

Transcript of the inquest touching the death of**Gaia Inigo YOUNG****Held at St Pancras Coroner's Court****on 14 February 2022****Before Her Majesty's Senior Coroner****for Inner North London****Coroner ME Hassell**

HMC:	<p>We are here today to resume the inquest touching the death of Gaia Inigo Young, who died on 21 July 2021 at University College Hospital, 235 Euston Road in London, whose investigation was begun on 28 July 2021 and whose inquest was opened on 11 November 2021 by one of my assistant coroners, Jonathan Stevens.</p> <p>I know that I have Lady Young back in court and Mr Brook. You're both very welcome. I understand I also have the sister of Gaia Young who's in court as well. You're very welcome too.</p> <p>As you know, I am obliged to hold an inquest into every death the cause of which is either apparently unknown or apparently unnatural. It's not something I pick and choose, it's an obligation under law and we're here simply to try to find the answer to four questions: who the deceased was, where she died, when she died and how she came by her death. We do this out of a profound respect for the sanctity of life.</p> <p>The way that I intend to approach the evidence today is by reading out some statements under rule 23 of the Coroners Rules and then by calling some witnesses to give oral evidence. Any interested person, by that I include any immediate family member and I'm</p>
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[Unclear] words are denoted in square brackets and time stamps may be used to indicate their location within the audio.

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	<p>conscious I have another interested person in court, may object to the reading out of statements because they'd like the maker to come to court to give oral evidence. But I know that these statements have been disclosed, and they come from Rosanna Lombardo, who's a general practitioner; Zoe Veary, who's a doctor in accident and emergency; Christian Hasford, a physician; Pedro Castanho, a neurosurgeon; and Dominic Heaney, a neurologist.</p> <p>When it comes to the witnesses giving oral evidence, of course it's very much a fact finding exercise. So, after I've asked the questions that I have, I'll give interested persons the opportunity to ask any questions that you may have, because if there are answers to be got, of course I want you to go away with as many as is possible.</p> <p>Before I begin, I want to make sure that the evidence that Coroner Stevens took when he opened the inquest is correct.</p> <p>I have Gaia, G-A-I-A, Inigo, I-N-I-G-O, Young, Y-O-U-N-G. Is that correct? Lady Young, how would you like me to refer to your daughter?</p>
Lady Young:	As Gaia.
HMC:	<p>As Gaia, thank you very much, thank you kindly. I have Gaia's date and place of birth as 4 March 1996 in Islington in London. I have her occupation as that of a product specialist and artist. I have her address as 67 Gibson Square in London. And I have her date and place of death as 21 July 2021 at University College Hospital, 235 Euston Road in London.</p> <p>Is all of that correct?</p>
Lady Young:	Yes.
HMC:	<p>Thank you.</p> <p>As I've indicated, I understand that I have another interested</p>

	person in court today, who is legally represented. Ms Robertshaw, perhaps you'd be kind enough to introduce yourself.
Ms Robertshaw:	Yes, good morning. I'm representing University College London Hospitals NHS Foundation Trust. I'm attempting to manage the audio, ma'am. I'm in the same room as Dr Samuels. So we'll try to have the systems running correctly so there's no more reverberation.
HMC:	<p>Thank you, Ms Robertshaw. You're welcome to court. Whilst there was on your first phrase, after that we could hear you very clearly, thank you.</p> <p>So, I shall start by reading out the statements that I have. Some of these I shall précis.</p> <p>The first is from Rosanna Lombardo. Dr Lombardo is a general practitioner at Ritchie Street Group Practice, and she gave a statement on 16 November 2021, saying as follows.</p> <p>Gaia registered at our practice in August 2017. She was last consulted via telephone on 2 March 2021 by Roger Goldberg, Dr Goldberg is a GP partner, regarding her eczema on her hands. This was a routine telephone consultation. She'd run out of steroid creams and was issued a steroid cream and an emollient, both on her repeat prescriptions. She was also seen on this day for a smear test by Bernice Roberts, Ms Roberts is our nurse practitioner.</p> <p>Prior to this consultation she was seen by a GP in February 2020 with eye symptoms and also regarding her eczema. Her only prescribed medications at the time of her death were steroid and emollient creams. She had a wholly unremarkable medical history.</p> <p>The next statement I have is from Zoe Veary. Dr Veary is a locum junior doctor at University College London Hospitals and she gave a statement on 29 November 2021 saying as follows.</p>

	<p>Gaia Young arrived in the emergency department of UCH at 12 minutes past 11 on the evening of 17 July 2021. She was brought in by the London Ambulance Service with a documented heat exhaustion.</p> <p>Handover notes described that she'd been cycling during the day and subsequently felt unwell, complaining of headache and vomiting. She had been feeling much better since the administration of an intravenous anti-sickness medication from the ambulance crew. Her observations were as follows, respiratory rate 20, oxygen saturations 100 per cent on air, blood pressure 105 over 67, heart rate 91, temperature 36.6 and blood glucose of 5.5.</p> <p>I saw her at 1:30 am, approximately two hours after her arrival. She was in a wheelchair asleep, with vomit on her clothes. She woke easily when I introduced myself and assisted her to lie on the bed. She was able to tell me her name and where she was and thanked me for coming to see her. Before asking further questions, I helped her to become more comfortable in bed and provided blankets, as well as trying to clean some vomit from around her mouth. She thanked me for this and was able to get into bed and position herself in bed with ease.</p> <p>Following this, I tried to engage her to take a full history, but I was unable to elicit a full history of the day's events. She was, however, able to answer several of my questions. She would often throughout the conversation turn over and fall asleep or pull the sheet over her head, but was rousable and would resume answering some questions, but with erratic responsiveness. She told me that she'd been cycling and then had dinner with friends at home. When I asked her whether she'd been drinking she said not enough and repeated this a few times and often made the comment, I made a mistake. She said that repeatedly.</p> <p>I tried to clarify if she meant alcohol and initially she said yes to drinking alcohol, but later she said no. I questioned regarding drug misuse, which she consistently denied. I asked her what mistake</p>
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	<p>she was referring to but she did not clarify this further. She also complained of some abdominal pain and feeling sick repeatedly.</p> <p>I returned to her multiple times over the next approximately 30 minutes to try to understand the clinical situation. At one point we discussed whether I should call her mother who was listed as her next of kin and initially she said no, but when I asked again later she said yes. I attempted once to call her mum between 1:30 am and 2:00 am, but there was no response and I did not try again because of the time of day.</p> <p>My initial assessment was that Gaia appeared dehydrated and slightly agitated. She would often roll in the bed and hold her abdomen. On examination she showed no features of infection or respiratory difficulty and her observations were all within normal limits. Her heart and abdomen examined normally. I was unable to perform a full neurological examination as she would only intermittently follow instructions. I was, however, able to observe that she was moving all four of her limbs in a coordinated manner.</p> <p>She was able to lift her neck and head off the bed and to look around the room and she was able to move her limbs against resistance when I attempted examination. I deemed her, however, on my first assessment to have a Glasgow coma scale of 14 out of a possible 15, as I felt she was confused. There were no signs of injuries such as bruising and no rashes. She did, however, have large pupils but they were equal and reflexes were normal. My initial concern was, given her age and history of being with friends, that she could be potentially intoxicated and also that she appeared dehydrated.</p> <p>My first decision was that she was to have an intravenous line inserted, fluid resuscitation and blood tests taken. It was difficult to site a cannula that was working, as often she seemed to be more comfortable with her arms underneath her, which meant that the cannula dislodged or fluids weren't running through effectively. Her bloods showed a mild hyponatraemia which given her clinical state</p>
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	<p>I felt may be due to dehydration, so I continued with fluid resuscitation. I also gave her two further doses of anti-sickness medication to improve her symptoms of nausea and vomiting.</p> <p>I went to reassess her several times and she showed some improvement in her clinical state. I asked her several of the same questions again and she told me that she'd drunk only a small amount of alcohol and had been out today. She didn't give me any further information regarding this. I asked my senior registrar to review her as I felt she was still very drowsy and I would have hoped for further improvement by this time.</p> <p>I only had one to two minutes before being with her when she became less able to answer my questions. When my registrar went in to review her she was much more alert and was able to answer several of his questions. She had a Glasgow coma scale of 15 at this time, so 15 out of a possible 15. She complained of feeling sick. We made the decision at this point for medical referral for ongoing review.</p> <p>Next, I have a statement from Christian Hasford. Dr Hasford is a consultant physician at UCH and gave a statement on 2 February 2022 and a supplementary statement on 11 February 2022. He says as follows.</p> <p>I was the consultant in charge for the acute medical unit on the night that Gaia was admitted. I remember her well. I saw her on the post-take ward round at 10:26am on 18 July 2021. She had arrived in hospital at 17 minutes past 11 on 17 July.</p> <p>She was seen by A&E at 1:34am on the 18th and seen by the on-call medical team at 3:38am. When I saw her, her NEWS 2 score was low, indicating that her vital signs were normal so she had not been highlighted for review earlier in the morning. At that point there was no clear explanation for her presentation. The suspicion had been heatstroke or intoxication. Neither her behaviour, beyond what had led to her admission and been described in the notes, nor her wellbeing had raised concerns for the nursing staff during the</p>
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	<p>hours since her arrival on AMU before my attendance.</p> <p>From the notes we found no history of relevant premorbid conditions that would shed any light on the presentation. Collateral history had not been available overnight but when this did become available it did not change the clinical picture. So this was confusion query cause in a previously normal patient. Mum had been able to confirm that the observed behaviour was most odd and out of character.</p> <p>The young woman in front of me appeared both co-operative and non co-operative in a noncombative way at the same time, a not unusual finding in young patients presenting in particular overnight with confusion query cause. I asked her a general question about how she came to be in hospital. Initially she answered but on asking a follow-up question she turned away, as had been the pattern since admission. She answered some questions seemingly lucidly, others remained seemingly unheard.</p> <p>Examination, or achieving her cooperation with examination, was difficult. She pulled the bedsheets over her head in a way which did not seem deliberately obstructive and in a way commonly seen with patients who could not sleep all night because of admission disturbance and feel that they should be allowed to sleep first before further exposed to repeat examination.</p> <p>She did not show signs of clinical photophobia, now or earlier. This is greater than general avoidance of irritation in light or sound which is common with headaches. Photophobia would indicate potential meningeal irritation or meningitis and is therefore something which clinicians actively look for. This condition, meningitis, though does not present with confusion.</p> <p>I noted that unlike the dilated pupils observed earlier, she had rather small pupils and they were sluggish in response to light. Pupils are generally more responsive in younger people and sluggishness indicates an alteration or a depression of reactivity of the central nervous system and is common in conditions including</p>
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	<p>intoxication, either recreationally or because of prescribed medication.</p> <p>My assessment was of an intracerebral process with an uncertain cause. The most likely of the possible causes could include that it was toxin-related or an inflammatory cause, so an infection or autoimmune or a combination. Based on my clinical impression intoxication was a potential cause, but I did not feel this was intoxication by alcohol or a conventional recreational drug or heatstroke. Gaia did not look to me like someone I would expect to use recreational drugs, but I was aware that I should avoid making the presumption that she had neither taken nor had been given a recreational drug.</p> <p>There are a vast number of chemically new synthetic substances appearing in society and these are often impossible to test for, so we could not definitively rule that out. I thought that intoxication was unlikely but it could not be excluded as a medically viable explanation for her condition. However, her presentation did not strike me as a typical encephalitic process either, the symptoms were not too suggestive to me for encephalitic process, too fluctuant and not localisable to an area of the brain.</p> <p>As there was not a conclusive cause, I sought to treat and manage the most likely reversible causes of her presentation. I therefore covered her for bacterial and viral insult, so herpes, by prescribing an antiviral and an antibiotic agent. In addition, I advised that we needed to obtain a CT head, lumbar puncture and a neurology opinion. I anticipated that the lumbar puncture would be the most useful diagnostic tool at this stage. A lumbar puncture allows confirming a diagnosis of the above named entities and it significantly narrows the range of differential diagnoses.</p> <p>The blood tests were diagnostically unhelpful. The only notable finding was a mildly low sodium which was a highly non-specific finding and I felt was a consequence of the underlying central nervous system pathology or her earlier bouts of vomiting. Venous</p>
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	<p>blood gas was not acidotic, which was a reassuring finding in terms of acute illness, so for example, sepsis. My direct involvement then ended. Gaia will not leave my memory. As a parent, I cannot imagine the loss and grief of her family and I give my deep and heartfelt thoughts.</p> <p>I've been asked to provide further comment on the clinical view that Gaia did not demonstrate photophobia, despite comments from her mum that her behaviour before attending hospital included asking that heavy blackout curtains be drawn and later Gaia found having pulled a bedsheet over her head, rolling away from lights, covering her face and not willing to open her eyes.</p> <p>I understand that the issue of photophobia is an important one. Translated, it obviously only refers to light avoidance and light avoidance is not uncommon in many settings, from when we want to go off to sleep, when we have a migraine, when we simply feel rough, when we had too much sunlight exposure and many more causes well known to most of us.</p> <p>In the clinical context of meningeal irritation, it's not a stand alone system and comes together with avoidance of movement and in particular, neck stiffness. Like so many things, photophobia is a clinical finding, which to any experienced clinician will be obvious almost on approaching the patient. Gaia clearly did not fit that definition. That does not mean that she did not for whatever reason prefer avoiding light. When I saw her in the far narrower given clinical context, she did not show signs of photophobia.</p>
Mr Brook:	Madam, I don't wish to interrupt, but Lady Young tells me that she's never heard or seen that statement from which you've just made some...
Lady Young:	I've seen a short comment by Consultant Hasford regarding the photophobia, but this seems to be an extension, an extended version. I've never really come across it.

HMC:	I'm so sorry, Lady Young. My understanding was that when this was served, when this was filed with the court, it was also served on you at the same time.
Lady Young:	A shorter version, yes, but not that version.
HMC:	This is a one-page...
Lady Young:	Mine seems to be just a little bit like that.
HMC:	Ms Robertshaw, can you help me? Did you file and serve simultaneously?
Ms Robertshaw:	Ma'am, the same document was sent in one email to yourself and Lady Young that you have just read.
Lady Young:	I'll check it later on.
HMC:	<p>Thank you, Ms Robertshaw.</p> <p>Next, I have a statement from Pedro Castanho. Mr Castanho is a consultant neurosurgeon at the National Hospital for Neurology and Neurosurgery and he gave a statement that is undated, but was received by my office on 8 February 2022, saying as follows.</p> <p>A neurosurgical opinion from our team was sought for Gaia on 18 July 2021 at around twenty to seven in the evening. An initial CT scan obtained on the 18th at around seventeen minutes past one in the afternoon was reported as demonstrating no acute intracranial finding. Whilst in preparation for a lumbar puncture later that day, she went into respiratory arrest and was subsequently intubated without the need for sedation and was transferred to intensive care. These events took place at about twenty to four in the afternoon.</p> <p>A second head CT was obtained at just before five in the afternoon. This was reported as demonstrating slight degradation of grey-white matter differentiation, as well as loss of sulcal spaces,</p>

	<p>low lying tonsils. In combination with the drop in GCS, these findings were suspicious for generalised brain oedema. No acute haemorrhage, no infarction, no obstructive hydrocephalus.</p> <p>The on-call registrar was contacted at around twenty to seven in the evening. Advice was provided and written on the medical records a couple of minutes after that. At that time, Gaia had radiological and clinical signs consistent with critically raised intracranial pressure and likely irreversible neurological damage, with a Glasgow coma scale of three out of a possible fifteen, three being the lowest possible score, and fixed and dilated pupils for over an hour and a half.</p> <p>The absence of a space occupying lesion, hydrocephalus or other potential surgical targets precluded any neurosurgical intervention. Subsequent CT angiogram and venogram were obtained at about twenty to nine in the evening on that day and demonstrated the absence of intracranial circulation, essentially incompatible with life. The cause of her progress was not known at the time but suspicion had been raised for possible infectious encephalitis with widespread brain oedema. This was the only time the neurosurgical team had any contact with her and the next we heard was that she'd sadly died.</p> <p>Finally, I have a statement from Dominic Heaney. Dr Heaney is a consultant neurologist.</p>
Mr Brook:	<p>Madam, before you read that statement, may I just say I believe you received an application from Lady Young that this not be read into evidence on the grounds that it was only delivered last Friday and that it doesn't assist the court in any event. Can I just say that I anticipated that you would want this to come into evidence anyway and the only caveat I would make there is, so I won't pursue the application.</p> <p>But the only caveat I would make, that in fact the contents of that report does have some incoherence within it which I'll address you</p>

	<p>on later perhaps. Really it only supports our applications for further neurological reports, but I'll make those at the end. But in case you've had an application come through, it may not have found its way to you, I don't pursue it but with those caveats.</p>
HMC:	<p>Thank you, Mr Brook.</p> <p>So, Dr Heaney is a consultant neurologist based at the National Hospital for Neurology and Neurosurgery, although he says part of my role as consultant is one of a team of neurologists who provide on-call neurology advice to the main UCLH Trust, including the acute medical services. I was the consultant on-call at the time that Gaia was admitted to UCLH. I have a clear recollection of the matter. Gaia presented to UCLH emergency department.</p> <p>The neurology team was first involved following the referral from the medical team on the AMU. I do not know when the referral was made but it's likely to have been around midday, following the AMU ward round. The neurology registrar, Dr MacDonald, received the referral and as is normal on-call practice, reviewed Gaia directly so that she could discuss the findings with me afterwards. She assessed Gaia first at around 2:30pm. As part of her assessment, Dr MacDonald reviewed the medical records, medical and nursing notes, lab work and also noted the CT head scan that had been undertaken just after 1:00pm. The report showed no acute intracranial finding.</p> <p>In addition to the CT scan, Dr MacDonald was aware that the first of two attempts at lumbar puncture had taken place at approximately 2:15pm, but had been abandoned as Gaia had become very agitated during the procedure. It was documented contemporaneously that the intrathecal space was not accessed, the dural was not punctured. Dr MacDonald called me to discuss at around 3:15pm.</p> <p>We used the electronic records to simultaneously review all the notes and scanning images and we discussed Gaia's presentation</p>

	<p>in detail. We noted the presentation and lab findings and that she'd been commenced in intravenous antibiotics and antivirals, but that the diagnosis was not clear. I advised that the range of potential diagnoses was broad and included venous thrombosis and encephalitis.</p> <p>As part of our review, we discussed the utility of lumbar puncture. On the one hand, lumbar puncture would provide cerebrospinal fluid which could be analysed and offered a good prospect of contributing perhaps decisively to diagnosis, for example, identifying infection or similar. On the other, lumbar puncture could present risk if performed in the context of raised intracranial pressure.</p> <p>Following review of the scan, my view was the CT could be interpreted to show generalised brain oedema and I considered lumbar puncture may not be safe to perform, due to the risk of coning if the dura was compromised. In parallel with my call with Dr MacDonald, Gaia was sedated at 3:15pm. The lumbar puncture was attempted for the second time.</p> <p>During the second lumbar puncture attempt Gaia became unresponsive and in respiratory arrest and the crash team was summoned. The lumbar puncture was not completed, again it's described that the intrathecal space was not accessed. Gaia did not recover neurologically following this and was transferred to the intensive care unit at UCLH.</p> <p>Although I had informal discussions with Dr MacDonald that afternoon to discuss Gaia's progress, notably at six minutes to seven in the evening of 18 July, I discussed Gaia with the second of the registrars on-call that day, Dr Farag. We further discussed the need for neurosurgical review and the possibility of venous thrombosis.</p> <p>At some point on 18 July 2021, although I do not know the exact time, the neurosurgeons advised that neurosurgical intervention was not indicated. Following further CT scanning performed at</p>
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	<p>8:37pm, we established that it was unlikely that her deterioration was due to a clot, in other words a thrombosis.</p> <p>I handed over the neurological aspect of her care to a consultant colleague the following morning, but note that later in her admission cerebrospinal fluid obtained on 22 July 2021 showed a white cell count of four, RBC 9600, blood stained and so protein and glucose not measured, with no organisms grown after culture, an autoimmune screen including antineuronal antibodies negative and an infection screen, HIV, NEURO-9, Lyme Borrelia, negative.</p> <p>In conclusion, all that I have understood to date suggests that Gaia was in good health, with no history of neurological illness before 17 July 2021. Overall, after her presentation she remained unwell and continued to behave oddly over the eleven or so hours of observation. She deteriorated at 10:23am on 18 July, when she was found to have a fever. Antiviral and antibiotic treatment was started at that time. A further, very significant deterioration occurred at 3:15pm on the 18th, when she developed respiratory arrest and from this point there was no neurological recovery.</p> <p>Based on the clinical progression and investigation, it seems likely that Gaia developed a rapid onset of severe generalised cerebral oedema. This view is supported by the clinical presentation and findings of imaging. The oedema led to coning and brainstem herniation, culminating in the respiratory arrest that occurred at 3:15pm. This required a prolonged resuscitation and was complicated by profound hypoxic ischaemic brain injury. The cause of the cerebral oedema is not apparent. It is extremely unusual for patients to develop malignant cerebral oedema causing such rapid progression to herniation.</p> <p>Is there any reason why I should not take those statements into account?</p>
Mr Brook:	Only subject to the comments that I have made.

HMC:	<p>Thank you, then I formally admit these statements of Rosanna Lombardo dated 16 November 2021, Zoe Veary dated 29 November 2021, Christian Hasford dated 2 February 2022 and 11 February 2022, Pedro Castanho undated but received 8 February 2022 and Dominic Heaney dated 9 February 2022, all under rule 23 of the Coroners Rules.</p> <p>I'm going to call the witnesses in what may seem like reverse order, in that I'm going to call the pathologist who conducted the post mortem examination first, Lady Young.</p>
Lady Young:	Madam Coroner, is Dr Rebecca Andrews still on your list?
HMC:	Yes and what I anticipate is that Professor Sheaff will be able to include the evidence of Dr Andrews in his evidence. So, as I've indicated, I'm going to call the pathologist who conducted the post-mortem examination first, because I think it will enable the other witnesses to give better evidence. So I now call Michael Sheaff. Professor Sheaff, would you like to swear on a holy book or would you like to affirm?
Prof Sheaff:	I'll affirm please.
	<i>Affirmation made.</i>
HMC:	Thank you. Can you please give me your full name, your professional role and your professional address.
Prof Sheaff:	Yes, I'm Michael Sheaff, I'm a consultant histopathologist based at Barts Health. I am the senior pathologist for autopsies on site there and I have been doing autopsies for 20 years.
HMC:	Thank you. Professor Sheaff, did you conduct a post-mortem examination of Gaia Young?
Prof Sheaff:	I did.

HMC:	When and where did this take place?
Prof Sheaff:	It took place on 28 July 2021 and that was at St Pancras Public Mortuary.
HMC:	Can you please describe for us your findings.
Prof Sheaff:	<p>Yes, I'll start with the external findings. There was a recently sutured surgical wound down the centre of the body involving the chest and abdomen, in keeping with organ retrieval for transplantation. There were several intravenous access lines and there was a nasogastric tube and airway and they were both in their correct positions. I found no evidence of trauma or old surgical scars.</p> <p>I examined the cardiovascular system and found a normal heart weighing 220 grams. I examined the heart muscle, I examined the valves and I examined the coronary arteries and all appeared normal. I examined the large vessels coming in and going out of the heart and those too were normal.</p> <p>When I examined the chest, I also looked at the lungs and the pleural cavities. The lungs were normal weights, the left 282 grams, the right 224 grams and both were essentially normal. I found no evidence of aspiration or pneumonia. The airways were opened and found to be normal and unobstructed. In the gastrointestinal system I examined the mouth, the oesophagus and the stomach and all appeared normal. The duodenum and the colon were also normal. The liver had been removed and with it the gallbladder and the pancreas was also absent at the time of the autopsy.</p> <p>When I examined the genitourinary system, the kidneys had been retrieved but the bladder appeared normal and the internal genitalia were normal for age, no evidence of pregnancy. The spleen was normal, there was no evidence of enlarged lymph nodes. The thyroid gland was normal, the adrenal glands were</p>

	<p>absent, as is often the case when the kidneys are retrieved for transplantation.</p> <p>When I examined the scalp and skull, I found no abnormality. We removed the skull and examined the outer surface of the brain, which appeared normal apart from evidence of oedema, in that the normal undulating outer surface of the brain was smoother than normal. In view of the history, I thought it was essential that the brain was not examined further on site and it was sent off to Professor Al-Sarraj, as you know, who conducted a formal neuropathology exam.</p>
HMC:	Are you able to help me with Professor Al-Sarraj's findings?
Prof Sheaff:	<p>I am, I have the report in front of me. I do also have a comment. Where he summarises that the brain shows changes secondary to other factors, including hypoxic ischaemic damage or the effects of drug use or abuse, but there's no evidence of a primary brain pathology which could have caused the respiratory arrest or cerebral oedema, he didn't fact find generalised cerebral oedema.</p> <p>I also took small pieces of heart and lung and spleen and they were essentially normal, I found no significant abnormality. It obviously would not have been appropriate or sensible to have taken samples at the time of autopsy for toxicology, but I was provided with a sample of premortem blood. I cannot tell you exactly the date of that blood sample, but it was sent off to toxicology and it found no ethanol, amphetamines, morphine or other drug in a general screen. The report does include a list of compounds on the back that make up that screen and it is very extensive.</p>
HMC:	So, given all of those findings, Professor Sheaff, what's your opinion of the medical cause of Gaia's death?
Prof Sheaff:	Well it's clear that everything's pointing towards generalised cerebral oedema, leading to raised intracranial pressure and the

	consequences of that. But I'm really sorry, I'm not able to tell from the autopsy, even after the specialist neuropathology exam, what the underlying cause of the cerebral oedema is.
HMC:	Given the medical history such as you know it, and the findings of the post mortem examination, what do you regard as the possibilities?
Prof Sheaff:	<p>It seems to me the - I wasn't there at the time of the initial presentation, I'm afraid - but the possibility of dehydration associated with heatstroke was obviously considered. There is no way that the autopsy can prove or disprove that, but I guess that is a consideration. As I say, the toxicology analysis is extremely exhaustive. I can't speak for the toxicology department, but there may be compounds, particularly with new compounds becoming available that are not picked up in that general screen.</p> <p>The other possibility, of course, is that something happened catastrophic on 17 July that cleared up by the time - and caused the consequences that we've seen - but was no longer visible or evident at the time of the autopsy on 28 July or at the time of death.</p>
HMC:	What sort of catastrophe?
Prof Sheaff:	Some sort of clot or thrombosis in the brain or in the covering of the brain. That does seem to have been excluded by the radiology though. I'm afraid the bottom line is I simply don't know.
HMC:	If we're looking at likelihood, in terms of the three alternatives that you've provided for me. The clot seems unlikely given that radiology excluded that. A toxin was considered by the clinicians and again doesn't seem terribly likely, of course possible but doesn't seem terribly likely. The dehydration or heatstroke, if that's what it was, was treated. Does that seem likely?

Prof Sheaff:	I have to say, when I was doing the autopsy the clinical information provided to me seemed to lead in that direction. But from what I've heard from the evidence you've read out this morning, it seems that people were fairly confident that that wasn't going to be the cause of death. Again, I'm sorry, the autopsy can't prove or disprove that. But it was certainly the most likely consideration I was having until I heard the evidence this morning from those other witnesses.
HMC:	Right, so now that we have that evidence, we've got three possibilities, none of which seems very likely, I think. I'm paraphrasing you, but is that your evidence?
Prof Sheaff:	That is my evidence. I don't think there's one that stands out as being more likely than the others, or any one that seems more likely on the balance of probabilities than anything else, not even marginally. So I'm afraid I'm just going to have to accept that the cause of the cerebral oedema is unknown as far as the pathology is concerned.
HMC:	But you were able to rule out, or Professor Al-Sarraj was able to rule out, primary brain pathology?
Prof Sheaff:	Correct and I found no thrombosis at the time of the autopsy in the sinuses.
HMC:	So just give us a rundown, Professor Sheaff, of the - when we talk about primary brain pathology - of the sorts of conditions that you and Professor Al-Sarraj have been able to rule out.
Prof Sheaff:	There are significant major ones that I would have been able to identify at autopsy very readily and that would have been – Significant bleed in the brain or in the surroundings of the brain, the meninges, such as a subdural or subarachnoid haemorrhage.

	<p>Tumours, either intrinsic brain tumours or metastases from tumours elsewhere to the brain. They may not be visible on the outside of the brain, but certainly when the brain is sliced Professor Al-Sarraj would have found that fairly readily.</p> <p>Infections, there was no evidence of meningitis macroscopically at time of autopsy and I note that Professor Al-Sarraj did in fact look at the meninges under the microscope and found no infection. He specifically comments that he found no evidence of encephalitis, so no inflammation of the brain tissue itself under the microscope.</p>
HMC:	So all of those ruled out?
Prof Sheaff:	Yes.
HMC:	In terms of the general autopsy, you were also able to rule out any cancer, any tumour elsewhere?
Prof Sheaff:	Yes, I was.
HMC:	What about any other sort of infection that wasn't within the brain?
Prof Sheaff:	No evidence macroscopically at the time of autopsy and nothing microscopically in the lungs, which would obviously be one of the major sites. The kidneys were not available obviously, so I can't be absolutely sure there was no pyelonephritis, but I suspect that they would not be accepted for donation and transplant if there was obvious pyelonephritis in them. Likewise the liver and the adrenal glands. I'm sure the harvesting team or the transplant team would have let us know if there was a significant pathology in any of the organs that were taken.
HMC:	Professor Sheaff, thank you. Is there anything else you think it would be helpful for me to know?
Prof Sheaff:	Only that I've seen the correspondence from Lady Young. Clearly

	she's absolutely correct that the cause of death that I provided in my report does not provide a clear medical cause of death, it's all functional. But I'm afraid I just don't have the underlying cause of the cerebral oedema. If it's felt to be more appropriate that the cause of death is as I had put originally, but altered the cerebral oedema to cerebral oedema of unknown cause, if that made any difference then clearly that would be acceptable to me.
HMC:	That reminds me of one last matter, Professor Sheaff. Tonsillar herniation, take me through that.
Prof Sheaff:	Yes, tonsillar herniation, there was no evidence of tonsillar herniation at autopsy. This is where the lower part of the brain gets squeezed into the foramen magnum, a big hole at the base of the brain through which the spinal cord originates. But there was documented evidence of tonsillar herniation in the medical notes that I was provided with. So I'm sure that that was an important event that happened, even though it wasn't visible at the time of autopsy, which had contributed to possibly the respiratory arrest as we've heard and certainly to the raised intracranial pressure. That's why I had put it in the cause of death.
HMC:	Can you help us with why you didn't find any evidence of tonsillar herniation?
Prof Sheaff:	I can only imagine that the oedema had become less severe by the time of the autopsy. So the lower part of the brain had gone through the foramen magnum, but by the time of the autopsy it was less prominent or visible certainly.
HMC:	Also, for the sake of completeness, we know that Gaia arrested at around the time a lumbar puncture was being attempted. Did you find any link between the lumbar puncture and the arrest?
Prof Sheaff:	I'm afraid that's not something the autopsy can answer.

HMC:	Was there any evidence that the lumbar puncture contributed to death?
Prof Sheaff:	There was no suggestion that it did certainly. I think to be absolutely frank with you, I don't think the autopsy will tell you the answer to that. I think that will have to be a consideration of the temporal events and the timing between the lumbar puncture and potentially a change or an increase in the intracranial pressure and coning from that event. But as I say, no evidence of tonsillar herniation or coning at the time of autopsy certainly.
HMC:	<p>Thank you very much, Professor Sheaff.</p> <p>Lady Young, questions for Professor Sheaff?</p> <p>Mr Brook, are you going to ask them?</p>
Mr Brook:	I'm going to ask them, madam, if that's okay with the court. Professor Sheaff, I wonder if you've received from Ms Robertshaw a copy of a series of questions which I've invited you to consider and just give answers to. That would only have come through this morning. Also a copy of the case which you don't need to read in any detail, it's only put forward by way of an example of the case of Rose. Have those been given to you this morning? I realise you...
Prof Sheaff:	I was provided with the questions this morning, yes.
Mr Brook:	Excellent. On the basis of what you've said, I rather get the impression that you will probably agree - there may be some caveats but you probably agree with number 5, where I invite you to agree or comment upon a series of questions beginning with the causal primary pathology originated in the brain and they go on. Are you able to assist us with answers to those? Madam, have you had them?
Prof Sheaff:	I will try my best.

HMC:	<p>I have received those and in fact Professor Sheaff has received those from my office, so I asked for those to be forwarded this morning when I saw them.</p> <p>But just for the avoidance of doubt, Mr Brook, in this court evidence is only taken into account if it's articulated in open court, so no documents are taken as read. So the questions need to be put one by one.</p>
Mr Brook:	I understand. In that case, I'm going to read through and the preamble to my questions so that it goes on the record.
HMC:	So just one by one, if you would please, thank you.
Mr Brook:	One by one, okay. I'm going to just set it up, if I may, first of all, madam. You comment in your report that the brain injury was irreversible and catastrophic, but you consider it to be a secondary event with no primary pathology. That you've already told the court, I think and you've already told the court that you're unable to give any definitive answer to what was the underlying cause.
Prof Sheaff:	That's correct, yes.
Mr Brook:	Thank you. So do you agree with the following statements on the balance of probability? I realise you've read them, I'm just mindful of what Madam Coroner has told us. The clinical history denoted cerebral disturbance, do you agree with that?
Prof Sheaff:	Yes, that was my understanding when I did the autopsy. It looked like the primary pathology was likely to be in the brain.
Mr Brook:	Yes, thank you. As I said, I think many of these questions you've very helpfully answered anyway, but let's go through them. The post mortem findings demonstrated abnormality of the brain, would you agree with that?

Prof Sheaff:	I would agree with that. At the time of the autopsy the brain looked generally very swollen and Professor Al-Sarraj has looked under the microscope, having also found generalised cerebral oedema and found secondary ischemic changes.
Mr Brook:	Thank you. Again I think we can anticipate the answer. Post mortem findings of the rest of the body were unremarkable and uninformative?
Prof Sheaff:	Yes, with the caveat that obviously the liver, kidneys and adrenal glands were not available at the time of the autopsy.
Mr Brook:	That which you could examine unremarkable?
Prof Sheaff:	Everything I saw was normal, yes.
Mr Brook:	The toxicological screen was negative and there was no evidence of drugs or toxins?
Prof Sheaff:	Yes, that is correct.
Mr Brook:	Thank you. So accordingly, would you agree with this? The causal primary pathology originated in the brain, whatever it was?
Prof Sheaff:	Yes.
Mr Brook:	The effect of the primary pathology was limited to the brain?
Prof Sheaff:	Yes, I would agree with that.
Mr Brook:	There was no morbid, anatomical correlate of the primary pathology?
Prof Sheaff:	If by that you mean that we weren't able to find any macroscopic or microscopic precise disease to cause that, then yes, that is correct.

Mr Brook:	Thank you and that there was a catastrophic coning event, however that came about and this was irreversible?
Prof Sheaff:	Yes, that's based mainly on the clinical information provided rather than the autopsy itself.
Mr Brook:	But on the balance of probabilities, this would be your conclusion?
Prof Sheaff:	Yes.
Mr Brook:	The underlying cause of Gaia's condition is still unknown. You've helpfully explained why that has to be with your specialism. Would you agree that absent the catastrophic coning event it's not possible then at this stage to know the chances of Gaia having recovered either spontaneously or with appropriate treatment, until the underlying cause of Gaia's condition is known?
Prof Sheaff:	Yes, I think I agree with that, but I think that's more a clinical question than it is for the autopsy, if I may say so.
Mr Brook:	Yes. If you look at the document that came over, number 6, I will read it out for the...
HMC:	Just in terms of the case that you've introduced there, Mr Brook, I'm not sure how much I'm helped by looking at any similarities with another case. I'm also rather reluctant to have Professor Sheaff comment on a case that he really knows nothing about.
Mr Brook:	Madam, the purpose for introducing this is just to show the multiplicity of causes that could have given rise to Gaia's death.
HMC:	I think then just ask about the causes. As I say, I think to have Professor Sheaff comment on a case that he really knows nothing about, that he's been introduced to this morning wouldn't be right. But feel free to ask about particular causes.

Mr Brook:	<p>No, I'll do that. Is it possible when one is faced with a generalised oedema, which was eventually the conclusion on examination of the first CT scan, to embark upon another course of treatment, leaving aside the lumbar puncture which was in fact the route taken, which might have a different outcome?</p> <p>For example, forgive my lack of particular specialist terminology knowledge here, but in this particular case which for the reasons already put forward by Madam Coroner we're not going to explore, there was a suggestion that relieving the pressure on the brain may have enabled recovery to have come about. That didn't happen in this case and it led to a spontaneous herniation as the brain expanded. So the question is, if the lumbar puncture hadn't been proceeded with, could...</p>
Ms Robertshaw:	Apologies, ma'am, for interrupting, I'm just cautious that this is not a treating clinician. I'm not sure it's possible for this witness to address a question about treatment options.
HMC:	Well, Ms Robertshaw, I have that in my mind, but I was going to allow the question to be put fully before making a decision about that.
Mr Brook:	Is it within your knowledge that some other form of treatment may have led to a successful outcome? For example, relieving the pressure on the brain by way of a tap or some such thing?
Prof Sheaff:	<p>Well I'm not a specialist, as you know, so I don't think I can answer that with the sort of clarity and experience that is required for this court. I think it would be better answered by a clinician. What I would say, if you would like me to say, is that I have read the case, a little bit about the case that you've suggested here to have some similarities.</p> <p>I suspect it's slightly different, in that it seems to have a pathological abnormality when the brain was examined in the form</p>

	of gliosis, the scarring of the brain, which had led to the hydrocephalus in this unfortunate child, which we would have seen, or Professor Al-Sarraj would have seen when he did his microscopic examination. So I think we can be fairly confident that there isn't any clear pathological process going on in the brain that would lead to the hydrocephalus that this child suffered from.
Mr Brook:	Okay, so they're distinct on the facts as far as you can see by your perusal of that case and your knowledge of Gaia?
Prof Sheaff:	From the information that's provided in the question, I haven't seen that whole case but it does describe blockage of the CSF flow by gliosis in part of the brain which did not allow the CSF to flow properly and be resolved properly, which I do not believe we are dealing with in this particular case.
Mr Brook:	I think actually, madam, Lady Young does have a question which is probably better put by her.
Lady Young:	Professor Sheaff, the <i>Rose</i> case was brought forward because of a possible parallel aetiology. So in the case of the little boy, because of the blockage in his brain the CSF pressure obviously rose and compensated for a while and then he basically had the catastrophic event. What I'm trying to point out is could something similar have happened to Gaia, but not via a blockage in the brain but via a well known neurological illness called idiopathic intracranial hypertension? So that Gaia had for whatever reason a rising CSF pressure, too much liquid in the brain and then she decompensated and then she had the catastrophic event. That was the reason why this case was put forward.
Prof Sheaff:	I see, well I'll try my best to answer that question, but again it may be better addressed by a clinical specialist. This child did actually have an anatomical abnormality though, which we have not demonstrated in your daughter's brain. The issue of idiopathic intracranial hypertension again is better addressed by a clinician,

	but my understanding is that I don't think it's a fatal condition. I do not believe from what I've read that it ever becomes a fatal condition and is usually a chronic low grade type of abnormality in the brain. But I may be corrected by the clinical team when they come to address that issue.
Lady Young:	Thank you.
Mr Brook:	Thank you, just a few more perhaps general questions, which I think will assist, the answers will assist here. In a case where there is raised intracranial pressure, leaving aside whether it's known about at the relevant time, would you recommend that the patient not be moved? Could any movement, as the matter becomes critical, be dangerous to the patient?
HMC:	Professor Sheaff, are you able to answer a question like that?
Prof Sheaff:	I don't think it's appropriate for me to. I don't know the answer, so it's not within my expertise, I'm afraid.
HMC:	That's a clinical question.
Mr Brook:	Again that would require a clinician to look at that?
Prof Sheaff:	Yes.
Mr Brook:	Thank you very much.
Lady Young:	A neurologist, Professor Sheaff?
Prof Sheaff:	A neurologist, yes, neurosurgeon, or intensivist, probably will be better addressing them.
Mr Brook:	Thank you so much, Professor Sheaff, that's very kind.
Lady Young:	Thank you, yes.

HMC:	Ms Robertshaw, any questions?
Ms Robertshaw:	No questions for this witness, thank you.
HMC:	Thank you. In that case, Professor Sheaff, thank you very much for your - oh, I beg your pardon, we have another question, I'm so sorry.
Ms Young:	I'm sorry, is it okay if I ask one?
HMC:	It certainly is. Is it Ms Young?
Ms Young:	It is, yes.
HMC:	Ms Young, of course it is. Forgive me for not coming to you, I should have done.
Ms Young:	No, that's fine, I wasn't going to but there was just one question, which is connected with the autopsy.
HMC:	Of course.
Ms Young:	Professor Sheaff, did you examine or ascertain in the post mortem whether the, I think, dura surrounding the intrathecal space in the spine were punctured at any point, giving an indication of whether the lumbar puncture had punctured the space even though we were told earlier that the clinicians didn't think so? But I wondered if that was an area that you'd examined and were able to see whether there had been any, any piercing, any breaking.
Prof Sheaff:	I'm afraid I only caught every other word there, but I think I understood the question. Did I examine at the time of autopsy the lumbar puncture site, to see whether there was evidence that a needle had got into the correct place? The answer to that is no, but I think I heard from one of the witnesses earlier that there was a

	successful lumbar puncture, because we were provided with the results of CSF microbiology, I think, unless I misunderstood. So at some point it sounds like there was a successful lumbar puncture.
Ms Young:	That was after she died.
Prof Sheaff:	But I'm just going by the witness statement that was read out earlier, not from my own reading.
Ms Young:	The date of that statement was after the death, because the date was given.
HMC:	So yes, the question was just directed, I think, Professor Sheaff, as just seeking to understand whether the dura had been punctured and whether you were able to verify that.
Prof Sheaff:	I cannot.
Ms Young:	Thank you.
HMC:	In that case, that concludes your evidence. Thank you very much for your attendance today and you are now discharged. Thank you kindly.
Prof Sheaff:	Thank you.
HMC:	I now call Dorit Young. Lady Young, if you'd be kind enough to come up to the witness box.
	<i>Affirmation made.</i>
HMC:	Can you please give me your full name?
Lady Young:	Lady Dorit Young of Dartington.
HMC:	Lady Young, are you Gaia's mum?

Lady Young:	Yes.
HMC:	Can you tell me what sort of a person Gaia was?
Lady Young:	I will talk about her in my statement.
HMC:	Right, well let me just deal with one matter first then, which is, I have already checked the details for registration purposes with you that you gave in your statement of 20 August 2021. Can I ask you also to confirm that you identified Gaia?
Lady Young:	No, I did not.
Mr Brook:	Yes, you did.
Lady Young:	What do you mean?
Mr Brook:	As the deceased.
Lady Young:	But I wasn't in the mortuary. I saw her in hospital. Oh, I see.
HMC:	Right, thank you very much. Thank you. Now, I know that you were keen to give evidence. Tell me what it is that you think it will be helpful for me to know.
Lady Young:	I try to give Gaia a voice, it's a personal statement but it's informed by me virtually wading through all the documentation and I do think I have some really important points to make.
HMC:	Now, in terms of your evidence, what you're not able to do is to address me as to where the evidence goes. So, under rule 27 of the Coroners Rules, no person is allowed to address the coroner as to the facts. So that means that nobody is allowed to say to the coroner I think the evidence points in this direction or in that direction. You're able to give me direct evidence of anything that

	was in your knowledge, so anything you saw at the time, or anything that might be relevant in terms of what's within your direct knowledge, but not a commentary on the medical records or on the other evidence. That's prohibited under the Coroners Rules.
Lady Young:	I'm basically talking a lot about the chronology and how it all started. Basically that is evidence, it's not my personal assessment. I do think that as Gaia's mother and - now I'm a bit in a muddle. I prepared a statement which I thought, I want to read now. Can I just start it and we see how it goes? It's not addressing you, it is really my experience, how I was treated in the hospital during Gaia's illness.
HMC:	What I'm looking at is the question I have to answer, it's how Gaia came by her death.
Lady Young:	I address that.
HMC:	So I appreciate it's extremely important to you how you were treated, very important indeed. But what I'm looking at is Gaia. I don't say that it's not important, it's extremely important how you were treated, but that's not a question for this court.
Lady Young:	But I talk as well about how Gaia was treated, how she was completely misdiagnosed, how signs were misread. Yes, that's what I'm basically talking about.
HMC:	So, your understanding of the diagnosis and your analysis of the diagnosis I can't accept from you. I can accept a description of how Gaia looked, so if you want to move directly to that. I'm sure that you don't... you're saying, I'm sure that you will remember, I'm sure this is indelibly printed on your brain. If you want to tell me some detail of how Gaia looked at a particular stage, I'd be very happy to take that.
Mr Brook:	Madam, may I make a very small suggestion and I apologise

	because I realise this is your court. If Lady Young could be permitted to read her statement but then you then decide which parts of it you feel you can take into account and which you cannot, I'm sure it won't influence your judgment in any way. You could simply exclude those parts.
HMC:	Well, rule 27 of the Coroners Rules is very specific that no person may address the coroner as to the facts. So I can't have the rule offended in court. So go to what you...
Lady Young:	I'm not really addressing you, Madam Coroner.
HMC:	Go to what you saw, Lady Young. Tell me about what you saw, signs, what Gaia was doing, how she looked. I'd be very happy to take any of that from you.
Lady Young:	I'm stuck now.
HMC:	Lady Young, was it your intention simply to read a statement, rather than giving oral evidence? Because if that was your intention...
Lady Young:	The oral evidence is part of my statement, it's all embedded in one document. I have never been to a coroner's court. I thought that I as the mother could take 13 minutes to read, to in a way...
HMC:	I'm not making myself clear, I'm so sorry. What I'm trying to ask you is whether everything you wanted to say is written down, is in the document.
Lady Young:	Yes.
HMC:	Right, then we can deal with it in this way. If Mr Brereton will come and take the document from you, I will look through it and any parts that I think are admissible - thank you, Mr Brereton - I will read out, because then everyone will know what I'm taking into account. If

	<p>you would like to go to sit down now. If there's anything additional then you can pop back into the witness box afterwards.</p>
Lady Young:	<p>Okay.</p>
HMC:	<p>So, I'm reading from the statement of Gaia's mum, Lady Dorit Young of Dartington.</p> <p>Gaia was a much loved, beautiful and healthy young woman who was admitted to hospital on Saturday night, 17 July 2021 and within 16 hours she was effectively dead. I believe that with proper care she need not have died. I believe that she lost the chance to live. How can it be that a previously healthy young woman dies in a leading hospital and yet nobody knows why?</p> <p>The last time I saw my daughter alive was in the ambulance as it left our home at 10:45pm on the Saturday night, taking her to UCH. From 7:30pm that night she had a sudden severe headache with awful vomiting bouts, she was still vomiting upon admission. She was very seriously ill.</p> <p>Her mental state was confused and altered, yet she remained conscious. I think that Gaia would have been very scared, embarrassed and self-conscious in hospital.</p> <p>I'm paraphrasing but I think it's implicit here that Lady Young is saying that she thinks that Gaia would not have taken drugs.</p>
Lady Young:	<p>No way.</p>
HMC:	<p>That's really helpful information, thank you.</p> <p>I was not kept informed. There was a single call at 1:17am on Sunday morning from a withheld number, no message left and no number given to call back. There was another single call at 9:41am. I was on the phone myself and again, no message was left. There was no further attempt made to contact me.</p>

	<p>I don't recognise my daughter in any of the clinicians' descriptions. Gaia was a responsible, polite, clean living, thoughtful young woman, with a keen interest in her own health and her intellectual and professional development. She was also very protective over me and as her only parent left, would not have wanted to worry me. She was my beloved child. If anyone had asked me, I would have told them that it's simply not possible that she would have been recreationally intoxicated. Gaia was able to say and did say no to drink and drugs.</p> <p>Desperate for news, I went to the hospital at 10:35am and called from inside reception, which COVID restrictions prevented my passing. A call came to me at 4:27pm after Gaia had effectively died and I was told that the decision had been made for no other intervention. I was asked by the doctor, can you tell me if Gaia was taking drugs. I was so shocked I was unable to understand anything.</p> <p>I ask for a face to face meeting with the trust with two nurses, should they be willing to do so, each of whom showed real care towards Gaia in her last moments of life. If I could talk with these plainly caring nurses, it might help me to find Gaia in those 16 hours at UCH and give me some peace.</p>
HMC	Ms Robertshaw, I'm sure that a meeting with the trust can be arranged, can't it?
Ms Robertshaw:	Yes, absolutely, ma'am. Thank you.
HMC:	Thank you. Those are very helpful bits of information, so thank you very much. I formally admit that under rule 23 of the Coroners Rules, thank you. I now call Thomas Samuels. Dr Samuels, would you like to swear on a holy book or would you like to affirm?
Dr Samuels:	I'd like to affirm, ma'am.

	<i>Affirmation made.</i>
HMC:	Thank you. Can you please give me your full name, your professional role and your professional address?
Dr Samuels:	My name is Dr Thomas Samuels, my professional role is internal medical trainee at University College Hospital and my professional address is the address of the hospital, 235 Euston Road, London.
HMC:	Thank you. Dr Samuels, when you say that you're a trainee, tell me when you qualified in medicine.
Dr Samuels:	2015.
HMC:	Assuming things go according to plan, when might you expect to be appointed as a consultant, roughly?
Dr Samuels:	In approximately eight to ten years' time, I would think, depending on a variety of career decisions.
HMC:	Dr Samuels, I know that you're not in the room alone, that's perfectly acceptable. However, please remember that your evidence must be yours and only yours. So you aren't able to speak to anybody else during your evidence giving, even if it's just a fact check. However, you're very welcome to refer to your statement if you need to, and certainly to refer to the medical records if you need to. If you want to look at any other document, including any notes you may have made for yourself that aren't part of the medical records, then you need to raise that with me and we can discuss that. Do you understand the warning that I've given you?
Dr Samuels:	I understand. I have some written notes in front of me, I'm happy - would you like to see them? Or how may I present those? I'm able to put them to one side and not use them if that would be

	preferable.
HMC:	I think it would, because any notes should be shared with everybody.
Dr Samuels:	Of course, that's absolutely fine. I'll put them to one side.
HMC:	<p>But do feel free to refer to the medical records at any point, should you need to refresh your memory.</p> <p>So, tell me how it was that Gaia Young came into your care.</p>
Dr Samuels:	<p>I was one of the junior doctors on the acute medicine unit on 18 July. I started my shift at about nine o'clock in the morning and one of the first things we do on that day in the morning is to look at the patients who are on the acute medical unit, the ward in which I was based and the ward in which Gaia was currently a patient. Understand who the new patients are who have arrived since we were last on the unit, as I was working also the day before.</p> <p>The reason for this is the first thing that we do in the day is to undertake a post-take consultant ward round. It's trust policy and indeed national guidance, I believe, that all patients are seen by a consultant within 24 hours of admission. So the purpose of this round was to make sure that any patients who came in out of hours, by which I mean usually overnight as Gaia was, are seen in the morning to make sure that guideline is implemented.</p> <p>So as part of that, we go through the list of patients on the ward on the computer system and we identify those that are new and those that need to be seen. So that's the first thing that we did and that is when I became acquainted with Gaia, at least from her medical notes. I would have done that between about 9:00 am and 9:45 am.</p>
HMC:	What next?

Dr Samuels:	<p>So at that point we would review all of the new patients on the unit and we would primarily want to understand whether there is anybody that we should prioritise or see first because they are obviously unwell, from their medical records. In this particular case that day and has previously been mentioned by Dr Hasford in his statement, Gaia's early warning score, which is a score we use to determine how sick patients are, was normal. So we didn't identify her as a patient who needed prompt review, so we planned to review with her along with all other patients on the post-take ward round.</p>
HMC:	Please do go on.
Dr Samuels:	<p>So we commenced that ward round at about 9:45. During the ward round one of the senior nursing staff, [Elizabeth Muldoon], came to me directly during the course of the ward round and advised me that she'd received a telephone call from Gaia's mother informing her that she was very worried about her, that her behaviour was highly unusual and specifically that she felt like she hadn't taken any alcohol or taken any drugs in the time leading up to her admission.</p> <p>The information that I had at the time in advance of that was the notes that had been taken by the emergency department and by the medical registrar overnight. Those notes had suggested that some form of alcohol or drug intake was the primary thought behind the cause of her symptoms. So this new information to me felt concerning. It was information that I felt made alternative diagnoses more likely and made me sufficiently concerned about how she had presented to ask Dr Hasford to divert the ward round to see her next.</p>
HMC:	Please do go on.
Dr Samuels:	<p>So we arrived at Gaia's bedside about 10:25 in the morning. Dr Hasford has already provided a statement as to his assessment of</p>

	<p>her on the ward round. From my own recollection, she did appear to be behaving abnormally. She was drowsy although she was easily awoken, she did fall asleep during other questions during the round. She did at one point pull the duvet back over her head, although she did answer most of Dr Hasford's questions reasonably appropriately.</p> <p>I remember her specifically identifying that it was a concern of hers that she was to miss a dance class that day, I believe with her mother and that she was worried about that. Dr Hasford examined the patient, Gaia and found the specific findings that he has mentioned but that I will repeat. That her pupils were slightly small and sluggish, but that the rest of her neurological examination was essentially normal and there was no other part of the examination that was concerning at that point.</p> <p>We looked through her blood test results as they were at the time and he then came to a decision that the primary things that we should do were to do a CT scan of Gaia's head. Following that we were safe to carry out a lumbar puncture to try and get more information as to what the diagnosis might be. My understanding at the time was that our primary concern was a brain pathology of some sort, but at this point it wasn't clear exactly what that was.</p>
HMC:	So by this stage, you're no longer looking at intoxication as the primary cause?
Dr Samuels:	I would say that intoxication, for reasons that have been explained in the sense that substances that we cannot test for and substances that she may not have taken herself were still a possibility, but other possibilities had become much more prominent at that point.
HMC:	If you had had the information from her mum - obviously in normal times, in non COVID times, family would have been allowed in with her - if you'd been in that situation and Mum had said earlier on, look, this is not going to be intoxication, she'd not taken alcohol,

	she'd not taken drugs, would that have changed what you did earlier, do you think, what the team did earlier?
Dr Samuels:	I think it would at most have led us to see her first on the ward round at 9:45. I don't think it would have changed what we did in the first instance, because the tests that we decided on doing and the treatment that we gave at the time, which was primarily antibacterial medication, antiviral medication, that's what we would have done even in possession of that information. So I think at most it would have led to her being viewed maybe 40 minutes before she was.
HMC:	There wouldn't have been a change to the care overnight?
Dr Samuels:	It's difficult for me to comment about the care overnight. I can only answer what I would have done in that particular circumstance had I known that information. I would have prioritised her to be seen first on the ward round at 9:45.
HMC:	So by 10:45 or shortly thereafter, you've got a plan for CT scan and then for a lumbar puncture. Your primary concern is of brain pathology. What next?
Dr Samuels:	At the bedside I called to protocol that scan. To quickly make sure that that's clear exactly what that means, in order to get a scan one has to first request it on the computer system that we use. One then has to call the radiologists who are clinicians in the hospital at the time in order to get the scan accepted formally to be done, which is an act known as protocolling. The scan is then organised in terms of the logistics and taken down to the scanner, that is done with radiographers who run the machine. So the important thing to do was to make sure that the scan was protocollled and therefore, when the radiographers had space they would then prioritise her to come down next. So I protocollled it at the bedside before we left the ward round in order to try and speed

	that process up. We prescribed the antibiotics and antiviral medication as per the trust guidelines to cover for encephalitis as the potentially reversible cause of this presentation, so they were also prescribed then.
HMC:	I'm sorry to interrupt, forgive me. You prescribed antibiotics and? I just missed that.
Dr Samuels:	Antiviral medication.
HMC:	Thank you, please do go on.
Dr Samuels:	So at that point we had a clear plan in place. We weren't sure of the diagnosis but we were sure of the tests that we were going to do next to try and ascertain what that diagnosis was. We'd given treatment for the reversible cause that we thought most likely, so at that point we felt it was safe to proceed with the ward round and see other patients.
HMC:	What next?
Dr Samuels:	We finished the ward round about midday and as we usually do, I sat down with the two FY1 doctors who were with me on the unit to discuss what jobs were urgent and what we needed to prioritise. Gaia was the patient I was most concerned about out of all the other patients on the unit, so I prioritised her to go through the jobs that we generated from that ward round. I reviewed her chart first and I noticed that she was on her way down to the CT scan, but the images were not yet available for that. I knew that we were going to proceed to do a lumbar puncture later in the day but we needed a normal, un concerning CT head report first, so I waited at that point for that to come through. Part of the rest of the plan was to obtain neurology specialist advice, so the next thing that I did was to call the registrar on-call for the hospital, which is Dr MacDonald. I took her through the

	<p>details of the case at around 12:30 and asked her whether she supported our thinking and our diagnosis range and our management plan in the first instance and whether she would advise any further investigations or treatments be commenced at that point.</p> <p>She replied that she agreed with the likely diagnosis as it stood and the plan was a good one, but that she would also include a non-urgent MRI scan of the brain that could occur on Monday, which would be the next day. She would also advise us attempting to get an electroencephalogram, an EEG, on the same day if possible, but to discuss with the department that carries out that test as to whether that was something that they could provide.</p> <p>So that was the next phone call that I made, was to that department, to the electrophysiology department at the National Hospital. That phone call was about five minutes past one. The physiologist on-call took my phone call and she said that she would discuss with her consultant first as to whether that scan was indicated out of hours or whether it could wait for the following day. She subsequently returned my call about half an hour after that first phone call saying that it could wait, after her discussion.</p> <p>Between those phone calls I passed by Gaia's bedspace to make sure nothing had changed clinically, because I was concerned about her. On appearance she remained precisely the same as when we'd left her on the ward round earlier that morning and the nurses expressed no new concerns above and beyond what we were already aware of.</p> <p>The next key point was that around about 1:40pm I saw that the CT head scan had been done of Gaia's head and had been reported by one of the consultant radiologists in the hospital as normal. I looked at the images myself and within the limits of my experience they also appeared normal. So in that case, the management plan at that point was to safely proceed to do a lumbar puncture test.</p>
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HMC:	So what's the significance of a normal CT before proceeding to lumbar puncture?
Dr Samuels:	In Gaia's particular case, because she was behaving strangely, one of the potential causes for that would be raised intracranial pressure. The CT head scan would show evidence of that and so getting a negative scan, or what I should say is a normal report, would then support proceeding to an LP, or a lumbar puncture.
HMC:	What if she'd had raised intracranial pressure?
Dr Samuels:	Then that would be cause for concern. I would not proceed to do the test at that stage and I would then call back the neurology registrar for further advice. That's what I would have done.
HMC:	Why is it that you wouldn't conduct a lumbar puncture if a patient had raised intracranial pressure? What are you worried about?
Dr Samuels:	The primary thing I'd be worried about in that circumstance is that the act of doing the lumbar puncture and relieving some of that pressure would cause the brain stem to herniate, a process known as and as has previously been referred to by the witnesses, coning.
HMC:	So you had a normal CT. What happened next?
Dr Samuels:	At that point, I briefly rereviewed Gaia and she remained much the same as she had been about an hour previously. I was with one of the other junior doctors, Dr [Westby], he's one of the foundation year 1 doctors who was working with me at the time. I knew that Dr Westby had previously done these procedures, so I asked him whether he felt comfortable and confident to make the first attempt at this procedure, which he replied that he would. I asked him to talk me through the procedure briefly and he did so to the standard I would expect. So I felt confident to supervise him

	<p>to do the lumbar puncture on the first attempt in the first instance. We took a period to prep the equipment that we'd need, so we eventually started the procedure around about quarter past two in the afternoon. I assisted Dr Westby, so I was present the entire time and directly observing what he was doing.</p> <p>He made a technically very competent attempt at the lumbar puncture in the first instance, following what would be standard guidance for doing the procedure. However, he was unable to place the spinal needle in the intrathecal space. At about five minutes into the procedure, approximately that, Gaia became more agitated after previously being very calm and compliant with the procedure and doing very well. So at that point I felt that the correct thing to do was to abandon the procedure and repeat it at a later time, with me doing it.</p>
HMC:	Did you consider that the agitation might be a consequence of the lumbar puncture, it might not just be about the fact of two doctors trying to carry out a procedure, but it might actually be a consequence of the lumbar puncture itself?
Dr Samuels:	I did consider that. Dr Westby had used an adequate amount of local anaesthetic during the procedure to make sure that the area was totally numb. Up until the point that Gaia quite acutely became agitated, she had managed it very, very well indeed and hadn't made any indication that it was causing her discomfort. I did think that the procedure was one potential option and certainly thinking about what was causing her agitation was going to be a primary concern moving forward attempting it a second time, because I wanted to know how best I could support her to not be agitated.
HMC:	So what did you do?
Dr Samuels:	The plan in the first instance was to give her some time to relax and then to come back fairly shortly afterwards. Quite shortly after we finished the procedure she complained about headache, so one

	<p>of the things I considered was we may have not given her sufficient analgesia for that. That may have been the reason that she was agitated, so that was something that was at the forefront of my mind in terms of performing it for a second time.</p> <p>As we left the bedside, I met both Dr MacDonald, the neurology registrar, who'd come to review Gaia in person at about 2:30 or so. Also I met [John Scully], who was one of the specialist nurses working for the patient emergency response and resuscitation team. They are a critical care outreach team who review patients who are deemed to be unwell or at risk of intensive care admission. The nursing staff had referred Gaia to them, entirely appropriately and so we discussed the case and he reviewed Gaia as well and he felt the plan that we had going forward was appropriate. So I left the bedspace and I returned at around about just before 3:00 pm to do the lumbar puncture the second time.</p>
HMC:	Is it normal to develop a headache following a lumbar puncture?
Dr Samuels:	If the lumbar puncture is done to completion, one notable side effect that can occur is something called a post LP headache. It occurs in about 10-30% of the patients depending on the data source that you use, but it's usually very benign. I didn't think it was that that caused the problem because Dr Westby hadn't accessed the intrathecal space with a needle, so we'd in effect not done a lumbar puncture at that point. I felt that on the basis of what I knew at the time, the headache was entirely probably due to whatever underlying disease pathology was going on in her brain.
HMC:	You spoke to Dr MacDonald, Dr MacDonald's a registrar. Did you think that you needed to go back to speak to a consultant at this stage?
Dr Samuels:	I know that when I originally spoke to Dr MacDonald on the phone that she was going to review the case with a consultant, she'd said as much. I didn't feel anything else had changed that would require

	me to seek advice in excess of what her advice would be and what Dr Hasford's advice would have been on the post take ward round.
HMC:	You didn't think you needed to go back to Dr Hasford?
Dr Samuels:	Not at that point. I felt that the key advice that we needed was from the neurology team and that was the advice I was waiting for.
HMC:	Looking back, do you think you were right about that?
Dr Samuels:	I think looking back, knowing what I knew at the time, I wouldn't have done anything differently at that point.
HMC:	So just before 3:00pm you return. And then what?
Dr Samuels:	The plan at that point was to repeat the lumbar puncture. As I've previously mentioned in my assessment that her agitation, Gaia's agitation during the first procedure may well have been due to the headache she was suffering. So we gave her some pain relief shortly before starting the procedure to help her better tolerate the procedure. That was given at about just after ten past three, so at twelve minutes past three. Then shortly after that, I started the procedure with Dr Westby assisting me.
HMC:	What happened?
Dr Samuels:	<p>Initially everything went to plan. Gaia was very co-operative and she was easily able to assume the position that we need to do the lumbar puncture. I felt I could feel the space between the bones which I would need to go fairly well and I cleaned the area and using a sterile technique, as you normally would, I started applying the local anaesthetic, first to the skin and then to the deeper tissues.</p> <p>So it was at the point that I'd just finished putting the local anaesthetic into the deeper tissues that Dr Westby commented that he felt Gaia had become unresponsive. So I asked him to turn Gaia</p>

	<p>to face me so I could better assess her. It was immediately apparent to me that she was unresponsive. She didn't appear to be breathing but on palpation of her pulse I could feel a pulse, albeit a fast pulse and a thready pulse. At that point I asked Dr Westby to pull the emergency buzzer next to the bedside and we started resuscitation.</p>
HMC:	<p>Just before we talk about the resuscitation, you explained, Dr Samuels, that you started applying the local anaesthetic to the skin and then to the deeper tissues. Just help us with how you do that.</p>
Dr Samuels:	<p>Of course, the idea of the local anaesthetic is to stop any pain from the procedure. The areas that cause pain are around the bones and the very superficial skin so those are the two places that you apply anaesthetic. You use a very small, thin needle to apply a small, what we call a bleb, of anaesthetic just underneath the skin at the site at which you plan to insert the needle. A site that you've previously identified by palpating the spinal bones and understanding where you want to go.</p> <p>You then wait a while for that to work, maybe 30 seconds to a minute or so. Then you proceed to use a slightly longer needle but a much smaller than you would want, than one you would use for the actual procedure itself, to apply local anaesthetic around where the bones are to make sure that the needle passes between them without causing any pain. The idea being that the patient is going to be pain free, comfortable and can sit entirely still for the procedure.</p>
HMC:	<p>Does that needle go into the intrathecal space?</p>
Dr Samuels:	<p>It does not, no.</p>
HMC:	<p>Did you puncture the dura at all?</p>
Dr Samuels:	<p>No.</p>

HMC:	You asked Dr Westby to pull the emergency buzzer and you began resus. Who came to assist you?
Dr Samuels:	Pardon me, ma'am, I didn't quite hear the end of that question.
HMC:	You asked Dr Westby to pull the emergency buzzer and you began resuscitation. Who came to assist you?
Dr Samuels:	In the first instance the emergency buzzer summons anybody who's in the nearby environment to come, so it was all the nursing staff who were there and one of the other doctors, Dr [Leigh], who was also on the unit that day. That's who would come to assist me in the first instance. The normal procedure is then to put what's called a 2222 call out, which summons help from the emergency response unit within the hospital that's made up of a variety of different clinicians, in order to come and support acutely unwell patients.
HMC:	Who made the 2222 call?
Dr Samuels:	I asked one of the nursing staff.
HMC:	Did the team then respond immediately?
Dr Samuels:	They responded in a timely fashion, yes.
HMC:	Just take us through what you as a team did in order to try to resuscitate Gaia.
Dr Samuels:	In the first instance, my primary thought was that she had what's called a respiratory arrest, by which I mean that her breathing had stopped but her heart had not. So the key thing in that circumstance is to get her breathing again. What we did to do this initially was to flatten her bed to allow us to better treat her, to pull her bed away from the wall so that I could access the area around her head. Then I was asked to be given both what's called - well

	<p>two devices, one of which is called a bag valve mask and the other which is called an oropharyngeal airway.</p> <p>The purpose of the former is what it is described to be, it is a bag attached to a mask with a valve that allows the clinician to breathe for the patient by applying the mask to their nose and mouth. You can also add oxygen to that system to try and get oxygen into the lungs. They're both things which we did. The idea about the oropharyngeal airway, that is a device that's designed to hold the airway open by inserting it into the mouth and round the back of the tongue.</p> <p>The concern was that because Gaia's Glasgow coma score had dropped to three out of fifteen at that point, was that she may not protect her airway on her own. So that device was inserted to make sure that we had access to her airway so when we were using the bag valve mask, that we were able to oxygenate her lungs freely.</p> <p>She very rapidly, having previously gone blue, returned to a pink colour within about 60 seconds of us first assessing her as being unresponsive. That would tend to indicate that we had adequately oxygenated her and the results from the first of the blood gases that were done as part of the resuscitation attempts supported that we had very quickly returned her oxygenation to normal.</p>
HMC:	How long was it after you were sure that Gaia was breathing that Dr Westby drew your attention to the fact that she was unresponsive?
Dr Samuels:	I was not aware that Gaia had stopped breathing until Simon Westby alerted me to the fact that she had become unresponsive.
HMC:	But how long was it before then, the last point when you were completely confident that Gaia was breathing?
Dr Samuels:	When I started the procedure she was breathing. I didn't make note of her breathing after that, so it's impossible for me to say beyond

	that of when she stopped.
HMC:	How long was it after the start of the procedure that Dr Westby said she's unresponsive?
Dr Samuels:	I see, apologies. I didn't look at the clock so it's difficult to say precisely. I would say based upon the stage that we'd reached in the procedure that it would have been no more than about three minutes.
HMC:	Presumably during that period of necessity the patient has to be turned away from you?
Dr Samuels:	That's correct.
HMC:	So Gaia's colour returned to pink and what then?
Dr Samuels:	At that point, I felt that we'd managed her airway and breathing appropriately. In a usual resuscitation attempt your focus then moves to circulation, i.e. how well the heart and the blood vessels are performing and whether they're adequately perfusing the body. To that end I'd already asked for the emergency resuscitation trolley which is on the unit to have been brought to the bedside and the electrical sensing pads that come with the cardiac defibrillator to be placed on Gaia's chest so that we could monitor her heart rhythm, to assess whether that was normal or abnormal. We also took a blood pressure to understand whether her blood pressure was normal or abnormal.
HMC:	What did you find?
Dr Samuels:	We found that she was very tachycardic, so her heartrate was very fast, it was approximately 160, from memory. Her blood pressure was very high, her systolic blood pressure was about 185 and the diastolic pressure was about 100. Her actual heart rhythm was highly abnormal. So at that point, my assessment of the rhythm

that whilst it was highly abnormal and very concerning to me, is that at present she had a strong pulse and that she was pink in colour and so she was perfusing the rest of her body adequately.

The primary issue seemed to be the one of her having stopped breathing, which we were managing. So I resolved to continue to monitor that but not intervene with that at this point in time, to understand how that evolved over time. Around about that sort of time, the emergency response unit who had been called by the 2222 call started to arrive.

That team is broadly speaking made up of several different types of professionals. There are representatives from the anaesthetics team, from the intensive care team, from the medical team and also porters to help with fetching samples or running samples to the lab. One of the two key senior decision-makers that attended - well I would say three perhaps - were the anaesthetics registrar, the medical registrar and one of the ICU consultants.

At that point, I asked whether the anaesthetic registrar would like to take over from me in managing Gaia's airway, as that's their area of expertise. They agreed and so we provided a safe transfer of care for that particular regard which allowed me to step back towards the foot of the bed and discuss what had led us to this point with Dr Harris, who was the consultant intensivist and Dr [Donovan], who was the medical registrar.

At that point, I explained to them exactly what I told the court. Dr Harris asked me in detail about the details of the lumbar puncture and exactly what had happened. I again explained in much the same way as I've explained it here. He asked me how much local anaesthetic I'd used and whether it was possible that the local anaesthetic had gone into a blood vessel or the spine. I replied that I used less than the amount of local anaesthetic that is judged to be safe for a particular person during a procedure and that based upon my assessment and what I'd observed that there was no indication that it had gone into a blood vessel or that it had gone

	<p>into the spine.</p> <p>I discussed the cardiac trace with Dr Donovan. We both reviewed that again and we found that it was now looking much more normal, albeit still fast but now at a rate of about 130. With a blood pressure that had come down to more usual albeit still raised levels, about 140 systolic, there or thereabouts. So at that point we felt that it did not need further intervention. It was around about that time that the anaesthetics team who were managing Gaia's airway reported that her pupils were dilated and unequal in size.</p>
HMC:	What does that indicate to you?
Dr Samuels:	<p>That would indicate that some severe intracranial event had occurred. At that point, we reviewed the situation as we were aware of it. That is that Gaia had become abruptly unresponsive, stopped breathing but had maintained her cardiac output throughout. We very quickly re-established ventilation of her lungs and so oxygenation of her body, but there had initially been abnormal electrical activity of the heart, but that that had seemingly improved. But that she was still unresponsive with a GCS of three and she had pupillary signs that would indicate she had a severe intracranial event of some description.</p> <p>We reviewed that together as a team and the decision was made that firstly, Gaia needed a repeat CT scan of the head to understand whether there was an observable cause for this severe intracranial event. To do that safely she would need to be intubated, by which I mean a tube would have to be placed into her windpipe and then attached to a machine to breathe for her and that would mandate that she would then be transferred to the intensive care unit for further management.</p> <p>So at that point, with that decided and plans being made already to intubate her and transfer her to the CT scanner, I asked Dr Harris and Dr Donovan whether it was okay that I handed Gaia's care over to them to continue her treatment. Dr Harris in particular, who</p>

	would have taken over all responsibility for Gaia's care, as she was going into the intensive care unit said that that was fine. So that was the last point at which I was directly involved in her care at the bedside.
HMC:	Looking back on all of this, Dr Samuels, if you had another Gaia tomorrow is there anything that you would do differently?
Dr Samuels:	I've thought about this an awful lot and based upon the information I had, I have to say I don't think I would do anything differently.
HMC:	I have consultants who are going to help me insofar as they can with the medical cause of Gaia's death, and I appreciate that obviously you're still a doctor in training, you're still a junior doctor, but nevertheless you were there at the time. So I'm going to ask you for your insight. Is there anything you can tell me that might assist in reaching an understanding of how Gaia came by her death, most particularly what the medical cause of her death was?
Dr Samuels:	I think we've so far gone into this in quite significant detail in terms of what the various investigation results have been since the events that I've described and they've not really made anything any clearer than it is already. I don't really have anything else to add to what's already been said. My thoughts, as much as I am junior to most of the people who've given evidence here today, are very much the same, I don't know. That's as much as I know, as unsatisfactory as that is as an answer.
HMC:	Dr Samuels, is there anything else you think it would be helpful for me to know?
Dr Samuels:	Not that comes to the top of my head.
HMC:	Thank you. Lady Young, I don't know whether it's going to be you or Mr Brook who asks questions?

Lady Young:	Both of us.
HMC:	Who's going to start?
Lady Young:	I think I'll start. Dr Samuels, I'd like you to talk us through both lumbar punctures in much more detail than you have done so far. But my first question to you is that I know from [Sister Elizabeth Muldoon's] recollection that she discussed with you that I would be called at 12 o'clock and you promised to do so. Why did you not call me? You knew I was absolutely beside myself, Gaia was a patient you were very worried about and yet you didn't see it as necessary to inform me as the mother that Gaia was actually quite poorly.
Dr Samuels:	I didn't hear all of that, but I think I got the gist of the statement and the question. In response to Lady Young's question, I can only apologise that I didn't call you at the time which you described. The explanation of why I did not relates to the fact that I was doing everything in my power to try and progress Gaia's care as fast as I could to get us to an answer and to try and identify something that we could treat. But nevertheless, I recognise that communication during the cause of the day would ideally have been better than it was.
Lady Young:	Okay, can you just tell me who was actually in charge of Gaia's care at the time of the lumbar punctures? Who was in charge?
Dr Samuels:	Could I clarify the question as to who was overall - are you asking who was overall responsible for Gaia's care?
Lady Young:	Yes.
Dr Samuels:	Or who was in charge on the unit? Because the answers to those questions are slightly different.

Lady Young:	Who was in charge of Gaia's care, Dr Samuels?
Dr Samuels:	The ultimate person in charge and responsible for Gaia's care at that point was Dr Hasford, the acute care physician, who we previously had a statement from. But he was not present on the unit at that point, I was the most senior doctor on the unit at that point. So it would be me that I think your question, the answer to your question, I think, is it would be me.
Lady Young:	All right. Can you just tell me who was present at the first lumbar puncture attempt?
Dr Samuels:	Myself and Dr Westby, one of the foundation year 1 doctors.
Lady Young:	Do you consider Gaia a more difficult patient for a lumbar puncture? We have heard that she was rolling her head, she was fidgety, she was restless. So there was no basically sedation considered beforehand and you gave that task - I think Dr Westby actually volunteered.
Dr Samuels:	There are several questions there, I'll try to deal with them in turn. Physically speaking, Gaia would have been quite a straightforward person to LP as she was quite slim. So feeling the bony landmarks that we need to do in order to accurately direct the needle were fairly straightforward for her. She had previously been restless on the ward round but during the initial attempts to do the lumbar puncture she was very calm and collected. So actually it was a relatively straightforward thing to try and do in the first instance. I apologise, I believe there was a third question you asked. Would you mind repeating it?
Lady Young:	I think you answered that question. How did you consent Gaia?
Dr Samuels:	Gaia, at that point, we didn't believe was able to consent for herself, so we proceeded to do the LP on a best interest decision.

Lady Young:	You didn't see it necessary to take consent from her next of kin, even by phone? The lumbar puncture is after all a potentially fatal procedure.
Dr Samuels:	On the whole, lumbar punctures are a procedure in which severe events occur very rarely and it was a procedure that I felt needed to be done promptly. So whilst I agree, I think in a perfect world discussing it with you would have been ideal, I don't think it was strictly necessary to do at the time. I think proceeding with the diagnostic investigation in the first instance was the best course of action.
Lady Young:	You said it was a procedure to be done promptly, but was it to be done urgently? Was there a timeframe to it?
Dr Samuels:	The procedure needed to be done that afternoon, the earlier the better really, because we needed some answers from it in order to progress her care. We'd done what we could at the time and in order to do anything further we would need more information that we had.
Lady Young:	Thank you. My question was who was present at the first attempt of lumbar puncture?
Dr Samuels:	Pardon me, Lady Young, did you ask who was present at the first attempt?
HMC:	Yes.
Lady Young:	Who was present at the first attempt, yes.
Dr Samuels:	Yes, at the first attempt it was myself and Dr Westby.
Lady Young:	Can you describe how you put Gaia into the position for the lumbar puncture?

Dr Samuels:	<p>Of course. So the position of the lumbar puncture, it can be done in several different ways, but the one in which we wanted to do it for her is essentially the foetal position. Although to describe it in further detail, the patient's neck needs to be flexed, their hips flexed and so they're tucked up into a ball. The idea there is to try and open the spaces between the lumbar vertebra as much as possible to make it as likely as you can that you can access the space between them and therefore insert the needle into the intrathecal space to get the samples.</p>
Lady Young:	<p>Am I right that you were the first person to hold Gaia in that position whilst Dr Westby did his attempt at the lumbar puncture? Can you describe how you were holding Gaia? Dr Westby says very clearly in his report that you were holding Gaia in position. How did you do that?</p>
Dr Samuels:	<p>Of course. So I was gently putting a hand on the back of her neck and gently putting a hand underneath her feet to try and keep her, whilst not restraining her, in the position that we needed her to stay. Initially I didn't need to do anything and I didn't need to change the position at all. She achieved the position we needed to with relatively little difficulty and as I previously described, during that initial stages of the procedure held that without much in the way of problems.</p> <p>But when she started to become agitated, I briefly held her in position before instructing Dr Westby to take the needle out, so that no matter where the needle was we could be sure that it wasn't going to cause any damage. At that point I took my hands off.</p>
Lady Young:	<p>But it was nevertheless a significant posture change to the posture she had been in before, I would assume.</p>
Dr Samuels:	<p>Pardon me, Lady Young, I didn't quite hear that.</p>
Lady Young:	<p>I think putting Gaia into a foetal position, curling her into a little ball</p>

	with what you call vertebral compression, would be still quite a different positioning to how you found her in bed beforehand.
Dr Samuels:	That's correct, yes, it is quite different because in bed, although she had her legs drawn up slightly, she was otherwise lying as you would expect her to lie, flat.
Lady Young:	Okay, in the medical records on page 124, you say that not only was Gaia agitated but she developed a very severe headache. You talked a little bit about the reasoning for that headache, can you expand on that please?
Dr Samuels:	Certainly. We were aware that - well our working diagnosis at that point was that she had a primary brain pathology of some description that was leading to her symptoms. She hadn't complained of a headache on the post take ward round, but a headache would be entirely in keeping, it would be a symptom that we would expect in somebody who had a primary brain pathology, it's a very common symptom. It was obviously uncomfortable enough to cause her some agitation at the time of the lumbar puncture, which is why I made the decision to give her some pain relief before attempting for a second time, to try and control that better.
Lady Young:	But do you agree there's a kind of temporal relationship between her suddenly having a severe headache during the attempted first lumbar puncture? She didn't have, as you just said, much headache before, but suddenly during the second attempt or the first attempt she developed a severe headache. So do you see there is any relationship between the attempt and the sudden headache?
Dr Samuels:	I was watching Dr Westby throughout the procedure and at no point did he get any indication that the needle was in an intrathecal space. Beyond that, I don't see how they could have been linked.

Lady Young:	Okay, would you agree that this could be read as well as a signal that her condition was deteriorating?
Dr Samuels:	I agree, it was, yes. I think it could be interpreted as that.
Lady Young:	Okay, so we know we have a patient with a very unclear condition. We know that her condition somehow deteriorated during the first lumbar puncture attempt. We know that Gaia was put from one straight position into a much more curled up position with some pressure on the part between the neck and the head. Would you agree with that?
Dr Samuels:	Again, I'm sorry, the connection is not particularly good at points, but I think I heard everything. It sounds to me as if you described the information that I've given over the course of the past few questions, so I would agree with that.
Lady Young:	So we have a deterioration in her condition. You know that the neuro specialist registrar was coming back to Gaia's bedside to review her. Then there was some discussion going on between her and Dr Westby that she would take further information from the consultant at the neurological hospital, is that correct?
Dr Samuels:	I believe so, yes.
Lady Young:	Okay, you didn't see it necessary to take another CT scan to make 100% sure that Gaia did not have raised intracranial pressure? We know her condition deteriorated, we know she was a very poorly patient, you knew that the neurological registrar was beginning to get worried that maybe the scan wasn't as normal as initially reported and she's going to take more advice. You're fully aware of that. Also another point, Mr Westby picked up that Gaia's sodium had dropped now to 123. The results came in virtually immediately after you abandoned the first attempt. Hyponatremia in itself can cause

	confusion, brain swelling, coma, death. Should this not have rung a warning bell?
Dr Samuels:	<p>There are a few points to make there and a few questions that you've asked, I'll try and take them in turn. Something that jumps out at me about the first line of questions that you use is that I was aware that the neurologist felt that the scan was abnormal and that is not the case. I was not aware that the neurologist understood that. If I'd been aware of that, then I would not have attempted the LP for the second time. So I think that assertion is incorrect.</p> <p>I understand that the development of a headache is potentially a new symptom and is something that should prompt us to assess the patient, of course. At that point, there was no other indication that we needed to repeat CT scan again and I was very mindful of the fact that we needed to get an answer to her underlying disease as soon as we practically could in order to better treat her.</p> <p>So given that the neurology registrar had not indicated to me that there was any concern about the scan, I proceeded based on the information that I had. I think that repeating a CT scan at that point would have only delayed her care. Based on the information that was available at that time to me, I think repeating the CT scan would have been the incorrect thing to do.</p> <p>Now I think that you also had questions about Gaia's sodium. It is correct that a repeat blood test of her sodium that showed that it was 123 was available to me prior to starting the procedure and I was aware of that. Her sodium had been 128 initially when she presented to hospital, so there was a drop between that and the time at which we were assessing her.</p> <p>As Dr Hasford mentioned in his statement and I have I believe here, that original sodium of 128 was noted on the ward round and felt to be secondary to whatever was causing the underlying disease process. So that was the information that I was working off. Further to that, Gaia had not drunk very much during the</p>

	<p>course of the day and clinically appeared to me to be somewhat dehydrated, although not severely.</p> <p>So I felt that the most likely cause for the drop in her sodium and indeed a drop in her potassium, which was also noted to 3.3, was probably multifactorial, but certainly had some sort of background in the disease pathology and at that time we assumed it to be secondary. But that probably she had some dehydration on top of that due to lack of oral intake over the course of the day. So I felt the best thing to do in the first instance was to prescribe some fluid intravenously to her to help rehydrate her and replace some of those electrolytes.</p>
Lady Young:	<p>But her sodium had dropped from actually 129 to 123, despite quite some intensive rehydration. So should this not have warned you? You say in your recollections that there was some discussion during the ward round going on about hyponatraemia in Gaia's case, but you couldn't recollect what they were talking. So you didn't pay attention to it really.</p>
Dr Samuels:	<p>My apologies, I thought you'd finished your question, Lady Young, I do apologise.</p>
HMC:	<p>I think go ahead, Dr Samuels.</p>
Lady Young:	<p>Yes, that's fine.</p>
Dr Samuels:	<p>So my recollection of the ward round was that I can't remember the precise content of the conversation, but that quite clearly Dr Hasford felt that the sodium was a secondary phenomenon. By which I mean that it was a consequence of the pathology that was going on in her brain and he felt that it did not require any management further at that point.</p> <p>All of the intravenous fluid that had been given to Gaia to resuscitate her had been given in the early hours of the morning. So she'd not received anything whilst I'd been on shift since</p>

	9:00am and of course at this point it's about 3:00pm, so a period of time that's nearly six hours. That was the rationale for my prescribing the fluid that I did.
Lady Young:	I accept it was a secondary symptom but still one that was seriously declining. Okay, let's move on to the second attempt. Who was present at the second attempt?
Dr Samuels:	That was myself, Dr Westby and one of the nursing students who was present, as one of the nurses on the unit had asked if she could observe for her own training.
Lady Young:	Another nurse was putting her head through the curtains every five minutes as well, were you aware of that?
Dr Samuels:	She placed her head through the curtain at one point, I do remember, but beyond that I don't recollect.
Lady Young:	Okay, how did you position Gaia for that procedure please?
Dr Samuels:	In a very similar position to the one that we placed her in for Dr Westby.
Lady Young:	But this time Dr Westby was holding Gaia?
Dr Samuels:	That's correct, Dr Westby was round Gaia's head, watching her and helping her keep in position.
Lady Young:	Do you think it is possible that under the conditions Gaia was in, with the possibility of a raising brain oedema, that the positioning and the specific curling of the body with some pressure on the neck could cause spontaneous herniation?
Dr Samuels:	I think that's a question that you would have to ask a specialist neurologist for a definitive answer, but to my knowledge, no.

Lady Young:	But I agree with you, we need a specialist neurologist to answer that question. Are you aware that the student nurse has given a very different report of the actual second attempt of the lumbar puncture?
Dr Samuels:	I'm not aware of the report and I'm not aware in what way it's different.
Lady Young:	Okay, it's different that she describes very, very carefully how you look for the space, how you put the local anaesthetic in. She describes you put it in, you wait a couple of minutes, you then proceed to the lumbar puncture. When the procedure has been finished, the emergency buzzer was pulled.
Dr Samuels:	Can I clarify something, Lady Young?
Lady Young:	Yes.
Dr Samuels:	So she says that I placed the local anaesthetic in position and then she says that I start the procedure? Am I correct in what I'm saying?
HMC:	So Lady Young, help me with where you're looking at, what page?
Lady Young:	I'm looking at the student nurse's recollections, it's the APPI statement, [Daniela Brioschi].
HMC:	What page?
Lady Young:	Page 1. Two doctors were present during this procedure, one doctor performed the LP and the other doctor and I kept Gaia still during the procedure. So two people were now holding Gaia. The doctor performing the LP firstly examined Gaia's lumbar area to find the right spot to do the puncture. Secondly, he gave her a local anaesthetic and he waited a little while so that the anaesthetic would be effective. He then started to undertake the LP. Gaia

	<p>would still appear to be in discomfort but responsive throughout the procedure.</p> <p>A few seconds after the doctor finished the procedure, Gaia became unresponsive. The doctor pressed the emergency button and all the staff promptly came with the crash trolley.</p>
Dr Samuels:	Lady Young, your question about that was what precisely?
Lady Young:	There is a contradiction between your description of the second attempt and the nurse's description.
Dr Samuels:	I agree that's a contradiction, yes.
Lady Young:	They're fundamentally different.
Dr Samuels:	I think she must be mistaken because that's not what happened. I'm very clear about what happened, I was doing the procedure and I never picked up the lumbar puncture needle to proceed.
HMC:	Sorry to interrupt, Lady Young. Dr Samuels, I think you said that this was a student nurse who wanted to observe for her own training?
Dr Samuels:	That's correct.
HMC:	You may or may not know the answer to this question. Had she seen a lumbar puncture before?
Dr Samuels:	Only she would be only to answer that definitively, but the impression that was given by the nurse who asked if she could observe was that she had not observed one of these before. As I said, that's the best of my knowledge, you would have to ask her whether she had seen it before.
HMC:	Thank you.

Lady Young:	But she was certainly in a position to observe you much better than you were in a position to observe Mr Westby when he did his first attempt, because you were holding Gaia on the other side of the bed whilst he was crouching down doing the lumbar puncture.
Dr Samuels:	She was not on the same side of the bed as me. She was on the opposite side of the bed, at the same side of the bed that Dr Westby was, so she wouldn't have had a clear view of what I was doing.
Lady Young:	Maybe we can ascertain that. But we also have another nurse's statement where she basically describes that once you had started the process, then five minutes later on, so there were quite a few minutes before the emergency buzzer was pulled. This nurse also describes very plausible - that she was very, very troubled by her experience of the day. I only want to put this out to the court. I don't know what the answer is but I want to put it out.
HMC:	What is the question?
Lady Young:	The question is we have contradictions in the descriptions how the second lumbar puncture was performed.
HMC:	What's your question for Dr Samuels? You've put that already, is there another question that you have for him?
Lady Young:	Dr Samuels, can you please comment on this discrepancy? How do you explain that?
HMC:	I think that you've already asked about that, Lady Young, and I think Dr Samuels has answered. You then went on to say that the nurse was very troubled, I can imagine she was. Did you have a question about that?
Lady Young:	No, I think I'll leave it like that, yes.

HMC:	Thank you.
Lady Young:	David, do you have a question now?
Mr Brook:	Yes, I have very few questions actually. The coroner asked you if it was normal to develop a headache after a lumbar puncture. You gave a description of how you could have a post-successful lumbar puncture headache, but you went on to say that you felt in this case the headache was probably due to whatever was going on in her brain. Do you recall saying that?
Dr Samuels:	That's correct.
Mr Brook:	Thank you. So why didn't you pause at that stage and not go on to a second lumbar puncture, when you had that red signal?
Dr Samuels:	I feel at that stage that was not a new piece of information that required us to change our management steps at that point. It was to be taken into account, absolutely, but it wouldn't have changed what we did next.
Mr Brook:	In the ward round earlier on, Dr Hasford had commented that the sodium levels were a secondary symptom, but I think they were indicative of a deterioration in the brain. That, I think, is the evidence you were given. As they dropped and the potassium level dropped, which you knew prior to the second attempt, that this was also linked to something that was going on in the brain. Let me just read you something, if this helps. I was concerned about both the low sodium and the low potassium. The former can lead to seizures in severe circumstances and the latter instability in the heart's electrical rhythm. This is a further likelihood of deterioration, isn't it? It's another red warning light, isn't it?
Dr Samuels:	It's another facet of her case that would and should be taken into account, yes, that her case was progressing. I agree with that, but as I said, I've explained how I interpreted that information and what

	I did about it.
Mr Brook:	The coroner then said, do you think you needed to go back? By that she meant go back to Dr MacDonald and you answered, I knew she was going to review the case and come back to me. Looking back, knowing what I knew at the time, I wouldn't have done anything differently at that point. But you've got a red light on potassium, a red light on sodium, a red light on headache, you knew...
HMC:	I'm sorry to interrupt, Mr Brook, but I don't think that Dr Samuels has accepted that these were red lights. So I don't think it's fair to...
Mr Brook:	Did you...
HMC:	So if you could just wait until I've finished what I'm saying to you.
Mr Brook:	Of course, madam.
HMC:	I don't think it's fair to put to him that he has these red lights when he hasn't accepted that they were red lights. He's described them as things to be taken into account. So I think you need to rephrase your question.
Mr Brook:	Did you accept that these were significant things to take into account?
HMC:	Dr Samuels has already said that he thinks they should be taken into account. You can move onto the next question, but I think it's unfair to characterise them as red lights.
Mr Brook:	What weight did you give them?
Dr Samuels:	Pardon me?
Mr Brook:	What weight did you give them in the - it's a judgement call, but

	what weight did you give them? You've got headache, which you could expect a mild headache, this is your evidence earlier on, after a successful lumbar puncture. You've said that the first attempt and indeed the second attempt were not successful. You've got severe headache, you regarded that as something - I felt the headache probably was due to whatever was going on in the brain. You've got continually falling sodium levels, these are dangerous levels now. I say they're dangerous because you characterised them as possibly leading to seizures.
Dr Samuels:	I confirmed that low sodium can lead to seizures, not that that specific level would necessarily lead to seizures in some or all people.
Mr Brook:	But it's reached a risk level, has it?
HMC:	I think you need to be more specific than that. So again, I think the question needs to be more precise. As Dr Samuels said, there's a difference between the possibility that a low sodium level can lead to seizures and this level being at the point where it could lead to a seizure. So I think you need to differentiate.
Mr Brook:	Thank you. Can I just read you something that you said in your statement? I was concerned about both the low sodium and low potassium. The former can lead to seizures in severe circumstances and the latter instability in the heart's electrical rhythm. Did you believe they were possible risks at that time?
HMC:	Well again, I think there needs to be more precision about the question. I'm sorry, Mr Brook, but there's a difference between these are potential risks and did you think that these levels at the time were putting Gaia at risk of these consequences.
Mr Brook:	I'm sorry, madam, I thought that was the gist. But if you accept the question as put by Madam Coroner, did you see them as risks in this case in that patient?

HMC:	So Dr Samuels, just to be clear about the question, did you think that the levels of sodium and potassium that Gaia had were at that point putting her at risk of these consequences?
Dr Samuels:	In my experience, which is by its nature limited compared to some of the other witnesses in this case, I've never seen seizures occur with a sodium of 123. I've not also seen electrical instability of the heart occur at a potassium of 3.3 either. I was aware that both were downward trending and my actions were therefore predicated on the fact that I wanted to arrest that downward trend before it got worse. I've explained already how my thinking went around that circumstance and what I did.
Mr Brook:	The coroner asked you the question, did you think you needed to go back? You said that you knew she was going to review the case. Then she asked whether looking back you would have done anything differently and you said no, in effect. You've got - I won't use the term red light, but you've got symptoms of a deterioration in the brain condition. You knew Dr MacDonald was making her own investigation and she would come back to you. Why not pause at that stage, or at least go back to her?
Dr Samuels:	Because I felt none of the new information impacted on the necessity to proceed with a lumbar puncture. There was no new information at that stage that changed the assessment that a lumbar puncture needed to be done. I was not aware of any information that had changed that assessment.
Mr Brook:	So you didn't regard falling sodium, falling potassium, a headache, as being new information?
Dr Samuels:	They're all indications of a possible primary neurological condition of which we were already aware, but none of those particular results would contraindicate going ahead and doing a lumbar puncture in the absence of other information.

Mr Brook:	The other information later because available from Dr McDonald but it was too late and that was not to go ahead. I'm sorry, Dr...
Dr Samuels:	That was not something that I was aware of at the time of doing the procedure.
Mr Brook:	Indeed not, but had you paused you would have become aware of it.
HMC:	Well, I think Dr Samuels has answered the question.
Mr Brook:	I think he has, madam, yes. You said that after Gaia stopped breathing you were able to resuscitate her and get breathing going again, but she could never breathe again unaided, could she, from that point onwards?
Dr Samuels:	That's correct.
Mr Brook:	That's correct, thank you. She never regained consciousness, did she, from that point onwards? Do you know?
Dr Samuels:	Pardon me, I didn't quite hear that one.
Mr Brook:	She never regained consciousness from that point onwards. You accept that, thank you.
Lady Young:	One question, Dr Samuels, from your point of view, what was the actual - what do you call it? What's the reasoning for the lumbar puncture in the first place? If you can just repeat it in your own words.
HMC:	I am actually conscious that we have other evidence to go to and as I've taken that evidence, I'm anxious not simply to rehearse evidence that I've taken already.

Mr Brook:	I've no further questions.
HMC:	Thank you. Ms Robertshaw?
Ms Robertshaw:	I don't have any questions for this witness, thank you, ma'am.
HMC:	Thank you, Ms Robertshaw. Dr Samuels, thank you very much for your attendance today. That concludes your evidence, you are now discharged. Obviously, you're very welcome to stay on the call to listen to the remainder of proceedings if you wish. Thank you kindly.
Dr Samuels:	Thank you.
HMC:	So, we have one more witness. Now, I'm entirely in your hands about how I proceed. I am very happy either to rise for lunch now, to rise for an hour until one o'clock. Equally I'm happy to rise for 10 minutes to give you a comfort break and to proceed. It's entirely up to you.
Lady Young:	Ten minutes would be probably enough, Madam Coroner.
HMC:	Thank you very much. Can I just check, Dr Wallis, that 10 minutes will be sufficient for you and that we can then proceed with your evidence?
Dr Wallis:	Thank you, yes, that's absolutely fine with me.
HMC:	Thank you very much. In that case, we'll say - if you would, Ms Robertshaw and Dr Wallis, if you would keep the connection please but obviously you can disable your cameras just for 10 minutes. It's now 12:58 and we'll be back here at 1:08. Thank you.

HMC:	<p>Please do sit down, thank you.</p> <p>Ms Young, I've just realised that I omitted to ask you if you wanted to ask any questions of Dr Samuels. I do apologise, I'm so sorry.</p>
Ms Young:	I know the time pressure.
HMC:	It's not that, it's just because you're not in my eyeline there, because you're not sitting where I would expect you to sit.
Ms Young:	If I sit there, it's just in place.
HMC:	It will jog my memory. Was there anything that you wanted to ask Dr Samuels?
Ms Young:	Yes there was, but I don't want to hold things up.
HMC:	Unfortunately he's gone now. I'm so sorry. It just occurred to me when I rose and I thought I didn't ask you. I really apologise. Can I ask what it was? Maybe we can get it from the other witness?
Ms Young:	Yes, let's see.
HMC:	Shall we try? Thank you very much. So I now call Daniel Wallis.
Ms Robertshaw:	Ma'am, sorry to interrupt.
HMC:	Sorry, Ms Robertshaw.
Ms Robertshaw:	Dr Samuels has stepped away, but I believe he's intending to come back to give some further evidence. So if there is a further question for him, he may well reappear.
HMC:	That's most helpful, Ms Robertshaw. It is entirely my error, but I

	would like questions to be answered if that's possible. So if you could let me know just a little later in proceedings, Ms Robertshaw, thank you very much, thank you. Dr Wallis, would you like to swear on a holy book or would you like to affirm?
Dr Wallis:	To affirm please.
	<i>Affirmation made.</i>
HMC:	Thank you. Can you please give me your full name, your professional role and your professional address?
Dr Wallis:	My name is Daniel Wallis, I am a part time consultant in emergency medicine at University College London Hospitals. I was not involved in the clinical care of The Honourable Gaia Young, but as governance lead for emergency services I was asked to conduct a serious incident investigation, together with my colleague, Dr Christine Gregson. My address is at University College London Hospitals, 235 Euston Road, London, NW1.
HMC:	Thank you. Dr Wallis, firstly, let's just cover very briefly Gaia's progress after she left Dr Samuels. My understanding is that essentially she made no recovery, is that right?
Dr Wallis:	Yes, that is my understanding, that the respiratory arrest and deterioration that reflected on the afternoon of 18 July proved to be irrecoverable.
HMC:	Then is it right that Gaia died on 21 July?
Dr Wallis:	My understanding is that that was the date death was certified, but I apologise, that's not something of which I have first hand knowledge and I would need to refer to the medical records to confirm that.

HMC:	Please don't hesitate to do that, just so that we can get that piece of evidence, thank you.
Dr Wallis:	May I refer to the serious incident report?
HMC:	Please do.
Dr Wallis:	I think the information is in there and I'll just confirm it from that, if I may. I apologise for the delay, we've recorded in the serious incident report that brain stem death was confirmed on 21 July 2021.
HMC:	<p>Thank you.</p> <p>What I would like to discuss with you first and foremost, Dr Wallis, is the medical cause of Gaia's death. So, what I've heard from Professor Sheaff and what seems to be accepted by all who treated Gaia is that she had cerebral oedema which led to her death via tonsillar herniation. So the cerebral oedema caused raised intracranial pressure, tonsillar herniation and that resulted in death.</p> <p>But the much more important question to my mind is what caused the cerebral oedema. Professor Sheaff was not able to take me any further forward with that. He gave some possibilities, none of which he felt was particularly likely. Can you assist me any further?</p>
Dr Wallis:	<p>I will do my best on the basis of the investigation we conducted, although I'm afraid we also do not have an absolutely conclusive answer. As we indicated in the updated serious incident report, although it was led by Dr Gregson and myself, we took advice from a range of specialists within the trust: neurologists and endocrinologists, radiologists and a biochemist.</p> <p>Several volunteered that this tragic death of Gaia was exceptional and unusual in its rapid progression and outcome. The updated SI</p>

	<p>report we produced was provided after the result of the post mortem investigations was known to us, in which as you say it was apparent that although there was demonstrable cerebral oedema, there was not a demonstrated primary cause in the brain for that cerebral oedema.</p> <p>In life, as you know, clinicians consider the possibility in particular of encephalitis and there was a suggestion of that on an MR scan undertaken some time after her respiratory arrest and abrupt deterioration. But since that was not demonstrated or confirmed on post-mortem examination, we considered alternative possibilities.</p> <p>In that context, the one ante mortem abnormality of potential relevance that we considered was the hyponatremia the low serum sodium, because it is known that hyponatremia can be associated with cerebral oedema and encephalopathy. Some of the challenges in evaluating the significance of hyponatremia in this tragic case include the fact that the level of sodium was not so low that would be unequivocally expected to be associated with the outcome.</p> <p>But it is known that the impact of hyponatremia is related not only to the laboratory level of sodium, but also to the rate at which it has declined, the intrinsic ability of the brain to adapt to the, what is known as osmolar stress, of the low sodium concentration and comorbidities.</p> <p>There is a suggestion that young women, premenopausal women, with low body mass, slim build, may be particularly susceptible to the effect of hyponatremia on the brain and may be at greater risk of not being able to recover from that encephalopathy.</p> <p>But those suggestions, I should say, come from a review which also reviewed evidence relating to patients who develop hyponatremia after an operation, for example. So I can't say to what extent that is relevant to Gaia's case, but clearly hyponatremia was a concern.</p>
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	<p>Investigating what happened, we were unable to say unequivocally why she was hyponatremic. The two main possibilities include, first, the possibility of sodium loss in sweat on a hot day followed by rehydration with what would be called hypertonic fluid, such as water, where the effect would be to dilute the sodium concentration, sodium level.</p> <p>And/or a problem within the brain which could cause what is known as the syndrome of inappropriate ADH, where the brain secretes antidiuretic hormone, retaining excess water in the body and so again, causing the sodium level to fall. Either or both of those mechanisms might have been relevant to the hyponatremia that developed. In the latter situation, giving three litres of fluid would be expected to cause further decline in the serum sodium, as happened.</p> <p>When we discussed this and I should say that we have, I think, reviewed this intensively with many people over a period of time to try to understand what happened, that there is a spectrum of views as to the significance of the hyponatremia. On the one hand, there is a view that a sodium of 123 is not low enough to have caused the catastrophic cerebral oedema and death which resulted.</p> <p>On the other hand, there is a view that in the context of symptoms which were consistent with though not specific for hyponatremia, it could have played a significant part. Similarly, we could not come to a clear view as to whether alternative treatment for hyponatremia, such as giving hypertonic saline, so-called concentrated saline, could have reversed the process of her illness.</p> <p>I think we have to say positively that there is just some information which we do not have relating to, for example, her sodium level during the day or two before she came to hospital. In the absence of complete information, it's simply not possible to come to an unequivocal conclusion.</p>
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HMC:	<p>How would you determine whether this was a primary brain function, as opposed to sweating a lot that day because she'd been out and it was very hot? How would you determine the inappropriate ADH?</p>
Dr Wallis:	<p>I think there are two key things that we identified, that regardless of the - if I can just go back to the point at which Gaia was admitted, as is often the case when patients are admitted with symptoms that are troubling but not specific for one condition, clinicians have to make decisions in the context of uncertainty.</p> <p>I think when she first came in, many clinicians, we determined, would be likely to have treated her initially with attempting rehydration. We know that she appeared dehydrated, that she'd been vomiting profusely, by Lady Young's account and she had a borderline raised heart rate, raised lactate. I think in that context, many clinicians would have attempted rehydration.</p> <p>But I think two things should have been done. The first, to have monitored the sodium more closely to see whether the sodium was coming up with that rehydration or as proved to be the case, that it declined further.</p> <p>Second, tests should have been done on blood and urine for osmolality and for the urine, not just osmolality but also the urine sodium, which together with clinical assessment would have contributed to an assessment of the likely cause of the hyponatremia.</p> <p>Therefore, how it should have been managed and whether in the context of symptoms, which as I say were consistent with but not specific for the effects of hyponatremia, whether she should have been treated with hypertonic saline and fluid restriction rather than continued rehydration.</p> <p>So the purpose of the serious incident investigation is of course so that we learn whether, as has been suggested, should more have</p>

	been done to diagnose or to treat. One of the things we have learnt is that more should have been done to investigate and probably treat differently the hyponatremia. But what the impact of those changes would have been, we are unable to say.
HMC:	When you talk about the monitoring, are you specifically referring to the first period after admission, so overnight on the first night? Or does that extend into the following day, the period that Dr Samuels was talking about?
Dr Wallis:	<p>I think we would say that the sodium should have been followed more closely overnight and earlier in the following day. We know that there was an initial sodium of 129, we know that the sodium was repeated, as I understand it, after the first litre of fluid had been given. At that point, the sodium had not come up, it remained 128, 129.</p> <p>With the benefit of hindsight and expert advice, further litres of fluid should have been withheld and the sodium should have been monitored more closely during the ensuing hours. Also obviously the investigations on urine, on a urine sample, to better understand the cause of Gaia's hyponatremia.</p>
HMC:	Can you tell me why that didn't happen, why her sodium wasn't monitored, why the tests on blood and urine didn't take place and then, if necessary, fluid be restricted and she be given hypertonic saline?
Dr Wallis:	<p>Well I think probably there are two reasons, two or three reasons.</p> <p>First, acute hyponatremia in a person presenting, a young person presenting with an acute illness is uncommon, if not rare. As I and Dr Gregson have indicated in our report, multiple consultants have reviewed Gaia's care and none of us can recall a patient with hyponatremia of 129 who deteriorated in the way that happened. So I think there's something about the fact that this was unusual, if not exceptional. Hyponatremia is commonly seen in older patients,</p>

	<p>in particular, for example, who are taking diuretic medication, but this was a different scenario clearly.</p> <p>Second, 129, as you've heard from Dr Hasford's statement and from Dr Samuels, 129 is not strikingly low. I think most clinicians would say a level of 129 would not have been considered low enough to account for the symptoms of headache, altered mental state, unusual behaviour, vomiting, all of which are symptoms of moderate or severe hyponatremia but which are much more commonly caused by a wide range of other conditions.</p> <p>The third fact that we've identified in the report is an awareness of guidelines and of guidance related to this and some of the recommendations relate to improving awareness of those guidelines.</p>
HMC:	<p>So in terms of the likely cause of the hyponatremia, do you think that... Well, may I ask that in a different way. Which do you think is the more likely cause, or are you not able to say?</p>
Dr Wallis:	<p>I'm unable to say, I'm afraid and that's partly because I'm not myself an endocrinologist. I suspect and even having talked to an expert, an endocrinologist with expertise in this area and I think we just don't have the information to say categorically.</p> <p>What I think one can say is that it could be more than one cause because - and this is speculation rather than certain knowledge - but if someone dropped their sodium because of sodium lost in sweat and then replacement with water without sodium or electrolyte in it, that could drop the sodium in part. Then it's known that if someone develops cerebral oedema, the cerebral oedema is one of the intracranial causes that can cause inappropriate secretion of antidiuretic hormone, causing the kidneys to retain water.</p> <p>So it could be more than one and it's possible there could be a negative vicious cycle setup causing progressive cerebral oedema</p>

	<p>and hyponatremia. But I think it's right to say that that is speculation based on what I've heard other experts say and reviewing the guidance that is cited in the SI report. I can't claim any expert authority myself behind that possibility.</p>
HMC:	<p>In terms of the hyponatremia causing death, we've talked about the cause of the hyponatremia, but in terms of the hyponatremia being the cause of the cerebral oedema, are you of the view that that is likely? It doesn't have to be certain but are you of the view that that is the likely cause of the cerebral oedema, the hyponatremia, howsoever it was caused?</p>
Dr Wallis:	<p>I think we have to say there are two - there is a range of - we've found in our investigation there is a spectrum of views on this. One view, as I've alluded to, is that even a sodium of 123 is higher than the level of hyponatremia that would be expected to be associated with fatal cerebral oedema.</p> <p>The other view is that the hyponatremia is concerning and that in the absence of an identifiable primary cause for the cerebral oedema, there is nothing else we have been able to identify as cause for the cerebral oedema.</p>
HMC:	<p>So actually even with that, you've not got a likelihood? Given some people might regard that as likely, some clinicians might regard that as likely, but given that you have looked across the piece and you have, after all, got a very large pool of expert clinicians at UCLH from which to choose, across the piece you're not able to say to me that's a likelihood, taking all those views into account?</p>
Dr Wallis:	<p>I think all we are able to say is that it is concerning, the hyponatremia is concerning, but I don't think we can say that it was the likely cause.</p> <p>But I suppose I would add that in our discussions we have not explicitly asked experts would you say this is more likely than not to</p>

	<p>have been the cause.</p> <p>We have identified it is an area of concern, an area where there are lessons for clinicians and the trust to learn, but I don't think anyone has said it is more likely than not that this was the cause of the cerebral oedema.</p>
HMC:	Nobody has said that?
Dr Wallis:	I think even those who are most concerned about it if pressed would say there is an element of speculation about this, because the information is necessarily incomplete. This was an unusual case with a tragically rapid deterioration. What we do accept is that in response to that concern, that regardless of whether the hyponatremia was the driver for the cerebral oedema or not, it should have been managed in its own right, whether it was a secondary phenomenon or a primary phenomenon.
HMC:	What about other elements making up the whole picture? So I'm thinking here of the lumbar puncture, of the positioning for the lumbar puncture and then the anaesthetic. Dr Samuels has explained that the intrathecal space was not punctured, but he did introduce anaesthetic and in order to introduce the anaesthetic Gaia was placed in the foetal position. Did any of those you consulted indicate they thought this was a contributing factor?
Dr Wallis:	<p>Well if I can just comment on that episode as a whole, to put it in context.</p> <p>Appropriately Dr Hasford and his team considered the possibility of central nervous system infection. It's serious, it's treatable and therefore, to start antimicrobial therapy on the morning of 18 July, undertake a CT and if the CT was normal to then undertake a lumbar puncture, appears to have been rational and appropriate.</p> <p>Now the CT scan that was performed, the first CT scan that was performed, as we've noted in the report, was also the subject of a</p>

	<p>spectrum of views. As you've heard from Dr Samuels, it was reported by a consultant radiologist as showing no acute intracranial finding. Later that afternoon, Dr Heaney was concerned that it showed signs of generalised brain swelling, as I recall.</p> <p>Now with the benefit of hindsight and in retrospect, had it been known at the outset that that first scan showed signs of generalised brain swelling, then that would have triggered measures to reduce intracranial pressure and also, Dr Heaney feels, would have prompted consideration of hyponatremia as a consequence of some intracranial process in the brain.</p> <p>The fact is the report given to Dr Samuels and others on the acute medical unit was that there was no intracranial finding, acute intracranial finding and therefore, it was a rational priority to try to identify whether there was central nervous system infection and potentially identify the organism if that was the case. If lumbar puncture had caused a needle to go into the intrathecal space, then in the context of raised intracranial pressure that would be expected to be liable to cause coning.</p> <p>So far as we know, there is no evidence that a needle did go into the intrathecal space and therefore our conclusion was that it's unlikely, though we can't say impossible, that the lumbar puncture precipitated coning manifested by respiratory arrest and that instead the respiratory arrest, coning, was due to the underlying disease process rather than to the attempted lumbar puncture.</p> <p>As we've noted in the report, with regard to the spectrum of views about the interpretation of the first CT scan, we also note of course that while UCLH as a trust is fortunate having a neuroscience hospital as part of the trust, of course the standard of care for reporting emergency unenhanced brain scans is for a general radiologist to report them and in this case it was reported by a consultant.</p>
HMC:	So what is the view among consultant general radiologists about

	what that first scan demonstrated?
Dr Wallis:	We obtained an opinion from two radiologists, consultant radiologists, other than the report radiologist. The first considered that looking back in hindsight at that first scan, there were changes that were subtle and of uncertain significance. The second radiologist, also not involved at the time, considered that not having identified raised intracranial pressure on that scan did not constitute a care delivery problem.
HMC:	<p>So, in addition to the consultant radiologist who reported, two other radiologists gave their view.</p> <p>One said I don't think you can see the raised intracranial pressure. And the other one said I think you can probably see that there is some change. I think that with hindsight, I'm not sure I would have seen it at the time.</p> <p>I've paraphrased there considerably. Have I got the essence of what you're saying?</p>
Dr Wallis:	Well I think so far as I'm aware, nobody has disputed that with the benefit of hindsight there are changes consistent with raised intracranial pressure visible. The advice we were given by the two radiologists who were not personally involved in reporting the scan in the first place, that their view was that those changes were subtle and of uncertain significance and that not identifying them did not constitute a care delivery problem.
HMC:	They both said that?
Dr Wallis:	Well may I read you from the report, so that I don't misrepresent?
HMC:	Please do.
Ms Robertshaw:	Ma'am, just so that you're aware, while we have a pause, Dr Samuels has returned. So it may be you want to wait until the

	conclusion of this witness's evidence.
HMC:	Thank you very much, Ms Robertshaw.
Dr Wallis:	<p>Apologies for the delay. So in conducting this investigation we asked specialists in the relevant specialty who were not involved to review what happened. We asked the second radiologist, who reviewed the scan and the original radiologist's report and he wrote as follows.</p> <p>In hindsight, there is very little CSF - that is cerebrospinal fluid - space but grey-white matter differentiation is preserved, classically lost in cerebral oedema and a relative lack of CSF space is not unusual within a young patient. The clinical history at the time of the initial report was odd behaviour. Given the vague presentation and very subtle/subjective abnormality, I don't think the initial report was significantly in error.</p> <p>He advised in conclusion, changes on the initial CT were very subtle and of uncertain significance. Because of the requirements for an SI investigation to be explicit about whether...</p>
HMC:	I'm sorry to interrupt, Dr Wallis. I don't know what's happening but you're jumping up and down.
Dr Wallis:	I'm sorry, I'm dealing with two screens and I apologise.
HMC:	Thank you very much, that's better, thank you. Sorry, please do go on.
Dr Wallis:	Because of the requirements for an SI investigation to be able to say well, if there was a shortcoming did this amount to a care delivery problem, a further consultant radiologist advised as follows. Given that the findings were subtle on the first scan and minimal time between the scans, I do not feel that there has been a care delivery problem here. Our acute CT scans are reported by general radiologists, not neuroradiologists. There was a little bit

	more to that comment but that was the relevant part that we extracted into the SI report.
HMC:	Did anybody suggest that simply the positioning in order to undertake the lumbar puncture could be responsible for the coning? I mean the positioning of Gaia?
Dr Wallis:	Nobody suggested that. I think from a general clinical point of view, I would just make the comment that had raised intracranial pressure been identified on the first scan, not only would the LP not have been attempted but Gaia might well have been nursed in a head up position while awaiting advice from intensive care or others about how to manage the finding of raised intracranial pressure.
HMC:	Does that mean you think it likely that not being nursed head up and instead being in the position she was caused the coning? Is that likely, or is it possible?
Dr Wallis:	Well I think what I would say is this, that if one accepts that it is unlikely the LP caused the coning, then the coning was primarily due to the underlying disease process. Whether the difference between her being nursed head up and flat on her side accelerated that or made any significant difference, is something that would have to be asked of a neurologist. But of the neurologists I spoke to, no one suggested that that difference in position caused, precipitated the coning.
HMC:	So let me just try to summarise where I think you've taken us to, Dr Wallis. In terms of... so we're all agreed that the cerebral oedema caused Gaia's death. In terms of the cause of the cerebral oedema, it could have been hyponatremia, but you can't say that it's even a likelihood that it was. It could have been.
Dr Wallis:	I think what we found is that the hyponatremia could have been a significant factor but, as you say, we do not have the evidence to

	say it is likely that it was the cause.
HMC:	Right, so could have been. The cause of the hyponatraemia could have been sweating on a hot day, or could have been inappropriate ADH. You can't go further than that, so even the cause of the hyponatraemia...
Dr Wallis:	Yes, I think we cannot say. We've identified some ways in which that could have been better investigated and treated, but we cannot say categorically what the cause of the hyponatraemia was.
HMC:	Just for the sake of completeness, we've discounted encephalitis. I'm not dealing with the efficacy of treatment at the moment, I'm just dealing with what was the cause. The lumbar puncture is unlikely, in your collective view, to have caused the cerebral oedema. The lumbar puncture is unlikely to have caused that, assuming I accept the evidence of Dr Samuels that the dura wasn't punctured.
Dr Wallis:	Yes, there was, as I understand it and the view we've taken in the report is that, there was no evidence of CSF having been obtained on the first attempt and on the second attempt there was no flashback of blood or CSF when local anaesthetic was injected.
HMC:	So if we've got hyponatraemia as a possibility, lumbar puncture is unlikely, do we have anything else that's in the frame that could be responsible for the cerebral oedema?
Dr Wallis:	Not that we have been able to identify from the clinical evidence in terms of ante-mortem clinical assessment or investigations.
HMC:	In terms of what could have saved Gaia, better management of the hyponatraemia. If the hyponatraemia caused the cerebral oedema, better management of it then could have dealt with the hyponatraemia or would have dealt with it?

Dr Wallis:	We cannot say that. We know that further investigation should have been undertaken and earlier to try to elucidate the cause of the hyponatremia and that the result of those and clinical evaluation might have prompted different treatment for that. But we cannot say that that would have resulted in a different outcome on the basis of the advice and information we've been given in the investigation.
HMC:	So again, it's just a possibility?
Dr Wallis:	I think all one can say is that with the benefit of hindsight, one would like to be able to say that everything possible had been done to optimise the chance of a good outcome. We've identified areas for improvement, but we cannot say that that would have led to her life being saved, particularly as we cannot be certain of the significance of the hyponatremia for her cerebral oedema.
HMC:	I'm just setting that aside for the moment, so if it were the hyponatremia that were responsible for the cerebral oedema, I think what you're saying is better management of it would have given her a better chance, but you can't say to me that it would have saved her, even probably. It would have given her a better chance.
Dr Wallis:	Yes, that is what I'm saying. The other feature we identified in the SI investigation, serious incident investigation, was that a CT scan should really have been done at the time of admission. But again, we do not know how such a scan, had it been done, would have been reported. We know that when a scan was done some 12 hours later, it was initially reported as no intracranial finding. But we did identify that the criteria for an emergency CT scan were present at the time of admission.
HMC:	Why wasn't that done?

Dr Wallis:	I think for similar reasons to the hyponatremia not being investigated more intensively earlier on. First, that doctors may be influenced by what is most common and in this case, a self-limiting cause such as intoxication. Second, possibly lack of awareness of the guidance related to the indications for emergency CT scan.
HMC:	<p>So just going back to what could have saved Gaia.</p> <p>Firstly, if the hyponatremia was responsible for the cerebral oedema, then better management of it would have given her a chance, a better chance, I beg your pardon.</p> <p>Secondly, if an earlier CT had demonstrated raised intracranial pressure or the latest CT had been reported on as showing raised intracranial pressure, then nursing management in the head up position - again are you saying would have given her a better chance?</p>
Dr Wallis:	I'm sorry, did I let you finish the question? I apologise if I came in too soon.
HMC:	No, I think you'd got there. I got partway through the question and then I realised that I hadn't quite got your evidence on that point.
Dr Wallis:	Sure, ma'am, would you mind if I turn off the video for a moment? I'm concerned that I'm going to lose power despite being plugged in, I'm not sure why.
HMC:	Yes.
Dr Wallis:	Alternatively may I log out and come back in?
HMC:	Why don't you log out and come back in and we can easily wait for you.
Dr Wallis:	Thank you.

HMC:	I can certainly see you now, Dr Wallis. Do you think that's better?
Dr Wallis:	<p>Yes, I'm sorry, I was trying to be online for the inquest and be able to review the documents at the same time. Hopefully this is clearer and better.</p> <p>I think the key point that I was trying to make was this. That had raised intracranial pressure been identified on an earlier scan performed around the time of admission in the early hours of 18 July, or if it had been identified on the scan performed around one o'clock, I think, on 18 July, then attention would have been directed at measures in general to treat raised intracranial pressure.</p> <p>That might initially have included head up positioning, but it would have involved referral to intensive care, addressing the hyponatremia and ultimately might have involved administration of an anaesthetic and putting Gaia onto a breathing machine before she progressed to respiratory arrest. Now all of that is said, of course, with the benefit of hindsight and the fact is that even when she had a CT scan performed later on 18 July, initially it was reported by a consultant as showing no acute intracranial finding.</p> <p>But in answer to the question of what if anything could have been done to improve the possibility of recovery, it would have been earlier identification of raised intracranial pressure, had that been visible - and we don't know - on an earlier CT scan.</p>
HMC:	In terms of what better management of the raised intracranial pressure, or what management of the raised intracranial pressure at an earlier stage would have meant if being nursed in the head up position, being on intensive care, being intubated, perhaps being medicated to try to bring the intracranial pressure down, if all of those measures had been instituted are you saying then that that would have given Gaia a better chance, or that that probably would have saved her?

Dr Wallis:	I'm unable to say it would have saved her. A neurointensivist might be able to give a more precise view on that. I think all I can say is that in terms of the investigation we did, we identified these as measures which would have given her the best chance possible. But we were not able to conclude that they would have saved her, particularly in the context of such rapidly progressive cerebral oedema.
HMC:	When you say you were not able to conclude that they would have saved her, do you mean that you concluded they wouldn't have saved her, or simply that you were unable to reach a conclusion about that?
Dr Wallis:	<p>The primary purpose of the SI investigation was to learn the lessons that the trust needed to learn as to how we could improve care, learning from any shortcomings identified in Gaia's care.</p> <p>I have to say we did not explicitly ask a neurointensivist what the prognosis would have been had those different scenarios transpired, such as a hypothetical CT scan in the early hours of the morning and the possibility that a different radiologist would have identified an abnormality on it.</p>
HMC:	Was there any general sense?
Dr Wallis:	There was no general sense that if only that had been done she would have been saved. As I've mentioned, several specialists in different specialities volunteered that this was an exceptional and unusual case, tragically.
HMC:	So, any other care which if given differently might have changed the outcome?
Dr Wallis:	We were not able to identify any care that we could say it would be likely the outcome would have been different. We identified areas where care could have been improved, but we were not able to say

	<p>that had those improvements been in place she would have survived. But I acknowledge that that was not the primary focus of our investigation.</p>
HMC:	<p>Turning to the primary focus of your investigation, which is learning lessons, you identified several areas of suboptimal care. What have you put in place to try to reduce the likelihood of this occurring again in the future?</p>
Dr Wallis:	<p>The principal recommendations and actions that have followed are, first, that both the emergency department and the acute medicine department need to raise awareness of the existing national and international guidelines for the investigation and treatment of hyponatremia. Certainly as far as the emergency department is concerned, that was addressed at a clinical governance meeting last year.</p> <p>The trust, as you can imagine, has a set of guidelines for dealing with medical emergencies. Currently dealing with hyponatremia is not one of those, but we have recommended that the trust urgently needs a guideline on the trust's intranet that is available for easy reference by clinicians on hyponatremia. I know that that has been accepted by the consultant who has overall oversight of those medical emergency guidelines and the trust's endocrinologist who advised the SI report is going to oversee the production of that guideline. I think we've put a target date for that of April this year.</p> <p>In addition, we have recommended that there be regular teaching sessions on both neurological presentations such as altered mental state and hyponatremia, both in the emergency department and in acute medicine, on the acute medical unit. I think again I can say that the endocrinologist has given a talk on that in the emergency department junior doctors teaching and the college tutor has been asked to ensure that that is a regular feature of the rolling teaching programme that already exists and similarly, on the acute medical unit.</p>

	<p>Then finally, we recommended that the first CT scan in particular be reviewed at an imaging learning meeting so that the learning to be had from review of that CT scan was available to radiologists more generally.</p>
HMC:	<p>Dr Wallis, anything else you think it would be helpful for me to know?</p>
Dr Wallis:	<p>I don't think so but perhaps I could just conclude saying that both Dr Gregson and myself and all the other consultants, I think, who have given advice on the trust's investigation were struck by the tragedy of the loss of this young woman. I needed to say that our heartfelt sympathies go out to Lady Young and to all of Gaia's family and friends.</p>
HMC:	<p>Do you think it would have made a difference if there had not been a focus initially on intoxication?</p>
Dr Wallis:	<p>I think that is a concern. As I alluded to earlier, when patients are initially admitted there is often an element of uncertainty, a lack of complete information which in this case, as in others, was exacerbated by the infection prevention control measures that had followed in the wake of the pandemic which prevented Gaia's mother being with her when she arrived in hospital.</p> <p>But regardless of that, doctors had to consider both what is common and likely and what is less common, even unusual, but where investigation and treatment can make a difference. So I think that as I've said, there should have been a CT scan performed around the time of admission, even if it seemed most likely in the absence of collateral information from Gaia's mother.</p> <p>Even without knowing that intoxication was unlikely, other possibilities should have been considered, including a primary intracranial problem investigated by CT scan. Including earlier investigation of the cause of hyponatremia, even if at that stage it</p>

	<p>might seem that that was unlikely to be a salient or significant factor.</p> <p>So I think there was a degree of what is sometimes called availability bias, in other words, people being overly influenced by information that's readily available, such as it's not uncommon for young people on a Saturday night to arrive in the emergency department intoxicated and an element of confirmation bias that once one possibility is raised, that somehow gets reiterated and echoed.</p> <p>So I think there was a problem about being overinfluenced by one possibility, but even in the absence of the information subsequently available from Gaia's mother, there should have been an awareness of the need to consider and exclude other more serious possibilities, even if they were not most likely. That's really where we've drawn attention to the fact that a CT scan should have been performed earlier.</p>
HMC:	<p>Thank you very much, Dr Wallis.</p> <p>Lady Young, any questions from you?</p> <p>Mr Brook?</p>
Mr Brook:	<p>First of all, Dr Wallis, you mentioned that in the circumstances it appears that the lumbar puncture procedure was reasonable, rational and appropriate. Do you recall saying that? Can you hear me Dr Wallis?</p>
Dr Wallis:	<p>Sorry, I can hear you again now, but the sound went after lumbar puncture.</p>
Mr Brook:	<p>Okay, you mentioned that it would have appeared to the clinicians at the time and you were reviewing what they did at the time, that a lumbar puncture procedure was reasonable, rational and appropriate. Do you recall saying that?</p>

Dr Wallis:	I recall saying that on the basis that they'd been told the CT scan was normal.
Mr Brook:	Exactly so. You also went on to say that the CT scan was subject to a wide variety of views and that had it been known that the first CT scan showed generalised oedema, then in the context of that case it's unlikely that a lumbar puncture would have gone ahead because it could have led to coning.
Dr Wallis:	Yes, correct.
Mr Brook:	<p>Right, but in fact we don't have to have the benefit of hindsight for that because Dr MacDonald and her senior colleague, on the basis of that very first albeit belated taken CT scan, did provide them with sufficient evidence of symptoms of generalised oedema that in fact Dr MacDonald then contacted the clinicians with her care to say do not do a lumbar puncture. So we don't need either a second CT scan for that, nor do we need the benefit of hindsight.</p> <p>You seem to suggest that no one had concluded that, but in fact [Alicia] MacDonald and her superior had concluded that. That was the conclusion on their review, their review that Dr Samuels did not wait for. Do you have any observations on that?</p>
Dr Wallis:	<p>Yes, may I clarify our understanding of the chronology, because I think that's crucial to answering your question. My understanding is that after the first unsuccessful attempt at lumbar puncture Dr MacDonald then returned and saw Gaia in person and examined her. My understanding from Dr MacDonald's statement is that at conclusion of her assessment it was agreed that it was necessary to undertake further investigations to try and establish the cause of her encephalopathy and so into Gaia's treatment.</p> <p>At that point, she did not advise lumbar puncture should not go ahead. After that, in parallel, she went away and reviewed the scans with colleagues at Queen Square, while the attempt at the</p>

	second lumbar puncture was being undertaken. After she had discussed the scans with Dr Heaney and they had concluded an LP was not advised, she then immediately contacted the doctors on the acute medical unit, but by that time tragically Gaia had already had a respiratory arrest.
Mr Brook:	Do I take it that you spoke - you're not just going through the statements, have you also spoken with Dr Samuels in the course of putting your report together? Have you also spoken with Allycia MacDonald? Or are you just looking at their witness statements?
Dr Wallis:	I had not spoken to either, but my colleague, Dr Gregson, with whom the report was written, may have done so.
Mr Brook:	May have done so, but you can't tell us she did so.
Dr Wallis:	I can't say with certainty, but she provided the chronology relating to care on the acute medical unit.
Mr Brook:	Would it surprise you to know that Dr Samuels earlier today accepted that he knew - I'll just quote, I knew she was going to review the case and come back to me. Now she wouldn't be coming back just on the case, if that's what she meant, she was coming back to him and he was halfway through his shift. Does that make any difference to the way you see things?
Dr Wallis:	I'm sorry, can you just clarify for me the way I see which?
Mr Brook:	Well you seem to see it from the statements that you've seen and you don't know whether your colleague actually personally interviewed these people, that there was a general I will review by Dr MacDonald and I'll come back at some stage. What I'm putting to you is the evidence we heard this morning from Dr Samuels, which he said before he attempted the second lumbar puncture he was aware that Dr MacDonald was going off to review that very CT scan, the only one in existence at that time and that

	<p>she was going to review the case, according to Dr Samuels and he said and come back to me.</p> <p>So under those circumstances perhaps I could ask you this question. It's not that it needed a second CT scan, there was sufficient on the first CT scan for those qualified to recognise symptoms of generalised brain oedema. If you were in Dr Samuels' position, would you have waited for that information to come back?</p>
Dr Wallis:	If I can just clarify my answer to the first question, when I said that I thought it was rational and reasonable for there to have been a plan for a lumbar puncture, that referred to the plan on Dr Hasford's ward round, assuming the CT scan was normal. I wasn't talking about the specific decision to attempt a second LP.
Mr Brook:	No, because things change as cases progress.
Dr Wallis:	Sure. Now I'm not party to exactly what Dr MacDonald said to Dr Samuels, but if she said at the end of her assessment I'm going to discuss the CT scans with colleagues at Queen Square, implying there was doubt about their interpretation, then that casts a different complexion on it. But that was not implied to me, it certainly wasn't stated explicitly and it wasn't implied to me in the statement she provided for the SI investigation.
Mr Brook:	Yes and that of course if it was the way I've just described it and the coroner has her own note on that and we've all heard this evidence, then that would, as you say, put a different complexion on proceeding with the lumbar puncture.
Dr Wallis:	Yes, my understanding from her witness statement was that at the end of her clinical assessment she was of the view that proceeding with further investigation, as has been discussed, was appropriate. But it's entirely correct that I've not spoken to her and I don't know exactly what she said to Dr Samuels.

Mr Brook:	No, thank you. Just looking at the idea that what would have saved, could have saved Gaia, you mentioned better management of hyponatremia, if that had been dealt with there was a better chance of an outcome. But in the same way that you're not able to say well she would have lived, you're also not able to say well she would definitely have died either, are you? Can I just add to that, you don't know the underlying cause and that's why you aren't really able to answer that question.
Dr Wallis:	Yes, that's absolutely correct. We don't know but we've not been able to come to a view of a certain or definite underlying cause of the cerebral oedema and we're not able to say what the impact of hypothetically having addressed the shortcomings that we've identified would have been.
Mr Brook:	You said that no one suggested that putting Gaia into a foetal position could have caused or led to - could have caused coning. That's because you never asked the question of anybody, that's right, isn't it? You were looking at it in an entirely different way, whether performing a lumbar puncture would have led to spontaneous decompression, which could itself then lead to coning. The question about whether a person in a critical state was put into a position, in other words not treated head up, could itself have led to coning, was never on the agenda.
Dr Wallis:	I certainly thought about that, it was on my agenda. I had several discussions with neurologists and I do not recall precisely whether we discussed that specific point.
Mr Brook:	Your report doesn't actually include what you call the two reports that you obtained from the experts you went out to. Is it fairer to say that they were just well informed discussions, but there are no reports as such? Otherwise doubtless you would have added them as an addendum or an annex to your report.

Dr Wallis:	The information that came from other experts in endocrinology, neurology, imaging, some of it was by email, some of it was phone discussion, some of it was people sending what I think were described as preliminary thoughts. So there was a variety of what I would call informal documents and discussions by phone or like this, by Teams.
Mr Brook:	Do you think this court might be assisted by the very enquiries that...
HMC:	Well, I have to say, Mr Brook, that I think it's for the court to decide whether the court is going to be assisted.
Mr Brook:	It is, madam, I just wondered whether this particular expert could say whether in his view the court might be assisted...
HMC:	I think that's a matter for the court, thank you, Mr Brook.
Mr Brook:	So be it. Needless to say, no report was commissioned for the benefit of this serious incident report because you weren't actually concentrating on causes; you were concentrating on what lessons could be learned.
Dr Wallis:	We were concentrating on identifying any shortcomings, so-called care delivery problems. Whether there was a variation in practice between what happened and what relevant standards and guidance suggest should have happened. Any learning for future care and we did also consider the cause of death in the context of what was the impact of any shortcomings in care. But we did not primarily set out to establish the cause of death, because that wasn't the primary remit of this serious incident investigation.
Mr Brook:	Quite so, thank you.
Lady Young:	Dr Wallis, as far as I understand, neither you nor Christine Gregson have any neurological experience as doctors. You work in different

	areas, is that right?
Dr Wallis:	I can't answer for Dr Gregson. I don't have specialist training or expertise in neurology. Emergency neurological presentations are part of the clinical field of emergency medicine.
Lady Young:	Might it have been more appropriate if someone with a neurological background would have been part of writing those serious incident reports?
Dr Wallis:	<p>Well the trust asked me and Dr Gregson to conduct the investigation. I don't know if they had conversations with - when I say they, I don't know if the quality and safety department also had conversations with neurologists. But we obviously made it part of our investigation to speak to - in the first instance, obtain a statement from Dr MacDonald, in the second, to discuss the case with Dr Heaney, the neurologist who was involved, albeit somewhat peripherally.</p> <p>I think following discussions at Queen Square Hospital, that prompted a review by another neurologist who was not involved, with whom I also had conversations. But you're quite right, that a consultant neurologist was not part of the authorship of the report.</p>
Lady Young:	Dr Wallis, that was possibly one of the reasons why it crossed your mind that the positioning of Gaia, taking into account that she might have had raised intracranial pressure, could have caused spontaneous coning. I have taken intensive advice from a very eminent German neurologist and he said it is absolutely possible that the positioning and when you hold a person, a lightweight person like Gaia was, in a foetal position, you put pressure on the transition part between the neck and the head and on the feet. This could have put additional fatal pressure on the brain and caused the coning. Do you agree with that?
Dr Wallis:	I entirely understand your wish to know the answer to that and I'm

	afraid I'm unable to comment, because it is outside my expertise.
Lady Young:	Then we need a person with that kind of expertise to write an expert report. Do you agree with that?
HMC:	Well once again, Lady Young, that's not a matter for the witness; that's a matter for this court. So, I've allowed you both a great deal of latitude in terms of the questions that you've asked. Are there any further questions?
Lady Young:	One further question. We have established that a better management of the hyponatremia would have been beneficial. We have also established that an earlier CT scan might have given a point of reference to better understanding of the second CT scan. But I also want to point out there was never a fundoscopy considered or even attempted, at a stage when Gaia was possibly able to follow the instructions, I mean earlier on in her admission. Is that right?
Dr Wallis:	My understanding is that from the part of the report which was written by my colleague, Dr Gregson, my understanding was that the duty medical registrar on the night of admission, or in the early hours of 18 July, commented that he was unable to examine the eyes. I think the other point I would make which may be helpful is - and I think we've said this in the updated report - that when a patient is in hospital with access to CT scanning, then if a CT scan is performed it may be unlikely that fundoscopy would add anything. By contrast with a patient, for example, who is in outpatients or in a clinic in the community, where finding an abnormality on fundoscopy could prompt the patient being sent to a hospital to have a CT scan, to have a look at the brain. In the context in which Gaia was being cared for, there was access to CT scanning. My understanding from discussion with a

	neurologist colleague was that fundoscopy would be unlikely to have added any information beyond that which was found on CT.
Lady Young:	I disagree with you. All right, as you say, the CT is available...
HMC:	You're allowed to disagree, Lady Young, but the witness has given his evidence.
Lady Young:	I see. What?
Mr Brook:	He said what he said.
Lady Young:	I see, okay. But I think an earlier on fundoscopy, when we know the CT scan wasn't done for many hours, would have given some insight into an intracranial happening.
HMC:	The witness has given his evidence on that point, Lady Young. As I said, you don't have to like that, you don't have to accept it, but he's given his evidence.
Dr Wallis:	May I add to what I said?
HMC:	Certainly, Dr Wallis.
Dr Wallis:	I would just add that had fundoscopy been undertaken successfully when Gaia was first examined and an abnormality had been found, that would have prompted a CT scan.
Lady Young:	An earlier one.
Dr Wallis:	The view of the investigation, however, is that she should have had a CT scan done in any event.
HMC:	Thank you.
Lady Young:	One final question. How often do LPs, lumbar punctures, actually

	fail? Is that a say one in two...
Dr Wallis:	I'm sorry, I missed part of the question.
Lady Young:	Just a general question. How often do lumbar punctures fail, like the kind that Dr Westby tried to perform, that you don't get into the dura?
Dr Wallis:	I'm really sorry, but I'm just unable to answer that question. I don't know if there is data available to answer that, but I'm unable to answer it.
Lady Young:	Thank you very much.
HMC:	Ms Young, do you have questions?
Ms Young:	Thank you, yes, I do have a few.
HMC:	Just if you can keep your voice up.
Ms Young:	<p>Sorry, yes, I'll try to speak up. Just following on maybe from Dorit's last point, I'll just get my thoughts clear. When the first lumbar puncture was attempted and was unsuccessful, it's my understanding that conclusion was come to because there was no flashback, as in blood or fluid coming back in the syringe. I remember meeting Dr Samuels at the hospital at the time and I actually asked him then, how do you know that you didn't get into the dura? He said because nothing came back and normally there's quite a bit of pressure from the CSF which would cause that, so you would know if you were in there.</p> <p>But is it possible that they may have grazed, nicked, damaged the dura without realising, trying to get into the space in the first one, which caused a leak that then may have been one of the factors precipitating the coning?</p>

Dr Wallis:	I'm afraid I'm just unable to say. I entirely understand your concern about that possibility. I think the best I can do is to say anything is possible, but on the evidence we have it seems unlikely. I wish I could give you a categorical answer but I don't think I can add anything helpful.
Ms Young:	Why do you think it's unlikely?
Dr Wallis:	Well I think I can only repeat what I've said, which is the conclusion of our investigation was that in the absence of any CSF or blood flowing back through the lumbar puncture needle when it was attempted once on the first occasion and in the absence of any flashback of blood or CSF when the local anaesthetic was injected on the second, we have concluded that it's unlikely that either needle went into the intrathecal space. But I can't exclude that possibility.
Lady Young:	We had a very readily educated patient and a very unexperienced doctor.
HMC:	Lady Young, I have given you the opportunity to ask your questions and Ms Young is asking hers now.
Ms Young:	Thank you. Another question but this might have been - this is probably quite a straightforward question. When a lumbar puncture is undertaken these days, as with Gaia, is it normal to have a sats monitor on to monitor somebody's oxygen saturations, pulse, blood pressure and so on, like you do with many other procedures and if so, did that happen? That's the question.
Dr Wallis:	First of all, I need to say that performing lumbar punctures is no longer part of my practice. It has been in the past. The lumbar puncture was performed in the context of Gaia's care on the acute medical unit, where I don't work. When I performed lumbar punctures it was not a reason for having a saturation monitor or

	<p>blood pressure cuff, but if Dr Samuels is able to give further evidence, he would be able to give you more up-to-date information about what current practice is on the acute medical unit.</p>
Ms Young:	<p>The reason I asked is because there seemed to be maybe a few minutes between when he started it, I think he said three minutes, but wasn't sure of the exact timeframe. Then when the more junior doctor noticed that the breathing had stopped and at that time we don't know exactly when the breathing stopped and we know her heartrate was then very, very high and her blood pressure was high and her respiration was non-existent, which presumably her sats had dropped.</p> <p>So the reason I ask is that I'm a nurse myself and I'm involved in some of the monitoring. You would have thought that you would have seen those earlier signs that her heart rate was - why is it going up to 120, whatever it was, as well as - yeah, I suppose that's where that question was coming from.</p> <p>That it might have been picked up before oh my god, she's stopped breathing, press the emergency buzzer, whether that would have made any difference. But it's just a question I have, just I suppose in terms of learning from things, is that something that should be done if there's a risk that somebody could then - a crisis, although very rare, could actually happen.</p> <p>I'd like one more question. Dr Samuels also mentioned at some point that when Dorit asked about why they hadn't contacted her and he said that Gaia didn't have consent - that's right, it was about consent, she didn't have capacity to consent to the procedure. They made a best interests decision at that time and they didn't contact Gaia's mum because they felt that the urgency overruled that need to speak to her next of kin about that best interest decision to go ahead with the lumbar puncture, that's how it was laid out.</p>

	<p>So I suppose my question is, first of all, at what point was it determined that Gaia didn't have the capacity to consent to things? Again I'm talking from my own clinical practice, that if there's a point you think, especially during COVID, this patient doesn't have capacity, we should contact their next of kin and involve them in this. Even if he didn't have the time to do it, he could have said to a nurse could somebody call Mrs Young, because she needs to know what's happening with this. She's deteriorating, we're going with the second attempt at lumbar puncture. We've given her some morphine, we're doing all kinds of things that she can't consent to.</p> <p>That's something that I've wondered about ever since Gaia died, because I think that's also something that can be learnt from the not - yeah, so there's that question about why they didn't involve, although Gaia wasn't a minor, but at what point when she lost capacity could that have been the natural, to contact her next of kin?</p>
HMC:	Did you want Dr Wallis to answer that?
Ms Young:	Yes, I did. Do you have a policy on that? Or is that something...
HMC:	I think Dr Samuels apologised for that, I think he recognised that he should have done.
Ms Young:	Okay, sorry.
HMC:	So I think the only part of your question remaining then is at what point he felt that Gaia lost capacity. I wonder whether rather than Dr Wallis, we could just pop Dr Samuels back in the witness box and ask him that.
Ms Young:	Yes, good idea, because I've got a second part to that question about that...
HMC:	For Dr Samuels as well?

Ms Young:	...the same point.
HMC:	We'll do that because he can also answer the question about the sats monitor.
Ms Young:	Okay.
HMC:	Anything else for Dr Wallis? No. Ms Robertshaw, anything for Dr Wallis?
Ms Robertshaw:	Yes, ma'am, thank you, just one question. Obviously there's been discussion for an earlier CT scan having been done. You described the variety of views about what the CT showed when it was done. So firstly, do you think if it was done earlier the oedema would have been less advanced and it would have been an even more unclear picture? Or do you think there is a greater possibility it would have been identified at that stage?
Dr Wallis:	<p>I think with the benefit of hindsight we have to assume that Gaia's symptoms were attributable to raised intracranial pressure when she was first brought to the emergency department on the night of 17/18 July.</p> <p>As we heard from the radiologist's opinion that I read out earlier, evaluating the space between the brain and the skull in young people is harder than in older people where there has been a degree of atrophy of the brain, so it may be clearer whether or not there is significant cerebral oedema.</p> <p>I can't say what a different radiologist looking at a scan performed in the early hours of 18 July would have reported. All we can say is that when the scan was done at about one o'clock pm, a consultant radiologist was unable to identify cerebral oedema at that time.</p>
Mr Brook:	May I just add to that?

HMC:	No. Carry on, Ms Robertshaw.
Ms Robertshaw:	Thank you. If a CT scan had been done earlier, would that have been then repeated when it was? Or do you think it would have been less likely to have a CT scan the next day subsequent to the ward round if one was done around the time of admission?
Dr Wallis:	Again we're dealing with hypothetical situations, it is difficult to predict with certainty. As I said, if an earlier CT scan had been reported as abnormal, then attention would have been directed towards addressing any abnormality such as cerebral oedema identified on that scan. If that scan had been normal and she had been assessed in the same way on the ward round by Dr Hasford and they'd had the same concern about possible encephalitis or meningitis or at least excluding those possibilities, then I can't see any reason why Dr Hasford would have sought to repeat the scan, which had excluded - which hypothetically had been reported as normal.
Ms Robertshaw:	Thank you, that's all of my questions.
HMC:	Thank you, Ms Robertshaw. Dr Wallis, thank you very much for your attendance today. That concludes your evidence, you are now discharged. Obviously you're very welcome to stay on the call, thank you kindly. Ms Robertshaw, did you say that you have Dr Samuels with you?
Ms Robertshaw:	Yes, I'll just ask him to reconnect to the hearing now.
HMC:	Thank you. Dr Samuels, thank you very much, we're trying to spotlight you. Thank you, Dr Samuels, you are still under oath. I just want to put to you a couple of questions from Gaia's sister. Now there's a very unpleasant echo, I'm not quite sure why that is.

Ms Robertshaw:	I suggest you put your mute on until you're speaking.
HMC:	<p>Thank you, Ms Robertshaw. So just a couple of questions, Dr Samuels, which are factual matters.</p> <p>Firstly, when you attempted to perform the lumbar puncture on either occasion, did you have a saturation monitor or a blood pressure cuff? Is that usual? If it is, did you include that as part of the procedure?</p>
Dr Samuels:	As far as I'm aware, that is not usual practice and I did not have a sats probe or blood pressure monitor on either occasion.
HMC:	The next question is, that you explained that you weren't able to take consent from Gaia, she wasn't capable of giving you consent at that point. Can you help us with at what point she lost the ability to do that?
Dr Samuels:	It's very difficult for me to comment to say when she lost the ability to do that, because I think that from the first point at which I met her she likely did not have the ability to consent. So it would be speculation for me to say at what point. At the point that I met her she hadn't, before that I couldn't tell you.
HMC:	Ms Young, there was a follow-up question you wanted.
Ms Young:	<p>Yes, so if you felt that when you first met her on Sunday morning that she didn't have capacity, I'm not sure, did you or one of the team contact Dorit when you were going ahead with clinical decisions and when you felt if Gaia lost capacity then she was clearly deteriorating and very unwell? I know because of COVID it wasn't at that point felt to be allowed onto the ward.</p> <p>But was it something that you had - to include Dorit in those decisions and let her know what was happening before you went ahead with the CT scan, lumbar puncture and other procedures.</p>

	Because there was quite a gap between when you first saw her, which was 9:00 or 10:00 and then from what I understand, when you did, lots of clinical decisions were being made between then and 3:15 or when she stopped breathing.
HMC:	So, Dr Samuels, I'm going to paraphrase that question, just because I know the acoustics are difficult in here. So the question you're being asked is about contacting Gaia's mum. You've already apologised for not contacting her to update her on Gaia's progress, but what's being suggested now is, did you think of contacting Lady Young to talk to her about the treatment, given that you'd formed the view really from when you first met Gaia that she wasn't able to consent to that?
Dr Samuels:	I think with respect to giving Lady Young information, regardless of whether that was on Gaia's condition, investigations planned or in treatment, I think that that all comes under the same umbrella, which is covered by my previous answer. Is that in an ideal circumstance, I would have contacted her and updated her about all of those things, but I didn't and I do apologise for that. Regarding consent specifically, Gaia as an adult patient, there's no legal requirement for me to contact her. Doing the procedure in her best interest is the right thing to have done in that circumstance, but I completely accept that in a perfect world I would have discussed the procedure with Lady Young and explained why we were doing it.
Ms Young:	Well surely a best interest decision if someone doesn't have capacity, you would normally make an attempt to include the person that was next of kin, wouldn't you?
HMC:	So Dr Samuels, you're being asked in order to make a best interest decision, would you not normally speak to family in any event?
Dr Samuels:	I think that's incredibly decision specific. I think when it relates to a

	<p>variety of matters in where there are significant ramifications in pursuing a course of action, that it would be best practice to discuss that with the next of kin. I think in this particular circumstance, in advance of the events we had no way of knowing that they would pan out the way they did and lumbar punctures in the vast majority of cases, although I cannot give you specific numbers, proceed without complication.</p> <p>So I think it's very difficult for me to comment whether there is a line at which you should certainly contact next of kin to make a decision. As I said previously, I certainly accept that in her care during the course of the day at some point I would have liked to have done that, if I could go back and do it again. But beyond that, the information I've given is all I can offer up.</p>
Ms Young:	<p>Can I say one more thing? You said, from my understanding, that the reason that you didn't ask that earlier when you were in the morning session was that there was a kind of urgency to get on and do the LP. So I couldn't help but wonder if there was an urgency, which is understood, to try and ascertain the cause of her deteriorating condition, but then in an urgent situation would it be normal to get an FY1 doctor to do the LP when he wasn't experienced?</p> <p>We don't know whether he'd ever done one before, so you'd be using it as a teaching thing. I know people have to learn, but if something's urgent, so urgent that you can't call her mum, then to me that doesn't quite make sense that you would then be saying well let's have this FY1 do it. You also said that he talked you through the whole procedure before he did it so that you were happy that he knew what he was doing.</p> <p>That takes time, so those to me seem like what are the priorities there? Were the priorities of course he needs experience, but then if it's urgent and you're making a best interest decision, she can't consent, she's deteriorating, is it something that maybe - I wonder about that and I wonder what was going on in how you were</p>

	thinking at that time in terms of the urgency and involving a pretty junior doctor in that process. Sorry, that's a difficult question.
HMC:	You just need to unmute, Dr Samuels.
Dr Samuels:	<p>I do apologise. I understand your question. I think that it hinges on the definition of urgency and the timeframe in which you describe to be urgent. I understand that that is in some ways nebulous and there is no defined way of saying what urgent means. I think urgent as I described it was that lumbar puncture needed to happen that afternoon.</p> <p>Whether there was a difference in allowing my junior colleague, who I believed to be competent, to do the procedure in the first instance, I don't think that that delay would have - well with the information I had at the time, would have made any difference, which is why I elected to proceed in that fashion.</p> <p>Does that answer your question?</p>
Ms Young:	<p>Not really, because it seems to me a priority would have been to let the family know, to let her mum know in this situation. The reason I'm asking and I hope I'm not speaking out of turn, but I think with the consequence of what happened, that her mum wasn't allowed to be there, wasn't there at that very critical time when Gaia was so ill and actually lost capacity, then lost consciousness, to be kept away, to be not just not kept informed but also not included and not be able to be present, I think, because of what happened is a very serious part of it.</p> <p>Although at the time it may not have, because you didn't know what was going to happen, so just asking that. I suppose also in terms of going forward and learning from these kinds of situations, particularly when there are extra restrictions, which there have been for the last couple of years and may well be again if we get another variant or whatever.</p>

HMC:	<p>So there, Dr Samuels, I think that that point has been put to you fairly forcefully, that in these times of pandemic when loved ones are not able to be in hospital with the patients, does that not make it even more important that these discussions are had?</p>
Dr Samuels:	<p>I agree that we needed to pay special attention to communication with family members and next of kin in the context of them not being able to come into hospital and be with their family. As I've already said, I think that that's something I could have done better in this scenario. I do apologise if I've misunderstood, was there an added element to the question to which I haven't answered that I can provide an answer to?</p>
HMC:	<p>No, I'm getting a shake of the head, no.</p> <p>Thank you, Dr Samuels. Thank you very much and thank you for coming back to give evidence for that. Thank you kindly.</p>
Dr Samuels:	<p>Thank you, ma'am.</p>
HMC:	<p>So, that's all the evidence I've been intending to hear. I know that there are likely to be submissions. I don't know who is going to make those submissions, it's either going to be Mr Brook or Lady Young, in terms of additional evidence. I'll be delighted to hear those submissions now.</p>
Mr Brook:	<p>Madam, sometimes, I'm not sure what your practice is, but when people have had lunch and they're going on to the end of the day, yourself included, sometimes written submissions are allowed within say seven days. Would this be appropriate?</p>
HMC:	<p>No, I'm going to hear those submissions now, as I indicated at the pre inquest review.</p>
Mr Brook:	<p>Would it be an idea then for Ms Robertshaw to make her submissions first?</p>

HMC:	<p>These are submissions on behalf of Lady Young, so I would like to hear either from Lady Young or from you, Mr Brook.</p>
Mr Brook:	<p>Could we have a few moments?</p>
HMC:	<p>Of course, of course.</p>
Mr Brook:	<p>Madam, I'll go straight into it, if I may.</p>
HMC:	<p>Please do.</p>
Mr Brook:	<p>You're aware that we asked for further expert reports. Leaving aside for a moment the role of Dr Samuels and the model of treatment that he adopted, it seems clear that you don't have sufficient expert evidence before you to discharge your first duty, which is to find out if possible, with proportionate and reasonable investigation, what was the cause of death.</p> <p>Even Dr Wallis has said that that wasn't the main focus. He has spoken about he felt it necessary to go to some experts within the pool of experts that he had at UCH. Regrettably, that came in the form of emails so we don't know what the questions were and sometimes expert reports can be influenced by questions, we all know that.</p> <p>It is better, in my submission, that having recognised Dr Wallis has quite candidly said he was interested in the treatment and what could be done better, the model of care, that in order for you to answer the question what was the cause of Gaia's illness, we need to go out to other experts in either the same disciplines as Dr Wallis went out to, but didn't commission a report and didn't include any of the emails in an accident report and so far as I can tell, didn't even mention them in the report. I don't criticise him, I simply say that wasn't his focus.</p> <p>But it is your focus, madam, so I ask that the application for the reports that we've made, which we've already got for you, be</p>

	<p>granted. I think the way of doing that, because we have no names and it would be wrong for the counsel for the UCH to simply pop a name forward, just to give us seven days if you grant that application to put our heads together and find suitable experts in the areas that we've asked for.</p> <p>If we can't agree, to return the matter to you with such names and you do as you think fit in choosing them. That I think is an expeditious way of dealing with it, it's a fair way of dealing with it and it's the only way you're going to get the information that you need. Maybe it doesn't give you that information, but that is the right thing to do. No one's actually made a concentrated effort to obtain that information.</p> <p>Looking at Dr Samuels and the treatment model, perhaps it's unfortunate that we also didn't focus at the earlier stage of Gaia's admission, because we've heard from Dr Wallis how he believes an early CT scan might have assisted. We don't know what that would have done and it's easy to speculate that perhaps all it would have done is shown very little, but he did say that this is what brought her into the hospital. Had that been done earlier, then even if it showed the same as the first CT scan showed, it wouldn't have been necessary to have had too long...</p>
HMC:	Sorry to interrupt, Mr Brook, but I think there you're addressing me on the facts now. I'm not quite sure where you're going with that.
Mr Brook:	I'm trying to address you generally on the evidence and drawing it together.
HMC:	That's not permitted in this court.
Mr Brook:	Oh dear, how would you like me to approach the matter?
HMC:	No person - I thought I explained that earlier - under rule 27 of the Coroners Rules, which is why I didn't allow Lady Young to do that, no person may address the coroner as to the facts.

	So no person is allowed to attempt to persuade the court that the evidence points this way or that way.
Mr Brook:	So be it, madam. Then I think we can say this - and I hope I'm not transgressing this rule in making this point - where Dr Wallis said in answer to your questions...
HMC:	I think you probably are going to transgress.
Mr Brook:	You think I'm going the wrong way?
HMC:	Yes, I think so.
Mr Brook:	Well, madam, you've got the facts as you've heard them, or you've got the various points of evidence. You'll resolve the inconsistencies between one account and another. If I'm not permitted to draw attention to where those accounts differ so be it. But you might take the view that the CT scan...
HMC:	Again, Mr Brook, which ever way we cut this, you're not permitted to address me on the facts. You may address me on the law, but not on the facts.
Mr Brook:	Then, madam, I think you have the evidence before you. If I'm not permitted to address you on the points that I was hoping to make and they actually - let's see if you stop me on this. The use of hindsight in the report...
HMC:	So Mr Brook...
Mr Brook:	There it is then, madam, if I'm not permitted...
HMC:	...if you want to address me on the law you're very welcome to do that, but you're not permitted to address me on the facts.
Mr Brook:	Madam, your duty, madam, is to so far as possible discover what

	<p>the cause of death was and the underlying cause of death, whatever you decide about the event that might have triggered it and otherwise or unwise or a proper course of action, those are facts that you'll decide.</p> <p>But you simply don't have sufficient information before you at this stage to conclude as best you might be able to if assisted by further reports as to what the underlying cause of the brain oedema was. If you were to find that there was an intervening fact as a result of treatment, well again, that's a matter for you.</p> <p>As to the law, madam, well I wouldn't pretend to be able to address you on that and you'll know that so much better than me, it would be an embarrassment for me to try and do that.</p> <p>So, unless I can help you further.</p>
HMC:	<p>Thank you very much, Mr Brook.</p> <p>Ms Robertshaw, firstly, any submissions on the application for an adjournment for additional evidence?</p>
Ms Robertshaw:	<p>Thank you, ma'am.</p> <p>Firstly, of course it's a matter of your discretion which is brought in in almost all matters relating to the inquest to determine whether you feel that you have sufficient evidence to come to the conclusions that you need to do so. I note that one of the items of missing information Dr Wallis referred to was sodium levels before admission and therefore that is evidence which could not be obtained. Therefore further efforts, for instance, expert evidence is in my submission not going to - there's no evidence that that will provide you with sufficient help to assist you with the remaining questions in this case.</p> <p>In my submission, ma'am, similarly to previous email correspondence with your court and Lady Young on this point, it is deeply unfortunately for families who have to deal with cases</p>

	<p>where the inquest process cannot come to the clear and defining conclusions that would be of the greatest assistance in moving forwards for them with their loss.</p> <p>However, that is of course a recognised situation in inquests and that is why a conclusion of open is available to a coroner, which doesn't entail that the investigation has been insufficient, but that having viewed the proportionate investigation the evidence does not point to one specific conclusion on a definitive basis.</p> <p>As you know, ma'am, the legal requirement for you to return a conclusion or a finding is that of the Galbraith plus test and that is that the conclusion rests on evidence which is safe and sufficient. In my submission, ma'am, you have sufficient evidence to return a Galbraith plus conclusion, be that natural causes or open, that there is evidence which takes you far enough towards that point.</p> <p>It's entirely understandable that the family's questions go beyond the statutory questions that you're seeking to answer. In particular, as I referred to at the previous hearing, that your questions are who died, when, where and how they came by their death. Where the family's questions of why the death has occurred may well go much further in the chronology than the scope of your inquest.</p> <p>Ma'am, in our submission you have sufficient evidence to conclude your inquiry at this stage. However, it is of course a matter for your discretion and I commit further submissions at this stage, if that is of assistance, but that would be my submission in relation to the application for further evidence.</p>
HMC:	<p>Thank you.</p> <p>And do you have any submissions on law generally, Ms Robertshaw?</p>
Ms Robertshaw:	<p>Thank you, ma'am.</p> <p>As indicated, you are of course very familiar with the Chief</p>

	<p>Coroner's guidance to try to return a short form conclusion where possible, so that should be considered first. In my submission, ma'am, that the two potentially available short form conclusions would be either natural causes or open.</p> <p>A natural causes conclusion would rest on the case law which gives us a concept, if not quite a definition, of the natural death which is taken from omission from cases where unnatural deaths have been found. In the case of <i>Touche</i> as the leading case in this law, which states that if clinical steps had been taken the death would probably have been avoided.</p> <p>Obviously in this case we know that we have evidence that clinical steps have been taken and no evidence that there are steps which had they been taken, the death would probably have been avoided. Even a possibility applying <i>Touche</i> would still be a natural death.</p> <p>The related case law, for instance that of <i>Cannings</i>, states that a natural death could become unnatural if it's a wholly unsuspected death from natural causes which would not have occurred but for some culpable human failure. Ma'am, I suggest that to take it away from a natural causes conclusion on the basis of that case would relate to the primary pathology and the cause, for instance, behaviour prior to admission which led to hyponatremia, if it was your view that that was probably the cause of death.</p> <p>In my submission, ma'am, there isn't sufficient evidence of causation for you to make such a finding that there was an unnatural inclusion in the path of causation. The case of <i>Thomas</i> states that whether a death is natural or unnatural is a practical question of fact based on the ordinary meaning of the words. That the circumstances may make a natural death unnatural. In my submission, ma'am, the circumstances if anything point in the direction towards a natural death in this case.</p> <p>As we know, ma'am, the Chief Coroner's guidance would lead you towards considering an open conclusion if you do not consider that</p>
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	<p>natural causes would be an appropriate short form in this case. That is, of course, always available to you. Alternatively, you could consider returning a narrative conclusion. Ma'am, as you know, a narrative conclusion could only include that which is found on the evidence to have probably caused the death and not possible causes.</p> <p>In my submission, ma'am, on that basis alone, a narrative conclusion would be difficult to return in this case, given the absence of evidence of probable causes. In my submission, ma'am, it points that a natural causes conclusion or an open conclusion would be more appropriate.</p> <p>You will, of course, be very familiar with related law, in particular the statute requirements under section 5(3) of the <i>Coroners and Justice Act</i> that the narrative conclusion would not be able to go beyond the statutory questions as you have outlined and that it would be a breach of section 10 of that statute to appear to determine any questions of criminal liability or civil liability. That's obviously primarily for the benefit of the family, who will be less familiar with this law than you are yourself.</p> <p>I don't think there's anything further with which I can assist you at this juncture, ma'am.</p>
HMC:	<p>Thank you very much, Ms Robertshaw, thank you.</p> <p>[Silence]</p> <p>Reasons for determination</p> <p>I have considered carefully the application to adjourn part-heard in order to seek additional expert evidence. I've thought about this very carefully, but I'm not minded to agree to that. I shan't go through the explanation that I gave at the pre-inquest review of the law in this area, but I will just go straight to my thinking about whether I have sufficient evidence to allow me to conclude today.</p> <p>I'm of the view that I do have sufficient evidence. That's not to say</p>

that more evidence couldn't be got, I think that generally speaking more evidence could be got in most inquests. I think that we could come back for a whole week and listen to all sorts of different experts with their views about the cause of Gaia's death. What I have is evidence from those who treated Gaia and from those who didn't, from a variety of disciplines, albeit funnelled through fewer witnesses.

The Chief Coroner is very firm in his guidance to coroners that inquests must be proportionate. That's an odd word in this context because how can there ever be anything that's proportionate to a death? It's never going to feel right that there may be some avenue could be explored and which hasn't been. I understand that, but I think when he talks about proportionate, he means proportionate to the evidence.

He has reminded coroners very robustly that sufficient does not mean exhaustive. He guides coroners that it is not necessarily the coroner's job to hold an inquest that is exhaustive. It is the coroner's job to hold an inquest which is sufficient and my view is that, given the evidence that I have before me, I have sufficient to enable me to reach a conclusion.

I don't say that this is a definitive conclusion. My view is that there is not a definitive conclusion, that I have heard of the number of different views, of the spectrum of views concerning the cause of Gaia's death and I accept that evidence, that there is a broad spectrum of views.

I recognise that it has not been the trust's primary focus to look at the medical cause of death, but it has been an issue to which a great deal of thought has been given. Indeed, in investigating for the purposes of a review by the trust to learn from any gaps in care, the context for that has to be the cause of death, because without that there is an inevitable gap in the learning. I am conscious that there has been an updated serious incident investigation report following the report of the post mortem

	<p>examination.</p> <p>So having said all of that, I am of the view that I have sufficient evidence to allow me to conclude today and I'm going to do that.</p> <p>I could simply make an open determination - determination is what used to be called the verdict - I could make an open determination. But I think that I am able to reach more of a conclusion than that would suggest. I don't think it is so unknown that there's nothing I can say about this. It is clear from the evidence that Gaia died from cerebral oedema. It is not clear the cause of that.</p> <p>Hyponatremia is a possibility and that has been considered, I think, in some detail. What I've heard is it is impossible to, when I say be sure, it's impossible to be satisfied even on the balance of probabilities, whether hyponatremia did cause the cerebral oedema, because we don't have the sodium levels when Gaia was at home obviously, so I can raise it as no more than a possibility.</p> <p>The hyponatremia was not managed as well as it could have been, and if hyponatremia caused the cerebral oedema, then better management would have given Gaia a better chance.</p> <p>I can't say that it would have saved her, I don't have the evidence that allows me to say that and I don't believe that the evidence exists that allows me to say that. But I appreciate that her loved ones will... any loved one would want for the best chance at life, I appreciate that. So even if I don't reach the legal standard of the balance of probabilities in this court, I recognise that a better chance is an important thing.</p> <p>A CT scan was not performed when Gaia was admitted to hospital and it should have been. If it had been, there would have been a different focus. Gaia would have been managed in a different way, head up nursing, admission to intensive care, potentially intubation, potentially drug therapy. Again, this would have given her a better chance. Again, I'm sorry that I don't know that it would have saved her, but it would have given her a better chance.</p>
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The one element that I think I am able to discount as having an impact upon death is the lumbar puncture, the lumbar puncture itself as opposed to the positioning. I accept the evidence of Dr Samuels that the dura was not punctured. I found Dr Samuels to be a truthful witness and, whilst of course you could be truthful but mistaken, it seems to me that the evidence about that makes sense, that if there is no cerebrospinal fluid coming back, there's no blood, that it is very unlikely that the dura has been punctured. In the second attempt, this was the introduction of anaesthetic only. Again, there was no sign that the intrathecal space was entered. So as the required standard in this court, I find that the lumbar puncture itself was not relevant in the death.

All of this means that I'm going to make a narrative determination. It's not going to be neat, I appreciate that it would be much neater if I were to say natural causes, but I don't think that would do justice to the evidence that I have heard. It's been put to me by Ms Robertshaw that I'm not able to include anything within my determination that did not probably cause death. It seems to me that – well, I don't think that I accept that. It seems to me that I am able to include such conclusions I reach in terms of a factual matrix, but I need to make it clear that the required standard of the balance of probabilities has not been reached in terms of causation. I think that there's just perhaps been a little conflation of two areas of law, which is that I don't have to include anything that has not probably caused or materially contributed to death, but I think that I can, provided I make it clear that we're looking here at a lost chance, which is I think what we are looking at.

So the narrative will be messy, but I think that it will reflect the complexity of the medical evidence that I have heard and I don't want to oversimplify that. I'm very aware that coroners are urged to be as clear as possible, but I think otherwise there just is a risk of oversimplifying this and I don't want to do that. I will try to make it as simple as I possibly can.

	<p>Determination</p> <p>This has been an inquest on behalf of our Sovereign Lady the Queen by me, Mary Elizabeth Hassell, Senior Coroner for Inner North London, touching the death of Gaia Inigo Young. I find as follows.</p> <p>The Honourable Gaia Young was born on 4 March 1996 in Islington, London. She was a product specialist and artist and lived at 67 Gibson Square in London. She died on 21 July 2021 at University College Hospital, 235 Euston Road in London.</p> <p>Her medical cause of death was:</p> <p>1(a) tonsillar herniation 1(b) raised intracranial pressure 1(c) cerebral oedema.</p> <p>I make a narrative determination as follows.</p> <p>Gaia Young died from cerebral oedema. The cause of this remains unclear.</p> <p>It is possible that the cause of the cerebral oedema was hyponatremia. If the cause was hyponatremia, more monitoring and better clinical management would have afforded her a better chance of survival.</p> <p>A CT scan was not conducted as it should have been immediately following her admission to hospital on 17 July 2021. It is unclear what it would have shown if it had been conducted. A CT conducted the following day showed subtle signs of raised intracranial pressure, but this was not diagnosed at the time. If an earlier CT had been conducted and had shown raised intracranial pressure, or if the later scan had been reported as showing raised intracranial pressure, this would have changed the clinical management. A lumbar puncture would not have been attempted, although in any event the two lumbar punctures attempted did not puncture the dura and so did not impact on the outcome. However, knowing of the intracranial pressure would have resulted</p>
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	<p>in head up nursing, transfer to intensive care and potential intubation. All of this would have afforded her a better chance of survival.</p> <p>I confirm this by signing the record of inquest this 14th day of February 2022. That concludes this inquest.</p> <p>I say to everybody in court I'm sorry that we should meet in these circumstances. And I say most of all to Gaia's family that I am very, very sorry for your loss. I'm sorry for the loss of such a young woman, so suddenly and so shockingly.</p>
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