

IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2015 002601

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 60(2)

Section 67 of the Coroners Act 2008

Findings of: Paresa Antoniadis Spanos, Coroner

Deceased: Caleb Harley Pearson

Date of birth: 28 May 1998

Date of death: 28 May 2015

Cause of death: Diabetic Ketoacidosis

Place of death: Croydon, Victoria

I, PARESA ANTONIADIS SPANOS, Coroner,

having investigated the death of CALEB HARLEY PEARSON without holding an inquest:

find that the identity of the deceased was CALEB HARLEY PEARSON born on 28 May 1998

and that the death occurred on 28 May 2015

at 25 Donald Street, Croydon, Victoria

from:

I (a) DIABETIC KETOACIDOSIS

Pursuant to section 67(1) of the **Coroners Act 2008**, I make findings with respect to **the following circumstances:**

1. Caleb was a 17 year-old student who lived with his mother, Debra Hong, and younger brother Bryce, in Croydon, Victoria. He is also survived by his father, Karl Pearson. Caleb had a medical history of gastro-oesophageal reflux disease (GORD) complicated by oesophagitis, non-alcoholic fatty liver disease, constipation, asthma, obesity, hyperkeratosis pilaris and anxiety.
2. Caleb's issues with weight gain and anxiety become apparent in the aftermath of his parents' separation in about 2011. Due to his gastrointestinal pathology, Caleb was reviewed multiple times by Paediatric Gastroenterologist, Dr Vered Schildkraut between June 2012 and August 2013.
3. During routine blood tests in August 2012, Dr Schildkraut noted that Caleb had a mildly raised blood sugar level (BSL) of 6.4mmol/L.¹ Follow-up blood tests were undertaken in August 2013, with Caleb's fasting BSL being recorded as 5.5mmol/L, which was associated with a normal insulin level of 9mU/L.² At the time, Dr Schildkraut's main concerns about Caleb were reflux esophagitis (for which she had recommended Somac), increasing weight and regular school absenteeism. Caleb was not showing typical signs of Type I diabetes at that time but a borderline elevated fasted glucose with normal insulin was noted and discussed. This suggested the early stages of insulin resistance, potentially a prodrome to Type II diabetes mellitus in the future.
4. Dr Schildkraut referred Caleb to General Paediatrician, Dr Lionel Lubitz, who felt that his regular school absenteeism related to his underlying anxiety. Caleb's regular general practitioner (GP), Dr Ronald Krigsman, had already initiated a mental health care plan for him.

¹ A fasting BSL of ≥ 7 mmol/L, or random BSL of ≥ 11 mmol/L, is diagnostic of diabetes. A fasting BSL between 5.6mmol/L and 6.9mmol/L is defined as impaired fasting glucose.

² This demonstrates normal fasting blood glucose associated with appropriate insulin levels.

5. Dr Lubitz reviewed Caleb on two occasions, in September 2013 and October 2013, started him on an antidepressant, and recommended ongoing follow-up with his child psychologist. He commented that Caleb's abdominal pain could be a symptom of diabetes but is also one of the most common presenting symptoms for a wide range of paediatric conditions. Dr Lubitz would also have expected other symptoms suggestive of diabetes such as excessive thirst, increased urine output, weight loss and general debility. In fact, Caleb had recently experienced weight gain.
6. In March 2014, Dr Kringsman referred Caleb to Headspace, a youth mental health service. A short time later Caleb began home-schooling as he was having difficulty coping in a regular school environment.

Circumstances proximate to Caleb's death

7. Between 23 and 24 May 2015, Caleb became unwell with a cough, intermittent vomiting, a sore throat and lethargy, all in the context of decreased appetite over the past week. He presented to Dr Kringsman on 25 May 2015. Dr Kringsman found he was afebrile, had a red throat with enlarged tonsils and palpable submandibular lymph nodes. There were no other remarkable examination findings on assessment of his chest, nose or ears. Dr Kringsman diagnosed Caleb with pharyngitis and prescribed an oral antibiotic.
8. Ms Hong took the following two days off work to take care of Caleb at home but returned to work on the morning of 27 May 2015 when he said he felt a little better.
9. That evening, Ms Hong received a call from Bryce who said Caleb had vomited, appeared unwell and could not move. On returning home, Ms Hong found Caleb lying on her bed looking ashen. He said he could not move his legs, which appeared splotchy and off colour. Deeply concerned, Ms Hong decided to take Caleb to Maroondah Hospital, which was about a five-minute drive away. However, in the process of trying to move him to the car, he collapsed and was unable to get himself up. Caleb told his mother he felt that he was going to vomit again, and she observed that his breathing had become rapid. Ms Hong turned her son on his side and telephoned emergency services.

Attendance of the first ambulance (6.40pm 27 May 2015)

10. At 6.40pm, an Advanced Life Support Ambulance Victoria (AV) paramedic crew arrived. Ms Hong told paramedics that Caleb had issues with vomiting, heart burn and gastric reflux of unknown physical origin, and that other physicians had attributed his symptoms to anxiety. Paramedics were also told that Caleb had been unwell for the preceding four days, had seen his GP the day before, was prescribed antibiotics for a throat infection, and that when Ms

Hong had returned home from work, she found him unwell and unable to get up. Ms Hong also told the paramedics that Caleb had become anxious and started hyperventilating after collapsing.

11. Paramedics found Caleb anxious and distressed, tachycardic, hypothermic with a temperature of 35 degrees Celsius and tachypnoeic. The paramedics stated that he was not concerned about Caleb's low body temperature and assumed it was because he was out of bed and only wearing shorts. Caleb was alert and orientated with a Glasgow Coma Scale of 15, had normal oxygen saturation on room air and his blood pressure was normal. His raised respiratory rate of 40 breaths per minute and raised heart rate at 120 beats per minute stood out to the paramedic, and he sought to provide reassurance to help Caleb slow his breathing, who reportedly responded well. Caleb's chest was clear on auscultation and paramedics attributed his hyperventilation to anxiety. The paramedics also noted that Caleb had a slight rash on his body. When they queried this with Ms Hong, she told them that Caleb normally had some eczema. They also investigated whether Caleb was dehydrated, checked his mouth for symptoms and noted that it appeared normal.
12. Paramedics decided to get Caleb up and return him to bed. According to Ms Hong, Caleb could barely move, and paramedics kept telling him to get up, calling him a "*big boy*" and that he needed to help himself otherwise they would injure their backs. Paramedics made several attempts at manipulating Caleb's position on the floor such as putting him on his knees to push himself up, but to no avail. Ms Hong observed that Caleb was extremely upset and crying, and he said that he couldn't get up himself.
13. Ultimately, the two paramedics and Ms Hong worked together to place Caleb back in bed. His heart rate reduced to 96 beats per minute and his respiratory rate to 24 breaths per minute. At that point, paramedics concluded that Caleb was unwell because of his throat infection and was hyperventilating due to anxiety. His inability to get off the floor was thought to be behavioural and considered there was no imminent risk of deterioration.
14. The paramedics did not check Caleb's blood sugar level (BSL) as part of their assessment. Both paramedics thought their observations were consistent with Dr Kringsman's diagnosis of an upper respiratory tract infection. Ms Hong mentioned that she had intended to take Caleb to the ED and said that she thought he still needed to go there because he remained extremely pale. According to Ms Hong, the paramedics said that as Caleb was suffering from a virus, the hospital could do little to help him. It was their opinion that he needed bed rest, to continue his antibiotics, and that a possible appointment with his doctor in the morning was warranted. Paramedics left the home at 7.16pm.

15. Ms Hong stated that she still felt apprehensive about her son's condition and remained concerned that paramedics had not taken him to hospital. She later contacted her mother to share her concerns and she came over and agreed that something was wrong with Caleb and suggested she contact an out-of-hours doctor service.
16. Caleb was still unable to move and complained of a burning sensation in his groin. He told her that he felt like he needed to urinate but when he tried, nothing was produced. Ms Hong continued to monitor her son throughout the evening.
17. Sometime around midnight, Ms Hong noted that Caleb's breathing had changed and was now very fast and shallow. His gaze appeared glassy and vacant and his skin felt cold to the touch.

Call to the National Home Doctor Service (12.27am 28 May 2015)

18. At 12.27am, Ms Hong telephoned the National Home Doctor Service (NHDS) and requested an after-hours home visit. She informed the operator that she had called an ambulance earlier, but they had not been much help. Ms Hong said that Caleb had been vomiting since 22 May 2015, had a very infected throat, was extraordinarily pale and was breathing very quickly. She recounted her efforts to get Caleb up to take him to the ED before paramedics arrived and said that he had just checked on him, and he was lying in bed with his eyes wide and vacant, was pale and was breathing fast. The operator recorded that Caleb had vomiting, had an infected throat and was pale. No mention was made of his respiratory rate. As an alternative contact number was being ascertained, Ms Hong said, *"but he is very non-responsive, when I've tried to talk, you know..."*.
19. Ms Hong stated that she was told that the doctor could be a while and a they could not provide a timeframe for the doctor's arrival. Her recollection was that she was not advised to contact an ambulance however in a statement from the NHDS, the operator suggested that Ms Hong should call for an ambulance if Caleb deteriorated, and that a doctor would come when one was available. NHDS operators are not medically trained and this information was relayed to Ms Hong during the phone call.
20. The training policy for operators at the time of Caleb's death consisted of them watching a triage video upon commencement of their employment, which detailed the items on the triage protocol and various scenarios of when to book and when not to book in an appointment with a doctor.
21. The NHDS 'Prioritisation of Patients: A guide to urgency for non-clinical staff' (priority triage) protocol is in the form of a flow chart that designates a caller's concern to either Category One, where the operator advises the caller to telephone 000 immediately, or

Category Two, where the operator must tell the caller to attend an ED immediately. Category One symptoms include difficulty breathing/trouble talking and an altered level of consciousness or collapse. The triage protocol states that as callers are asked to give symptoms, the second step in the call process is for the operator to be alert for any symptoms that are tabled in the priority protocol. Operators can transfer callers to 000.

22. Ms Hong's comments that Caleb was breathing fast and was very non-responsive ought to have triggered the operator to advise her to contact 000 straight away in accordance with the triage protocol. However, it is apparent that the operator who took Ms Hong's call did not appreciate the gravity of the symptoms listed within the context of the triage protocol, nor did they document all the symptoms Ms Hong states she reported. Critically, the report of an altered respiratory rate was apparently either ignored or simply missed. Thus, this was a missed opportunity for reassessment by paramedics and possible transportation to hospital.
23. The NHDS's current process³ at induction is two, four-hour interactive training sessions run by their National Training and Development Manager that goes through all triage related policies and procedures as well as numerous triage scenarios. Operators are then 'buddied up' with a senior operator for up to three shifts before operating on their own. Senior support is available on every shift. Compliance is maintained via mechanisms such as frequent and continuous testing of operator understanding of the triage protocol and monthly sample reviews of individual operator calls.
24. The NHDS triage system at the time of the call was for operators to dispatch bookings to doctors in small batches based on the doctor's location. The operator dispatched a doctor to Caleb at about 3am. Now, all bookings are dispatched to doctors shortly after they are made.
25. Following the phone call to the NHDS, Ms Hong started monitoring Caleb at five-minute intervals. When Ms Hong checked on Caleb at 1.20am, he was not breathing, and she immediately called 000.
26. The first responders were a Melbourne Fire Brigade crew who immediately commenced cardiopulmonary resuscitation (CPR). At 1.26am, a Mobile Intensive Care Ambulance paramedic arrived and immediately took over the CPR. Resuscitation attempts were continued for about 45 minutes, but Caleb could not be revived.

³ That is as at the date of Caleb's death.

Medical Cause of Death

27. Senior Forensic Pathologist, Dr Michael Burke of the Victorian Institute of Forensic Medicine performed an autopsy and reviewed the circumstances of the death as reported by police to the coroner and post-mortem computer assisted tomography scans of the whole body (PMCT).
28. Dr Burke found natural disease in the form of a moderate to severe fatty liver and no evidence of any injury that would have caused or contributed to death. There was no macroscopic evidence of heart disease, no suggestion of cardiomyopathy, and no evidence of myocarditis. The examination also showed that there was no evidence of meningitis or encephalitis, and no haemorrhage within the adrenal glands to suggest fulminant meningococcal disease. There was no evidence of acute epiglottitis, glomerulonephritis or pancreatitis either.
29. Routine toxicological analysis of post-mortem samples detected acetone at a level of ~390mg/L in blood and ~315mg/L in vitreous humour,⁴ along with glucose at a concentration level of ~42mmol/L in vitreous humour,⁵ and pholcodine at a level of ~0.1mg/L in blood.⁶
30. Dr Burke considered that the vitreous glucose level of ~42mmol/L and raised acetone of ~390mg/L supported a finding of *diabetic ketoacidosis* as the medical cause of Caleb's death. He concluded that based on the known history, this indicated that Caleb suffered from previously undiagnosed diabetes.

Coroners Prevention Unit/Health and Medical Investigation Team

31. I asked the Court's Health and Medical Investigation Team (HMIT),⁷ within the Coroners Prevention Unit, to review the circumstances in which Caleb died and to assess the adequacy of the clinical management and care provided to him in relation to his last illness and to assist me in determining whether his death was preventable.
32. The HMIT did so based on the records available to the Court including Caleb's medical records from AV, Dr Krigsman and the Greater Knox Family Practice in Boronia, The Children's Private Medical Group and Monash Medical Centre. During their review, the HMIT requested and were provided with statements from Dr Stephen Rashford, Medical

⁴ Acetone is an endogenous substance that is produced in humans. Normal levels of acetone are up to 10mg/L. Acetone concentrations are markedly elevated during fasting. In diabetic ketoacidosis the level may range from 100 to 700mg/L.

⁵ Glucose concentrations in vitreous humour that are greater than 11mmol/L may be indicative of hyperglycaemia (high blood sugar levels in the blood).

⁶ Pholcodine is an opioid chemically related to morphine. It is a cough suppressant and has a mild sedative effect.

⁷ The HMIT is a specialist service within the Court comprising of highly skilled and experienced investigators, researchers and health care clinicians, independent of the health practitioners or institutions involved in the clinical management and care provided to the deceased. The HMIT provides advice to Coroners and assists them to fulfil their prevention role by contributing to a reduction in the number of preventable deaths.

Director of the Queensland Ambulance Service (QAS) and Dr John Welch, Staff Specialist in the Paediatric and Endocrinology Department at Monash Medical Centre.

33. After review of all the material, the HMIT concluded that Dr Krigsman's diagnosis of pharyngitis seemed to be a reasonable formulation. The advised that the indolent clinical presentation of diabetes mellitus, particularly type 1 diabetes mellitus (T1DM), often results in it mimicking an infectious process in the early stages. The history of decreased appetite for almost a week associated with an acute deterioration over the weekend is unlikely to have triggered consideration for diabetes as a possible diagnosis. As such, the assessment and management of Caleb during his appointment on 25 May 2015 seemed appropriate.
34. A blood sugar level was not necessarily indicated on the first presentation of the paramedics. However, it appears that their assessment was inadequate, with the paramedics not recognising the significance of multiple vital sign abnormalities and misdiagnosing Caleb with anxiety and a respiratory tract infection without an adequate assessment to confirm or exclude these diagnoses.
35. When seen by the first paramedic crew, Caleb presented with an undifferentiated illness that resulted in a raised heart rate, raised respiratory rate and clinical signs of dehydration. Despite some reduction in heart rate to within normal limits, Caleb's respiratory rate remained abnormal high and concerning until paramedics left the residence.
36. During my investigation I received medico-legal reports from Professor Stephen Bernard on behalf of AV, and Professor Hugh Grantham and Dr David Eddey who provided statements on behalf of Ms Hong. Ms Hong and AV also made submissions through their legal representatives.

What is diabetic ketoacidosis?

37. Diabetic ketoacidosis (DKA) occurs when there is no insulin produced in the pancreas and is associated with Type I diabetes. In this form of diabetes, the pancreas stops producing insulin, which is necessary for glucose to enter the cells of the body. Glucose levels in the blood rise but because glucose cannot cross into the cells, it cannot be used as an energy source. The alternative source of energy used as fuel comes from the breakdown of triglycerides producing fatty acids and ketones. A person breaking down fat will therefore have acids and ketones in their system. DKA has effects on a wide range of physiological functions including the heart and it can cause cardiac arrest.
38. The body's response to DKA includes an increase in respiratory rate and depth to remove carbon dioxide and acid from the system (known as Kussmaul breathing). Acetone is also


released in the breath, which produces a distinctive smell, but not all the population can detect it. Dr Welch could not say with certainty whether Caleb's tachypnoea was Kussmaul breathing but considering how unwell he must have been, it seems likely. He commented that Kussmaul breathing can be difficult to identify if it has not been seen before.

39. A further complication associated with high sugar levels is dehydration. This occurs when the kidney is unable to retain all the sugar passing through, leaving some in the urine, which draws water into the urine due to osmosis. The result of this mechanism is that a diabetic patient loses a large amount of urine and incidentally loses critical electrolytes in the process. Disruption of the normal potassium levels (one of the more important electrolytes involved in cardiac function), occurs not only to the increased urine loss but also due to a reduction of potassium entering cells. Glucose is normally accompanied by potassium when it enters the cell under the action of insulin.
40. With respect to the notes made by the paramedics that Caleb did not appear to be dehydrated, Dr Stephen Rashford considered it highly unlikely that Caleb was not dehydrated at the time of the first attendance since he suffered a cardiac arrest a mere six hours later. Cerebral agitation and coma are very late signs of dehydration and a patient can be completely awake and still be significantly dehydrated. Dr Rashford thought this was certainly the case at the time of the first assessment.
41. Dr Welch commented that dehydration can be difficult to assess and studies have shown that dehydration in DKA is particularly hard to identify using standard measures. Caleb would have been in DKA at the time of the first attendance, and possibly for days previously as the process is not swift.

Response by Ambulance Victoria

42. Professor Stephen Barnard provided a response on behalf of AV. He stated that the rationale for not transporting Caleb to an ED was underpinned by certain clinical factors. Those factors comprised a normal blood pressure, pulse and oxygen saturation levels, the fact that Caleb had already started antibiotics and Ms Hong agreed that she would take Caleb to the doctor in the morning, and that Caleb's observations improved somewhat following reassurance with paramedics.
43. AV have a Clinical Practice Guideline (CPG) in relation to assessment of a patient with tachypnoea and/or tachycardia. CPG A0103 – Respiratory Assessment classifies a respiratory rate of over 20 breaths per minute as moderate or severe distress, which must be understood with CPG A0102 – Perfusion assessment and CPG A0403 – Tachyarrhythmias.

44. According to Professor Grantham, Caleb's raised respiratory rate at 40 BPM alone should have precipitated an emergency response. Similarly, when it decreased to 24 BPM, that was still abnormal and ought to have elicited enquiries as to what was causing it. Even if the examination and history failed to arrive at an appropriate diagnosis, Caleb's persistent raised respiratory rate should probably have prompted transfer to hospital for further assessment.
45. Dr Rashford agreed with Professor Grantham. A respiratory rate of 40 BPM should be a red flag for any attending clinician, and a reduction to 24 BPM is still very abnormal for a male Caleb's age in whom a respiratory rate of 12 to 16 BPM would be considered normal.
46. The records also documented that during the first AV attendance, Caleb was anxious and began to hyperventilate and complained that he could not get up from the floor. Professor Grantham interpreted this as Caleb becoming severely acidotic and weak, which is associated with poor perfusion and ketoacidosis.
47. At the time of Caleb's presentation, AV did not have a clinical guideline about situation when a paramedic elects not to transport a patient to hospital. Professor Barnard commented that it is common for paramedics not to transport a patient to hospital after the initial assessment. In the absence of a clinical guideline, paramedics were to rely on their clinical judgment and any CPG's relevant to the circumstances. However, a CPG has now been developed and deployed.
48. Professor Grantham commented that AV paramedics would have had the tools to take a blood sugar level (BSL) at the time they attended Caleb. CPG A0101 – Clinical Approach is the CPG paramedics use to systematically assess all patients and to determine priorities of management. This includes a primary survey and/or life threat status, vital signs survey and a secondary survey of the patient. A blood glucose is measured *if required* but is not a mandated investigation. It is primarily used during assessment of a diabetic patient when hypoglycaemia is suspected and in accordance with CPG A0702, is the only instance when a BSL would be taken.
49. Dr Rashford disagreed with Professor Barnard's contention that there was no clinical indication to undertake a BSL as Caleb did not have a history of diabetes. He considered that although it may have been within the AV guidelines to be selective about when a BSL is taken, many other ambulance services would encourage a more liberal application, particularly when an undifferentiated illness is evident. Taking a BSL is a minimally intrusive and accessible test that can be performed within 60 seconds and, according to Dr Rashford, is considered part of a standard vital signs survey, which most paramedics will undertake should there be an indication to do so.

50. Dr Welch identified several factors that likely had some bearing on why a diagnosis of diabetes was not made. The symptoms of lethargy and vomiting can be quite nonspecific, and it is common for children to be diagnosed with an upper respiratory infection in the days or weeks prior to diagnosis. Unless the symptoms of lethargy and increased thirst are volunteered or asked about, they may be overlooked. Caleb was a 17-year-old teenager who was responsible for his own personal care and accordingly Ms Hong as his caregiver may not have been aware of those symptoms. Dr Welch also commented that weight loss is often seen at diagnosis, but Caleb was obese, which would make it more difficult to recognise a reduction in weight and could have been a clue to paramedics about a possible diagnosis.
51. AV conducted a review of Caleb's death and made several recommendations for improvement including the implementation of the 'Clinical Flags' assessment tool into the CPG's and to investigate the value or otherwise of mandated triggers for taking BSL. 
52. The revised clinical approach CPG includes advice to paramedics to discuss alternative options for what may be causing the presenting signs and symptoms other than their main hypothesis. This strategy can help avoid a confirmation bias where the collection of clinical evidence and thought process is tainted by the initial diagnosis.
53. CPG A0107 – Clinical Flags has been developed by AV to expand upon the initial clinical approach and highlights patients at risk. Any patient designated a 'red flag' would immediately be taken to hospital and any 'yellow flag' patients would undergo a thorough assessment before any decision not to transport to hospital. Red flags incorporate those patients with abnormal vital signs and yellow flags those with mental health symptoms.
54. Following Caleb's death, the paramedics who attended in the first instance underwent an internal AV clinical education program, with specific attention paid to the CPGs that concerned the AV Clinical Approach, Inadequate Perfusion Non-Cardiogenic/Non Hypovolaemia, Hypovolaemia (Dehydration), and Meningococcal Septicaemia.
55. With the benefit of hindsight, including the knowledge of the final diagnosis of DKA, AV acknowledged that it would have been appropriate to transfer Caleb to hospital at the time of the first presentation. However, they considered that there was no clear evidence available to the paramedics (who are not specialist physicians) that Caleb would have benefited from review in a hospital emergency setting.
56. Professor Barnard commented that paramedics were faced with an abnormal respiratory rate in isolation to other symptoms (which improved) with no other clear diagnostic clinical signs in the setting of normal oxygen levels. A complete list of medical causes of hyperventilation

might not be well known to paramedics since they relate to rare conditions in Caleb's age group. Further, acute DKA in a juvenile with no history of diabetes is not something that many paramedics would see in their career. In contrast, many paramedics are often faced with anxious teenagers with anxiety that sometimes manifests as physical symptoms such as an elevated heart rate, tingling in the extremities and/or mobility problems.

57. In Dr Rashford's experience, recent clinical review by a physician is often a common reason for why paramedics do not transport a patient to hospital. Rather than asking why a patient still needs the urgent attention of paramedics, attending crews appear to be reassured that a medical officer has recently assessed the patient and made a diagnosis. In fact, the opposite is true. Conversely, the fact that a patient who has already been assessed by a clinician seeks AV assistance should raise a red flag.
58. In this case, there was a heavy emphasis on the diagnosis of hyperventilation syndrome but there are many significant illnesses that are characterised by a rapid respiratory rate and it is important to exclude those illnesses as part of the presentation. Dr Rashford commented that it is reflective upon general paramedic training that this point is not widely understood, with the diagnosis of acute anxiety and secondary tachypnoea being made without consideration of a wider diagnosis.

Should a blood sugar level have been taken?

59. Following concerns in relation to the significant risk posed when an undifferentiated illness with a raised respiratory rate is present, the Queensland Ambulance Service (QAS) conducted further paramedic training. Their hyperventilation CPG stipulates that the diagnosis of acute anxiety in an undifferentiated patient should be one of exclusion. The QAS diagnostic guidelines reference DKA and BSL testing is standard procedure.
60. QAS paramedics are to consider taking a BSL in most patients who present as acutely unwell, particularly those with an undifferentiated illness. It is not an opt-in process. Dr Rashford accepted Professor Barnard's opinion that there was no history to suggest diabetes or treatment with insulin but commented that it is important to create systems whereby occult illnesses are diagnosed in a setting where practitioners with a variable level of training and experience attend undifferentiated presentations. Further, when the preliminary decision is made to not transport a patient to hospital, all avenues of assessment should be exercised first before the final decision.
61. Paramedics face the difficult task of seeing a high number of patients who may or may not need an admission to an ED. They are not experienced physicians and largely have a more

superficial knowledge base than the doctors in the hospitals to which they transport patients. Patients with undifferentiated illnesses represent a significant challenge to ambulance services worldwide. This is because the background training has concentrated on the treatment of acute, discrete clinical presentations rather than undifferentiated illness. Accordingly, the work that has been conducted by AV to inform its workforce of potential flags to identify underlying occult illnesses is commendable.

62. But ultimately, the onus is on health frameworks to install systems to ensure patient safety. It was the opinion of Dr Rashford that an emphasis on taking a complete set of vital signs ought to be mandatory in most circumstances. The discretion not to take a BSL remains with the paramedic if they feel there is no reason to take one. But Dr Rashford maintained that in a setting of unexplained tachypnoea, a BSL should have been taken.

Would Caleb have likely been diagnosed with diabetic ketoacidosis in the ED?

63. Professor Barnard considered that it was unknown whether transfer to hospital would have averted Caleb's death.
64. Dr Welch could not say with certainty whether Caleb would have survived if he had been immediately transported to an ED but commented that if he had made it to an ED and the diagnosis made, there was a chance he would have lived. In his eight years of experience working paediatric endocrinology, no child that presented to hospital died because of DKA.
65. Dr Rashford could not give a definitive opinion as to whether Caleb would have survived but did note that Dr Burke did not find any underlying significant illness to precipitate Caleb's presentation apart from a low-grade respiratory infection. Accordingly, it is most likely that with the appropriate early diagnosis and care, Caleb's DKA would have been treated successfully in hospital.
66. Dr Eddey, ED Staff Specialist in Emergency Medicine at Geelong Hospital, considered that Caleb's constellation of symptoms and signs would have quickly led attending medical staff to suspect a serious illness. It is unlikely that a diagnosis of DKA would have been made on admission to hospital by the triage nurse, but Dr Eddey would have anticipated that Caleb's abnormal observations and other history would have elicited a triage category of appropriate urgency (Category 2 – to be seen within ten minutes of arrival) in recognition of how unwell he was.
67. Basic blood tests including a full blood examination, urea and electrolytes and a blood glucose level and blood gases would have been taken as well as measurement of serum osmolality. An electrocardiogram (ECG) would have been performed to detect a cardiac arrhythmia or

changes to electrolyte disturbances, and other investigations of underlying causes as determined by the clinical history and examination, such as an x-ray and cultures. Critically, a urine test to check for infection and the underlying presence of glucose, ketones and protein would have been performed.

68. Dr Eddey commented that DKA is a relatively common emergency in EDs and general hospitals. It ranges in severity from mild to life threatening but in general it would be rare in the community for an otherwise fit and well young person to die from DKA if treated in a timely fashion. Dr Eddey would have expected medical staff to arrive at a diagnosis of DKA in a new diabetic relatively quickly and, absent any other lethal condition such as severe sepsis, Caleb would likely have survived.
69. He also commented that one would not expect a paramedic to possess the diagnostic skills to diagnose DKA in an otherwise well, young patient. However, the presence of a significantly elevated respiratory rate of 24 to 40 BPM warranted taking Caleb to hospital for urgent medical assessment. Indeed, the Ambulance Victoria Clinical Practice Guidelines would classify a respiratory rate of 24 to 40 BPM as severe respiratory distress requiring transportation to hospital in accordance with the time critical guidelines.

Findings

70. At a Mention Hearing held on 8 June 2017, all of the interested parties agreed or conceded that Caleb's presentation when the first AV paramedic crew attended should have triggered transport to hospital for further investigation. In terms of the preventability of Caleb's death, Counsel for AV submitted that it is unknown when Caleb became acidotic.
71. The standard of proof that applies in the coronial jurisdiction is the civil standard of proof on the balance of probabilities. Having applied that standard to the available evidence and submission from all interested parties, I find that –
 - a. The medical cause of Caleb's death was diabetic ketoacidosis and that he was an undiagnosed diabetic when he died.
 - b. Caleb's death was preventable in the sense that transportation to hospital by the first attending AV paramedic crew was indicated and that, if he had been taken to a hospital emergency department, it is likely that he would have been diagnosed with diabetic ketoacidosis and the appropriate treatment would have been initiated and his death prevented.

Comments

Pursuant to section 67(3) of the **Coroners Act 2008**, I make the following comments in connection with the death:

72. This case highlights issues associated with paramedics' scope of practice. The training of paramedics concentrates on the recognition and treatment of discrete acute clinical presentations and not the diagnosis of undifferentiated illness which poses a significant challenge to ambulance services worldwide when it is a core competency for emergency physicians.
73. Paramedics are not diagnosticians and as appeared to have occurred in this case, they were erroneously and fatally reassured by Caleb's mental health history and recent attendance at his GP and ignored concerning vital signs that warranted transportation to hospital and access to urgent medical attention.
74. Ambulance Victoria have reviewed Caleb's case in depth and attempted to institute systems to create an even higher level of patient safety within their service.⁸ I acknowledge that AV have now implemented a "Clinical Flags" assessment tool which provides a prescriptive approach regarding which patients must be transferred to hospital.⁹

Recommendation

Pursuant to section 73(2) of the **Coroners Act 2008**, I make the following recommendation in connection with the death:

75. I recommend that Ambulance Victoria considers a change to their Clinical Practice Guidelines to require paramedics to measure the blood glucose level of any patient they are treating who presents as acutely unwell and, in particular, in the setting of an undifferentiated illness.

Publication of finding

Pursuant to section 73(1A) of the Act, I order the publication of the finding, comments and recommendation above on the Internet in accordance with the rules.

⁸ AV have now adopted a 'Revised Clinical Approach Clinical Practice Guideline (CPG)' that uses a Clinical Flags CPG.

⁹ A 'Red Flag' indicates a patient cohort or clinical criteria which should be managed with a heightened degree of concern due either risk of deterioration or likelihood of AV re-attendance if an adequate care plan is not implemented. A 'Yellow Flag' indicates a patient cohort which is known to provide difficulties with assessment in the prehospital content, or contains a risk (possibly unrelated to their main presenting problem) due to significant factors in their medical history.

Distribution of finding

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

The Family of Caleb Pearson, c/o Ms Paula Pulitano, Slater and Gordon Lawyers

Dr John Welch, Monash Medical Centre

Dr Stephen Rashford, Queensland Ambulance Service

Ms Rani Kulkarni, K&L Gates

Ms Amie Herdman, Coronial Lead, Ambulance Victoria

Signature:



PARESA ANTONIADIS SPANOS

CORONER

Date: 1 August 2019

Cc: Manager, Coroners Prevention Unit