider a requirement for children representing within 72 hours to be assessed by senior medical staff (Registrar or Consultant) is indicated."

47. The Review also identified "incidental findings" regarding information incorrectly recorded on some of the relevant clinical documentation.[36]

48. The Review Team recommended that:

- CCDHB and the Department of Paediatrics offer a sincere apology to William's family.
- CCDHB notify Starship Hospital of this adverse event and recommend that Starship Hospital review the Starship Guidelines, specifically the statement regarding the usefulness of FBC and CRP in determining the risk of bacterial sepsis in a child of three months to two years presenting acutely with fever, and consider emphasising the importance of tachycardia as per the NICE Guideline.
- CCDHB's Paediatric Service develop a guideline clearly formalising the role and responsibilities of the house officers and registrars regarding assessment and discharge responsibilities.
- CCDHB's Paediatric Service adopt the NICE Guideline as a medical staff reference document.

[36] Specifically, Dr [redacted]'s electronic signature recorded that she was a registrar rather than a house officer, and William's Discharge Summary following his first paediatric assessment recorded the incorrect GP and medical centre.

- CCDHB's Paediatric Clinical Leader require all paediatric medical staff to read and sign off or complete a test on the NICE Guideline.

- CCDHB's CAA Guideline is modified to state that:

  a) discharge and admission decisions are to be made by a registrar;

  b) any child who re-presents within 72 hours must be assessed by the paediatric registrar or senior ED registrar/consultant prior to discharge from either ED or CAAU; and

  c) all children who re-present within 72 hours who have previously been reviewed by the Paediatric Service are reviewed by a paediatric registrar.

- CCDHB ED fully implement the CAA Guideline following further review.

- The information incorrectly recorded on the relevant clinical documentation is corrected.

49. CCDHB advised HDC that all of the Review Team's recommendations have now been implemented.