QUEENSLAND COURTS

CORONERS COURT OF QUEENSLAND

FINDINGS OF INVESTIGATION

CITATION:	**Non-inquest findings into the death of HK, a five year old boy**
TITLE OF COURT:	Coroners Court
JURISDICTION:	BRISBANE
DATE:	28/10/2024
FILE NO(s):	2022/2354
FINDINGS OF:	Ainslie Kirkegaard, Coroner
CATCHWORDS:	CORONERS: Child death; multiple clinical presentations; metropolitan public hospital emergency department; Influenza A; bacterial co-infection; paediatric sepsis; Queensland Paediatric Sepsis Pathway; Children's Early Warning Tool (CEWT)

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Background

1. HK is a five-year-old boy who died at a metropolitan public hospital emergency department on 23 May 2022.

2. His death was reported to the coroner because the cause of his sudden unexpected death was unknown.

3. These findings are informed by review of HK's patient records, information provided by his parents, autopsy findings, the outcomes of internal clinical review undertaken by the relevant Hospital & Health Service, and independent paediatric infectious diseases physician opinion provided by Associate Professor Adam Irwin from the Queensland Children's Hospital. A/Professor Irwin has been the medical co-lead of the Queensland Paediatric Sepsis Program since 2020. Since 2018, he has been a conjoint Senior Lecturer and Senior Medical Office in paediatric infectious diseases at The University of Queensland (UQ) and Queensland Children's Hospital and lead of the Queensland Paediatric Infectious Diseases Research Group. A/Professor Irwin has a particular interest and expertise in the recognition and management of serious infections and sepsis, regularly providing expert advice to treating clinicians, expert review of clinical incidents relating to serious infections and sepsis at Queensland Children's Hospital and other hospitals in Queensland and regularly provides teaching to clinical teams in the Paediatric Emergency Department and Paediatric Intensive Care Units and to undergraduate students on the recognition and management of serious infections and sepsis in children.

HK's medical history

4. HK's medical records show he had a history of reactive airways disease, dust mite allergy, and previous episodes of ear infection in 2018 and 2019. He was taking regular prescription medication including Ventolin, antihistamine, and steroid nasal spray. His scheduled immunisations were up to date.

Events of May 2022 leading up to HK's presentations to the metropolitan public hospital emergency department

5. HK developed a wheezy chest on the morning of Wednesday, 18 May 2022. His father took him to a local medical practice where he was seen by GP1. On examination, HK felt warm but was afebrile and looked comfortable. His throat was inflamed. Chest auscultation noted a mild wheeze. His abdomen was soft and non-tender. No vital signs are documented. GP1 advised HK's father to use Ventolin via nebulizer and told him to take HK to the emergency department if necessary. He provided HK's father with a medical certificate for 18 and 19 May 2022.

6. HK remained unwell with fevers, cough, runny nose, and sore throat. His father took him to a different medical practice on Friday 20 May 2022, where he was seen by GP2. HK's temperature was 36.4C. Chest auscultation noted normal air entry, no crepitations, and no rhonchi. His ears examined as normal with no redness or discharge or glue ear. He had nasal discharge from both nostrils, but his nasal mucosa was normal. His throat was not red, his tonsils were not enlarged and there was no pus on his tonsils. GP2 diagnosed allergic rhinitis and recommended that HK rest. His father was given a prescription for HK's antihistamine.

7. HK's father says he asked the doctor whether he was going to prescribe antibiotics, but the doctor said no, HK looked okay and for them to use Panadol and Nurofen.

Expert review and opinion on the adequacy of GP care

8. A/Professor Irwin reviewed the HK's GP records noting they suggest a history of reactive airways disease and self-limiting illnesses typical of pre-school aged children. While there were frequent primary care presentations which prompted antibiotic prescriptions, A/Professor Irwin considers this was within the range of normal. He considers there is nothing in the documented medical history to suggest severe asthma or other respiratory pathology or predisposition to severe infection.

9. Despite limited documentation, A/Professor Irwin considers the assessment made by GP1 on 18

May 2022 appears appropriate, and there is reference to safety netting given to the family. By comparison, the review provided by GP2 on 20 May 2022 was more detailed. A/Professor Irwin considers the diagnosis of allergic rhinitis was mistaken but does not believe this had any material impact on HK's care. In his opinion, a more plausible diagnosis would have been a viral respiratory infection for which supportive care and safety netting would have been appropriate.

10. In summary, A/Professor Irwin considers the GP care appeared appropriate.

HK's first presentation to the metropolitan public hospital emergency department – 22 May 2022

11. HK's mother took him to the local metropolitan public hospital emergency department on Sunday 22 May 2022, arriving there at around 5:10pm. She is a nurse. She decided HK needed to go to hospital because his face, hands and feet were very cold. The triage nurse noted a history of fever, one vomit earlier in the day, reduced fluid intake and abdominal pain. HK was triaged as Category 3. He was examined by a junior doctor Dr M at around 5:51pm in the children's emergency department. Dr M was being supervised by a consultant paediatric emergency physician Dr B, who was also Deputy Director of Emergency Medicine (Paediatrics). HK's mother described a seven-day history of daily fevers, which settled with paracetamol and Nurofen, and reduced oral intake over the past few days with HK refusing most solids. He had developed periumbilical abdominal pain since Thursday, 19 May 2022 and had a large vomit that afternoon and another large vomit while in the emergency department. He had not had any diarrhoea. Dr M noted HK did not have any cough, rhinorrhea, or sore throat. His mother was not sure when he last opened his bowels and was unsure about his urine output. She had tested him twice with a rapid antigen test and he was negative for COVID-19 both times. No one else in the family was unwell.

12. HK's vital signs were recorded as temperature 35.9C, blood pressure 98/68, pulse rate 113, oxygen saturations 100% on room air and respiratory rate 22 breaths per minute, all within normal limits for his age. On examination, HK was noted to be lying in bed, looking miserable but alert, interactive and neurologically intact. He was pink and well perfused but pale. His capillary refill time was less than two seconds. There was no increased work of breathing, his chest was clear. His abdomen was soft with some periumbilical tenderness but no guarding or peritonism and no rebound tenderness. There were active bowel sounds. His ears and throat were normal. His blood sugar level (9.3) and ketones (0.5) were normal.

13. Dr M discussed HK's presentation with Dr B who also visualised HK. Dr B felt HK's symptoms were most likely explained by a viral respiratory infection with associated mesenteric adenitis. Given the seven-day fever history and abdominal pain with no peritonism, Dr B requested chest-ray to exclude pneumonia.

14. In his subsequent statement, Dr B recalls that HK appeared to be moving comfortably and had a normal gait.

15. HK was observed in the Short Stay Unit while he continued to trial oral fluids. He was noted to be settled. His vital signs taken at around 7:21pm were recorded as temperature 36.3C, blood pressure 98.68, heart rate 149 (elevated), respiratory rate 18 breaths per minute, no increased work of breathing and oxygen saturations 99% on room air. He was alert and well perfused. He was tolerating oral intake.

16. Chest x-ray was reported as normal. The clinical impression was of a viral illness. HK had managed some apple juice and water (150mL) after having some anti-nausea medication and was settled. The observations documented appear to be those taken at 7:21pm. HK was discharged home with his mother at around 9:35pm with advice to return to the emergency department if his condition worsened or he developed further vomiting.

17. The formal chest x-ray report described minor bronchial wall thickening in keeping with minor inflammation of the lower airways that may be acute of chronic in nature. In his subsequent statement, Dr B explains he felt this finding was consistent with a viral respiratory illness though not diagnostic.

Expert review and opinion as to the appropriateness of HK's emergency department management

18. A/Professor Irwin observes HK was triaged promptly on arrival. The full set of clinical observations documented by a nurse are within normal limits for HK's age, there was normal perfusion and no increased work of breathing. There are no features in the patient history given by HK's mother or clinical examination to indicate severe illness, including sepsis. There is no documentation suggesting HK's mother was unusually concerned about his illness episode at this time. Parental concern is a recognised factor in serious illness and sepsis.

19. A/Professor describes documentation of HK's care following the initially reassuring clinical assessment as ambiguous. He observes Dr M's notes combine the assessment at 5:50pm with the latter assessment at around 9:30pm when she discharged HK home with 'worsening advice' regarding further vomiting. These later notes do not update the observations taken at 5:50pm (including the tachycardia documented at 7:21pm). The discharge documentation records the earlier observations. HK was discharged home two hours after the last documented observations. Dr B supported the decision to discharge but these details and the timing of these assessments are left unclear in the patient record.

20. Notwithstanding the ambiguity in the documentation, A/Professor Irwin confirms there is no objective evidence to support the notion that HK developed sepsis in the course of his first presentation to the emergency department. The presence of a single recorded elevated heart rate would not constitute a 'reg flag' for sepsis prompting urgent senior clinician review. A/Professor Irwin identifies adequate documentation indicating the absence of other risk factors and red flags when HK's observations were recorded at 5:50pm and 7:21pm. However, Dr M's progress note, and Dr B's subsequent statement (which refers to 'normal' vital signs) leave open the possibility that the tachycardia was overlooked. Given the purpose of admitting HK to the Short Stay Unit was to observe oral intake and monitor for progression of symptoms, the clinical observations documented at 7:21pm were less reassuring for serious illness than those documented at 7:50pm, raising the question why they were not measured and documented again to support the decision to discharge.

21. A/Professor Irwin notes HK's presentation was that of an acute febrile illness, most likely a respiratory infection despite the absence of localising signs. Acute febrile illnesses are exceedingly common presentations to the children's emergency department; whereas sepsis is uncommon, accounting for less the 1% of undifferentiated children with fever in the emergency department. A/Professor explains that sepsis is a dynamic process which is difficult to differentiate from self-limiting infections in the early stages but may rapidly progress. It is a medical emergency. In Queensland, a failure to recognise sepsis is the leading cause of preventable harm in hospitalised children.

22. A/Professor Irwin emphasises the difficulty of diagnosing sepsis in children with acute infection and stresses the importance of explicitly considering the diagnosis of sepsis in children with acute infections, and the need for regular reassessment. Despite significant research efforts, there is no single diagnostic test nor constellation of features that reliably predicts the later development of sepsis in children. The recognised difficulty in sepsis recognition led to implementation of the Queensland Paediatric Sepsis Pathway and publication of the Australian Commission on Safety and Quality in Healthcare Sepsis Clinical Care Standard in June 2022. The purpose of both these documents is to ensure sepsis is considered in any patient with an acute illness or clinical documentation due to infection, and to ensure timely recognition and management. The Queensland Paediatric Sepsis Pathway was implemented through hospitals in Queensland in 2019. It is designed to prompt screening for risk factors of sepsis and its early recognition using a series of individual red flag signs. The presence of these red flag signs leads to clinical assessment by the most senior clinician available, making this currently the best practice 'test' for the diagnosis of sepsis.

23. A/Professor Irwin observes there is no documented consideration of sepsis in HK's differential diagnosis nor documented use of a sepsis pathway to support the assessment. That said, he does not consider that use of a sepsis pathway would have changed the clinical assessment made by

Dr M at 5:50pm nor would it have prompted an escalation of concern following the vital vitals measured at 7:21pm. However, it may have prompted clearer documentation and repeated clinical assessment prior to discharge. Dr B affirms he actively supervised Dr M's assessment and supported the decision to discharge HK home with safety netting. In the absence of clear documentation, it is not certain that supervision took place in light of all the necessary information i.e., with a more contemporaneous set of clinical observations, and it is not possible to determine the trajectory of the illness course from after the 7:21pm observations to the time of discharge.

24. In relation to safety netting, A/Professor Irwin observes the documentation on this is brief and may not reflect the full conversation with the family, noting the emphasis appears to be on the importance of vomiting. He advises that consideration of the diagnosis of sepsis would also have prompted a discussion of other important features suggestive of sepsis onset and deterioration (such as cold peripheries, difficulty breathing, unexplained pain and drowsiness or confusion). The Queensland Paediatric Sepsis Pathway includes a safety netting checklist for families to take away. A/Professor Irwin does not believe that a different approach to safety netting would have led to a quicker return to the emergency department or a different outcome for HK.

HK's representation to the metropolitan public hospital emergency department – 23 May 2022

25. On arriving home HK was complaining of abdominal pain. They gave him fluids (Up & GO and electrolyte drinks). He had a bite of toast with jam and two sips of Coke, a drink he liked. He was then put to bed but after about half an hour complained of abdominal pain. His parents kept trying to get him to take electrolyte drinks but at around midnight HK asked them to take him to hospital. His father noticed HK's lips were blue.

26. His father tried to phone 000 but they couldn't understand him well so after 43 seconds he hung up and decided to drive HK to hospital himself. HK became unresponsive as his father was putting him in the car. The family drove back to the same metropolitan public hospital emergency department arriving at around 12:38am. HK's father carried him in. He was floppy and quickly recognised as being critically unwell. He was found to be in cardiac arrest (pulseless electrical activity). Emergency resuscitation efforts commenced immediately. His parents described HK as "not making any sound in car" for ten minutes prior to arriving at hospital. Initial venous blood gas showed elevated lactate (20) and pH 6.5. Unfortunately, despite prolonged emergency resuscitation, HK was unable to be revived. His parents were invited to kiss him before CPR was ceased.

27. The family advised that HK's younger brother had been unwell during the week with fever, runny nose, and mild asthma for which he was prescribed antibiotics.

28. Dr B made an entry in the patient record regarding his involvement in HK's presentation the previous evening. This entry provides broader context noting the emergency department was busy with relatively large numbers of children with viral infections with significant numbers of COVID-19, Flu and anecdotally Coxsackie. He described the staffing levels and the skill mix as both relatively good with two Registrars and two resident medical officers minimum for the duration of HK's attendance. Nursing staffing levels were also adequate. Dr B did not think HK's assessment or management were affected by excessive overcrowding at the time of his assessment. The only 'significantly distracting' case in the children's emergency department at that time was a category 1 child who was stablised and retrieved to another hospital.

Expert review and opinion of appropriateness of HK's second emergency department presentation

29. A/Professor Irwin observes that HK represented to hospital in extremis and the resuscitation response was immediate and comprehensive.

Autopsy examination

30. External examination including CT scan noted a well-nourished boy with no obvious significant trauma or skin rashes. Internal examination revealed no obvious congenital abnormalities. There were changes of laryngotracheobronchitis/bronchiolitis, asthma, pleuritis on the diaphragm,

possible early myocarditis and pericarditis, acute hypoxic ischaemic cardiac damage, and a likely recent Influenza A infection. There was no acute abdominal pathology to account for death. The brain was examined by a neuropathologist and confirmed to be normal. Skeletal muscle examination was normal.

31. Biochemical analysis showed mildly elevated glucose (likely reflecting the effects of an infective process), a mildly elevated ketone (3-hydroxybutyrate) possibly related to fasting/reduced oral intake but not at a level indicative of ketoacidosis and mildly elevated urea suggestive of a mild degree of dehydration. Microbiology testing identified *Escherichia coli* in the urine, scant *Staphylococcus aureus* in the left lung and Influenza A in the left (but not the right) lung. Viral testing was otherwise negative. Faecal testing was negative. Metabolic screening was unremarkable. Molecular screening identified no genetic abnormalities. Toxicological analysis detected non-toxic levels of paracetamol and anti-emetic medication. No alcohol or other drugs were detected.

32. Having regard to these findings, the pathologist was unable to determine the cause of HK's death. While there was inflammation in the upper and lower airways (laryngotracheobronchitis/bronchiolitis) against a background history of asthma, there was no evidence of acute airway obstruction by mucus plugs or established pneumonia. The heart showed mild chronic inflammation on the epicardial surface but no fibrin or acute inflammation, and mild chronic inflammatory infiltrate within the myocardium which the pathologist advised may represent early pericarditis and myocarditis respectively. The subendocardial myocardial injury (in a pattern in keeping with hypoxic ischaemic damage) was acute and occurred around the time of HK's collapse. The changes on the diaphragm were suggestive of recent pleuritis. The detection of Influenza A RNA in only one lung was favoured to represent a recent but resolving influenza illness. The pathologist explained that *Staphylococcus aureus* is an organism which can be associated with post-influenza infections, but its significance is uncertain given it was scant and there was no obvious bacterial pneumonia. The finding of *Escherichia coli* in the urine may reflect a urinary tract infection but was of uncertain significance given the absence of inflammation in the bladder. In the absence of abdominal pathology, HK's abdominal pain may have been due to mesenteric adenitis, inflammatory changes in the lungs, diaphragm or liver, urinary tract infection or it may have been cardiac in nature.

33. Lipid within the liver, heart and kidney cells is non-specific and may relate to the acute illness but raises the possibility of a metabolic storage disorder.

34. Overall, the pathologist considered the reactive and inflammatory changes in the airways and other organs support the likelihood an infective/inflammatory cause for death, but the autopsy findings alone were insufficient to confidently provide a final diagnosis of sepsis/septic shock. There were findings at autopsy that raised other possible underlying factors that may have made HK more susceptible to an adverse outcome from infection (such as a metabolic disorder) that autopsy could not entirely exclude. The pathologist suggested it was possible HK developed bacterial sepsis or was developing myocarditis on a background of recent viral illness, with rapid clinical deterioration.

35. While autopsy testing did not identify any obvious metabolic or genetic abnormalities, the presence of lipid within the liver, heart and kidney cells raises the possibility of a metabolic storage disorder. I note the pathologist's recommendation that for this reason, immediate family members seek medical advice regarding genetic counselling and screening.

36. A/Professor Irwin considered the autopsy findings, noting the presence of Influenza A virus on a respiratory sample. Considering this in the context of the documented course of HK's presenting illness, Dr Irwin considers it probable that the cause of HK's death was infection leading to septic shock, precipitated by Influenza A likely in association with a secondary bacterial infection (either *Staphylococcus aureus* or *Group A Streptococcus*). Sepsis is a syndrome of life threatening organ dysfunction caused by a dysregulated immune response to infection. Septic shock is the most severe form of illness associated with an approximately 20% risk of death in children.

37. His opinion is based on the description of HK's presenting illness in terms of a respiratory infection ("wheezy chest" with an "inflamed throat" documented by the GP on 18 May 2022) associated with fever (the duration of which is unclear but for up to seven days before HK's presentation to the

metropolitan public hospital emergency department on 22 May 2022), abdominal pain and vomiting. A/Professor Irwin explains that invasive bacterial infections secondary to or in co-infection with Influenza virus are well recognised and associated with poor outcomes. A/Professor Irwin identifies *Staphylococcus aureus* (also identified at autopsy) as an important bacterial cause of invasive infections in association with Influenza virus, though considered another important bacterial pathogen, Group A Streptococcus to be as likely the causative bacterial pathogen despite its absence from the autopsy findings. This is because in 2022, there was an increase in rates of invasive *Group A Streptococcus* (iGAS) infection in children reported in numerous countries worldwide, including in Australia. More than 30% of Australian children with iGAS required admission to Intensive Care, and this risk was approximately doubled in the presence of viral co-infection. Though deaths were relatively uncommon in Australian children, mortality in UK children with iGAS was 7%. A/Professor Irwin does not think the finding of *Escherichia coli* at autopsy is a likely contributor to HK's fatal illness. In previously healthy children, it is highly unlikely to cause such as fulminant illness, nor is it a plausible respiratory co-pathogen with Influenza virus.

38. The pathologist considered A/Professor Irwin's opinion, advising that given the presence of Influenza A RNA, a secondary bacterial infection complicating an Influenza A infection is a possibility. She agreed with A/Professor Irwin that absence of an organism on culture (such as Streptococcus) does not exclude it as a causative organism. She would consider A/Professor Irwin's probable cause of death as septic shock to be a likely possibility.

39. I have carefully considered the autopsy findings in conjunction with specialist paediatric infectious physician input in the context of the documented clinical course of HK's illness. The available information supports a finding that HK probably died from septic shock due to Influenza A infection and bacterial co-infection with *Staphylococcus aureus* or Group A Streptococcus.

Hospital & Health Service (HHS) clinical review outcomes

40. The relevant HHS commissioned a Root Cause Analysis (RCA) of the care HK received from the metropolitan public hospital emergency department. This is a systemic analysis of what happened and why and is designed to make recommendations to prevent adverse health outcomes from happening again, rather than to apportion blame or determine liability or investigate an individual clinician's professional competence. It is conducted by a review team who had no involvement in the patient's care.

41. I note the RCA was undertaken without the benefit of the autopsy findings or A/Professor Irwin's opinion.

42. The RCA team identified that HK presented on 22 May 2022 with common symptoms that could be caused by a wide range of conditions but felt the clinical investigations and management were appropriate. It was noted HK's mother did not feel she could express her concerns in a way that was respectfully considered. The RCA team observed that all patients, especially those from culturally and linguistically diverse backgrounds would benefit from being specifically asked if they feel safe being discharged and if their concerns have been addressed.

43. The RCA team was satisfied Dr B's oversight of HK's clinical examination and involvement in the clinical decision making was consistent with the expected standard of health care provision.

44. The elevated heart rate (149 beats per minute) recorded at 7:21pm was noted to have increased the Children's Early Warning Tool (CEWT) score to 1. All the other observations were within normal limits. It is not known whether the CEWT score of 1 was escalated as required by the CEWT actions. No repeat observations were completed while HK remained in the Short Stay Unit, nor were any completed prior to him being discharged home. The RCA team identified this as a learning opportunity, considering it reasonable to expect that observations in the children's Short Stay Unit be completed hourly at a minimum including within one hour of discharge (unless otherwise specified by a medical officer), and that abnormal observations be responded to according to the relevant CEWT score action.

45. The RCA confirmed that the emergency department was experiencing a higher than usual level of activity that evening with a proportionately larger number of paediatric presentations than usual,

including the child who required retrieval, who was being treated in the resuscitation room, some distance from the paediatric emergency department requiring input from Dr B who was responsible for overseeing the children's emergency department on that shift.

46. The RCA team did not make any recommendations.

Findings required by s.45

Identity of the deceased – [deidentified]

How he died –

I find that HK probably died from septic shock as a complication of Influenza A infection and bacterial co-infection with *Staphylococcus aureus* or Group A Streptococcus. I accept independent specialist paediatric infectious diseases physician opinion that HK presented to two different general practitioners with symptoms of viral respiratory infection for which supportive cares and safety netting were appropriate. I am satisfied HK was triaged and medically assessed promptly on his initial presentation to the metropolitan public hospital emergency department on 22 May 2022. His patient history and clinical presentation were consistent with an acute febrile illness, an exceedingly common presentation in children to the emergency department. While there is no documented evidence that those caring for HK actively considered sepsis as a differential diagnosis or using the Queensland Paediatric Sepsis Pathway, I accept independent specialist paediatric infectious diseases physician opinion that there was no documented objective evidence of sepsis during the course of HK's short admission to the Short Stay Unit for observation. He received appropriate clinical investigations including chest x-ray.

There is evidence it was busy in the children's emergency department that evening with a proportionately larger number of paediatric presentations than usual including a very unwell child in the resuscitation room some distance from the paediatric emergency department. It is reassuring that HK's clinical management was being overseen by the Deputy Director of Emergency Medicine (Paediatrics) who visualised HK and supported the decision to discharge him home. However, there was a missed opportunity to perform repeat observations to support the decision to discharge him home two hours after the 7:21pm observations which showed tachycardia (but otherwise normal vital signs). Without clear contemporaneous documentation and in the absence of vital signs repeated after 7:21pm, it is not possible to determine the trajectory of HK's illness between 7:21pm and the time of discharge other than to note he had tolerated 150mL fluids, was settled and had been seen mobilising comfortably with a normal gait at some stage prior to discharge. The Root Cause Analysis undertaken following HK's death has identified the importance of ensuring at least hourly observations in the children's Short Stay Unit including within one hour of discharge, and that abnormal observations be responded to according to the relevant Children's Early Warning Tool score actions. Use of a sepsis pathway may have prompted clearer documentation and repeated clinical assessment prior to HK's discharge home. It may also have supported the process of safety netting by providing written material for the family to take away with them. However, it cannot be said with certainty that repeating a full set of clinical observations would have changed the outcome for HK.

The outcome for HK and his family was devastating. His clinical journey demonstrates the dynamic process of sepsis which is difficult to differentiate from self-limiting infections in the early stages, but which can rapidly progress to a life threatening medical emergency. It demonstrates the importance of clinicians actively considering sepsis in any patient with an acute illness or clinical deterioration due to infection. Clinical tools such as the Queensland Paediatric Sepsis Pathway are designed to help signpost treating clinicians to earlier recognition and intervention.

Place of death – Metropolitan public hospital emergency department

Date of death – 23/05/2022

Cause of death – 1(a) Septic shock
1(b) Influenza A infection and bacterial co-infection with *Staphylococcus aureus* or Group A Streptococcus

I close the investigation.

Ainslie Kirkegaard
Coroner

20 September 2024