SCOTTISH HOSPITALS INQUIRY

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Hearings Commencing
19 August 2024

Day 37
Tuesday, 29 October 2024
Ms Gaynor Evans
Professor Mark Wilcox

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10:03

THE CHAIR: Good morning, everyone. Now, Mr Mackintosh.

MR MACKINTOSH: This morning's witness is Ms Gaynor Evans from the case notes of your expert panel, my Lord.

THE CHAIR: Thank you.

THE WITNESS: Good morning.

THE CHAIR: Good morning, Ms Evans.

THE WITNESS: Good morning.

THE CHAIR: Now, as you understand, you're about to be asked questions by Mr Mackintosh, who is sitting opposite you, but before you do that, I understand you're prepared to take the oath.

A Yes.

Ms GAYNOR EVANS
Sworn

THE CHAIR: Thank you very much. Now, we've scheduled your evidence for the morning, but we'll take a break at about half past eleven for coffee. Should you wish to take a break at any other time, just give me an indication and we'll take a break. The other thing is that you need to be heard, so can I ask you maybe to speak just a little louder and possibly even slower than you would normally? We have microphones, but nevertheless it's quite important maybe just to think about reaching the room and certainly reaching me because my hearing is not what it was.

THE WITNESS: Okay.

THE CHAIR: Mr Mackintosh.

Questioned by Mr MACKINTOSH

MR MACKINTOSH: Thank you, my Lord. Ms Evans, I wonder if I can take your full name.

A It's Gaynor Susan Jean Evans.

Q Thank you. You produced two statements for the Inquiry. I understand you want to make two minor corrections to your main statement.

A That's right.

Q So, I think if we could put the main statement bundle at page 11 on the screen-- sorry, page 40 on the screen, please. You want to make a change to paragraph 11, I understand.

A Yes, and there is a date of 2023, which should actually read 2013.

Q So you were Clinical Lead for IPC with NHS Improvement North of England between 2013 and 2016?

A That's right.

Q The second correction is in paragraph 20, which is on page 42.

A That's right.

Q This is about the last two

words. What should it say rather than "Chatham House"?

A It should actually say, "Wilton Park."

Q Wilton Park, and that's a Foreign Office training centre?

A That's right.

Q Thank you for that. Now, you've produced that statement and a supplementary statement, and are you prepared to adopt those as part of your evidence?

A Yes, I am.

Q Thank you. What I propose to do is to not simply go through your statements, or indeed the report of the case notes review, but to ask you a series of questions about your role in it and certain aspects that seem relevant to the Inquiry. Firstly, could you set out briefly your professional experience in Infection Prevention and Control?

A I commenced in Infection Prevention and Control in 1997. I started in the West Midlands in the Black Country in Dudley, and set up a service for Infection Prevention and Control, where there was no service previously. I worked collaboratively with the acute hospitals right next door to us. I worked across community and public health. I moved from Dudley in 2002 at the creation of what was then the Health Protection Agency and became part of the public health sector----

Q Within Health Protection England?

A Within Health Protection Agency, and I worked there until 2010. I worked as a local infection prevention specialist working with the community sector and acute. I worked with a regional office. I moved into a regional role, where I worked across the whole of the West Midlands looking at the epidemiology of bacteraemia across the whole of the West Midlands, particularly then-- in those days, it was MRSA, and we also had a big focus on Clostridium difficile in those days. From there, I moved to the Strategic Health Authority. I think that was in 2009/10----

Q Because there are quite a large number of health authorities in England.

A Yes, and this was the West Midlands, so this was the Birmingham Health Authority, which then merged across and then became a tripartite across three of the areas across the Midlands, so we covered East Midlands and West Midlands.

I was a regional lead for HCAI reviewing outbreaks of infection, serious incidents, supporting hospitals, supporting communities where there were large outbreaks, and supporting them to identify where they might have

originated and what we put into place.

Q What sort of outbreaks were they?

A So they might have been an increase in MRSA bacteraemias, for example; it have been an extraordinary increase in the number of norovirus, and anybody that works in hospitals will know how devastating that can be over the winter period. So there might have been very lengthy or prolonged outbreaks of norovirus; it could have been any community-acquired infection.

We had an outbreak, for example, in a burns unit, a Klebsiella outbreak a neonatal unit. So it could be any of those. It could be anything at all where you think, "Can we add some support to the organisation to do that investigation?" From that role, I then moved, in 2013, into a regional role with what was then the Trust Developmental Authority.

Q Sorry, what's the Trust Development Authority?

A Well, the Trust Development Authority is actually part of what is now NHS England, so there were changes in the NHS in 2013 where we had a series of changes which meant we created NHS England. We had a monitor which monitored hospitals----

Q So a regulator?

A A regulator, yes. It was a regulatory organisation, and so I became a regulator in Trust Development Authority for the North of England. So, I worked with organisations that were not, at that point, registered as foundation trusts, so they were working towards that accreditation of becoming a foundation trust.

Q In a sense, an inspectorate-type role?

A Yes, but it was more of a supportive role, so if you found that there were anomalies or standards could be raised, it wasn't just to tell them that the standards need to be raised, it was to support them to put mechanisms in place to do that. So it was a different type of supportive role.

When the two organisations merged together and we became NHS England, I worked with NHS England as part of their wider-- still doing the same role, but worked then within the whole aspect of the whole of the North of England with any organisation. So it could be any organisation, whether it be a foundation trust, to support them where they had challenges.

Q Then, in 2013, you took up this role across the whole of England?

A No, in 2017. I took the role in 2017 down to review the-- in 2016, the Secretary of Health-- Secretary of State for Health declared that we were going to have a gram-negative reduction

programme as part of a five-year plan, and my role in that was to work with organisations across England to reduce the number of gram-negatives.

Now, in the gram-negative programme, E.coli is by far the highest rate of infections. That's what we see the most of, and most of those infections in E.coli – we know from the research that's been carried out – we know are related to urinary retract infections, hydration. We know that there are problems – significant problems – with these, and hepatobiliary infections as well.

So, it was to work with organisations to see how they could put improvement programmes into place. So this role, while we talk about a gram-negative reduction programme, it was actually supporting organisations as a quality-improvement initiative to improve those rates of infection.

Q So, looking forward, one of the features that we read in the overview report of the Case Note Review is a discussion, which we'll come to later, about the Scottish mandatory reporting microorganisms. Am I right in thinking that some of these-- the E.coli is one of those national reporting microorganisms in Scotland? Now, remember, there's a person doing a transcript, and they can't see you nod, so if you're going to----

A Oh, sorry.

Q If you want to agree with me, please say yes.

A Yes, that's right.

Q So, we're going to talk about the Case Noteeview in a moment, and clearly it describes itself as a review dealing with gram-negative environmental bacteria. In your work across England on the gram-negative reduction programme, to what extent were gram-negative environmental bacteria a part of the programme?

A Not huge, other than the fact that you can have environmental organisms that actually transcend both. So they can be within people, but it wasn't something that we focused on because the numbers of those were much smaller.

We started with, "This is the lowest-hanging fruit. What can we change that's going to have a big impact quickly?" So we worked with the E.coli first. Now, those weren't included in the review that we undertook, so there weren't huge amounts of gram-negative----

Q So you're saying that the E.coli wasn't included in the Scottish review (inaudible), no?

A Yes, it wasn't included in that because we know that it is a huge problem across the whole of the health care agenda. We know that that is a----

Q Before we turn to the Case

Note Review, I suppose one question is, in your practice – perhaps the last 15 years of it that you've just described – had you ever come across a potential scenario of gram-negative environmental bacteria at the scale that this Inquiry is now dealing with?

A No.

Q Are you ever aware of that happening----

A No.

Q -- before at all at this scale?

A No, no.

Q Well, we'll talk about that at the end of your evidence as well. What I'd like to do now is just focus on a few issues around the-- There were three of you in the panel, the expert panel, and am I right in thinking that the decision-making at the heart of the panel-- of the expert-- of the Case Note Review is the three of you: you, Professor Stevens and Professor Wilcox?

A That's right.

Q In what way did you see your expertise is complementary or compatible with each other? How did it all work from an expertise point of view for the three of you?

A So, Professor Stevens, his role is he is the expert in paediatrics and paediatric oncology. So, in terms of patients, how you manage the patients, what would be expected from their symptoms, how you would expect them to recover, that sort of thing is his domain and his expertise.

Microbiology: Professor Wilcox is the microbiologist, has great expertise in his field, expertise about the organisms, about what we're seeking, the frequency with which these organisms appear in our normal day-to-day work.

Mine is with infection prevention to look at what were the practices like? What was the environment like? How did we review the environment? Did we look at the environment not just from a water perspective? Did we look at the cleanliness? What were the practices like at ward level? Were we following the protocols that were laid out for Infection Prevention and Control?

In the last 20 years, IPC – if I call it IPC – has actually risen in popularity because we can see the benefits that this has for patients. So I'm looking at what is the quality of the care that people have delivered, and IPC is one of those indicators of quality, so I'm looking at that.

Q Before we come to that process, I want to just capture, clarify a few things about how patients and infections made it into the Case Note Review. Would it be a useful shorthand to refer to those patients and those infections as a cohort? Is that something you would use? How would you describe

that?

A Yes, we'd say the patients are a cohort.

Q Okay, so how is it that the cohort was created? What role did you and your two colleagues have in the creation of the cohort you were examining?

A To be fair, the cohort was actually designed and agreed from a piece of work that had been done in 2019 from Health Protection Scotland, and they had undertaken a review and created a paper, and actually the cohort that appeared in there seemed to be a valid group of people that we could----

Q Well, let's just connect it to the document before we talk about it, so if we look at bundle 7, document 5, page 214. Hopefully this is the draft, and it's helpful because it doesn't have the redactions. Is this the report that you think that the cohort's built around?

A Yes.

Q Yes, right. So you were saying that you thought it was a useful cohort. Why was that?

A It appeared-- Once they'd done the analysis, it appeared that the number of children that were affected that they had identified in this cohort were a manageable group of patients. It seemed that we agreed with their definitions of, "Yes, we can use this group of patients," because it wasn't untenable. It met within the cohort. They were within that ward sector. We were looking at a very defined area.

They were also defined by the gram-negative bacteria that their bloodstream infection had been identified as. There were a few anomalies because there was an addition of another environmental organism that we added into the mix but didn't think that was unduly-- we didn't think that was unduly----

Q Well, let's break that down.

A Okay, sorry. There's a lot in there.

Q Firstly, we'll pick the last point up first: what was the organism you added in?

A So, the one that was added in that we decided to look at as well, and we agreed, was Mycobacterium chelonae, which-- we looked at that, included that in the cohort.

Q Because that's not in the cohort that's in this paper that's on the screen at the moment.

A Oh, right, so that was-- Now, I might, then, be telling you a fib, then, in that case, but if you could go to the first page-- Sorry, second one.

Q Probably page 217?

A 217, that's it. No, it's beyond that. It's after that page.

Q Is it the different datasets, in particular the list on page 219?

A That's it. That's the one. Sorry, that's the one. So we're looking at those, so I might be-- that might be an error on my part.

Q So which is the group that you understand became the cohort?

A So, I think the group that we had were the children that were identified, and they started off as a group of 85 children with 118 bacteraemias across those 85 children.

Q Yes.

A Of those 85 children, one later on-- But that is the cohort that we reviewed, that I am confident that those are ones that we reviewed, and the methodology that they used in here was how they came to agree that. Now, the three of us had little-- This had been decided, as far as I'm concerned-- this had been agreed when I turned up for the meeting in February 2020.

Q Right.

A So this had been agreed, that this is the cohort that we would use.

Q So if I ask Professor Stevens, he might be able to take it back a little bit earlier than that?

A He might be able to take it back because I turned up to the first meeting and this cohort had been agreed, so if-- I'm being a little disingenuous because I didn't have that input into that agreement for who would be included because I think that had already been decided when we met at that time.

Q Right. Well, I'll ask him about that, but what I want to also-- You describe this cohort as "manageable." What did you mean by that?

A Manageable in that we're not talking about 300 people. The original timeframe for this piece of work was to be three months.

Q Right.

A And when you're intensively looking through case notes, they take a considerable amount of time, and so to look through 80, 85 sets of case notes in that time seemed a reasonable timeframe to do that.

Now, unfortunately, because COVID hit in the middle of our work, we had a delay and it did mean that, actually, the amount of time we were able to dedicate to reviewing those became stretched. So we were finding ourselves needing additional resource to review some of the data that was required.

Q Now, one of the questions that I want to just connect this to is that there was a protocol produced, I understand, and this is now in bundle 27, volume 6, but it's actually a separate PDF for the purposes of today. I wonder if we can put that up on the screen. So, yes, would

you have seen this protocol at the time of February 2020?

A No.

Q You're shaking your head. When did you see it first?

A I saw it when it came to the case notes.

Q Came to the?

A When I saw it in the bundle of case notes.

Q For?

A For this hearing.

Q For this hearing. Right, okay, then I won't ask you about it further. I'll ask Professor Stevens about that. Now, are you able to help us what role Professor Bain played in the Case Note Review?

A So, my understanding is Professor Bain, at the time, was what we would call the director of Infection Prevention and Control or equivalent in Scotland.

Q For Glasgow?

A Yes, for Glasgow. She was a sort of conduit between the expert panel and the organization, and also the link between the Scottish Government and the oversight group, so she was a very key player in----

Q So you were, effectively, in some senses, reporting to her?

A Yes, she was in oversight. We reported, actually, to Fiona McQueen, but we did actually share all of the information and were very open and transparent with Professor Bain.

Q So, one of the issues that's going to, I think, arise is that-- and the Health Board is concerned that they haven't seen all the material and that they have some concerns about the methodology that the review conducted.

I'll put those concerns to each of you in turn, but just in terms of the mechanics, would you be able to tell us whether, for example, the Health Board would have been given a copy of the epidemiological protocol that we've just looked at?

A I wouldn't know.

Q No? Okay. In terms of the ultimate output from the Case Note Review, there's the overview report and we know the Health Board were provided with a draft of that, and it's in the bundle. So that happened, and you've described in your statement how you looked at the draft, the three of you, and you commented on it and made changes.

If we think about the methodology of the Case Note Review and how we should understand it, would it be fair to say that you can't-- Where's the actual workings of the Case Note Review conclusions? You've reached a conclusion, to pick one, that 30 per cent of cases have a probable connection –

we can talk about what that means in a moment – but if we want to look at the detail of why you reached that conclusion in each case, where do we find that?

A You would probably find that in the detail of the report we wrote back to families, which would be-- In each of those cases, we would have told the family why we'd drawn those conclusions. It isn't in the document, as in the report that we would write, but a lot of the conclusions that you draw are based on probability, as we know, and we've quite rightly said that these are based on probability.

But the workings as in-- and we do say in the report-- I can't remember where, but we do say that, actually, it is very difficult and there are very close assimilations between what will be a probable or a strong probable----

Q I want to come back to that in a moment, but what I'm more concerned with is finding the material because people-- If we go to bundle 6 and the report itself, which is document 38, and we jump straight to page 1026, we'll see, for example, in this table you've set out the demographic and clinical characteristics of the cases in the review, and that's an aggregate of the individuals, am I right in thinking?

A Yes.

Q Yes, and then if we go on further to table 4.2 on page 1028, we have the frequency of infection by organism year by year. Again, that's an aggregate of the individual cases.

A Mm-hmm. So all of this information we would have given to us by GGC. All we've done is actually put it in a different way, but it would have come from GGC. All of our information on the isolates came from GGC; we asked for all of the isolates from the labs; we asked for all of the information from GGC, which was, at times, a difficult process, but that's where we got our-- It's all the lab data.

Q I'm going to come back to the method taken in a moment, but if we just go to 1043, table 5.3, this is where the three of you set out your overall conclusions, and you're nodding.

A That's right.

Q But if we want to know why it is that 17 cases are weak possibles, we'd have to read 17 individual family reports, wouldn't we?

A Yes.

Q Right, and if we want to know why three cases are strong probable, we'd have to read those three reports?

A Yes. You could go back and look at some of the information, but this is an aggregate of all of the cases because we would have had those cases on the PTT, all of that information.

Q Yes, and we'll come to the method in a moment, but from the point of view of the external reader, whether it's this Inquiry, someone who downloads it from the website or the Health Board, we just have the aggregate numbers in this report.

A Yes, yes.

Q From our point of view, there might be some difficulty discussing that in an individual report in a public setting because there will be lots of personal data, I'm assuming.

A Yes.

Q It is an unfortunate reality of this cohort that a number of those children have unfortunately died since then, so there might be concerns of a family if we went through and discussed in detail your conclusions about their infection.

A Yes.

Q Yes, but the consequence of that is that we can't look at your workings and say, "What are you doing there? Why did you do that?" We can't challenge you at a micro level. You'd agree about that?

A I would agree, and the whole purpose of this-- We set out at the outset that none of these children in our report we would be able to identify from what we'd written. So where you have small numbers and you have perhaps one child with one infection, we set out very clearly that we would not write our report where any of the children would be able to be identified.

Q Except in their individual family report?

A Except in their individual reports, and that's quite significant because this report that we were tasked to do was actually to work with the families as well, ask the families' opinions. We took information from the families, we asked them if they wanted to contribute anything, so we use the information in a slightly different way because we did not want this to be a trauma to families afterwards, where they could identify their own child in this. They would know because each family will know what their infection was, but it was our intention to purposely not identify any.

Q We know, for example, that one particular family came back to you and said, "There's an error in respect to Mycobacterium chelonae," and you made the correction, so they're obviously in a dialogue.

A Yes.

Q Right. Do you know whether those individual 85 reports were supplied to the Health Board?

A We sent with the families-- When we spoke with the families, and we spoke to every family that wanted to

speak with us after we'd published the report, and we said to them we would advise that they shared with their clinicians. It wasn't obligatory, but we asked them if they would share it with their clinicians because this was pertinent to the families and I've no idea how many of those did actually share it with the clinicians. That was the family's information to share with the hospital at their discretion-- with the Health Board at their discretion. We didn't share it.

Q You didn't share it?

A No.

Q You don't know whether the Oversight Board or the Scottish Ministers shared it with them?

A No.

Q With the Health Board?

A No.

Q Okay. Now, let's look at the methodology, so if we can go back to----

THE CHAIR: Sorry, just so that I'm following that question, what you said, Mr Mackintosh, was you don't know if the Scottish Government Oversight Board----

MR MACKINTOSH: Shared it with the Health Board.

THE CHAIR: -- shared it with the Health Board.

MR MACKINTOSH: Yes.

THE CHAIR: Now, the question assumes – and I want to check on this – that the Scottish Government and/or the Oversight Board received the 85----

MR MACKINTOSH: That's a good question, my Lord.

THE CHAIR: -- individual cases. Now, what's the position on that?

MR MACKINTOSH: How did the individual 85 reports get to the families? Presumably, you didn't email them yourself, so somebody would have done that.

A No, it was done by the administrators and the administrator for our team, if I remember correctly. It was emailed directly out-- sorry, it was sent directly to the families.

Q By your administrator?

A By our administrator----

Q So those documents----

A -- as far as I'm aware.

Q -- would be in the shared drive that you were working off during the pandemic?

A Yes.

Q Because, presumably, you're all working from home?

A Yes.

Q We can, presumably, identify the administrators from your overview report because you name every member of the team.

A Yes.

Q You weren't an organisation-- you're not data holders for data protection purposes. Who were you working for?

A Scottish Government.

Q Scottish Government.

A The other person who would have had an input into this would have been Professor Craig White around the communications because there were very close links with Professor White on how we liaised with families.

Q But you earlier on said that you shared all your conclusions with Professor Bain.

A No, Professor Bain, at that point, had left the organisation and was now working for the Scottish Government at the end of the----

Q So who were you sharing with everything at the end, other than Professor White? Would it have been Ms McQueen or----?

A I can't tell you. I can't remember.

Q Right.

A I can't remember.

Q But in terms of your customer, in an administrative sense, is within the Scottish Government?

A Oh, I think it was Elaine, Elaine Vanhagen. I think we had a lot of dealings with her, but I couldn't swear to it was the same person.

Q So Elaine Vanhagen works for the Health Board?

A Yes. I couldn't say in the absence of Professor Bain because she continued to be part of the conversation, but I'm not sure who we liaised with at that time.

Q What I'm trying to just check is that you describe in the report that you were instructed to carry out this work by the minister.

A Mm-hmm.

Q In fact, we can see that in the report and, from your point of view as a member – and I'll ask Professor Stevens and Wilcox if time allows – you would have produced your work, and you've clearly described how someone sent the individual reports to the families. Where else did the rest of your conclusions go, as far as you know?

A They were all-- Well, we did actually raise this question, about where did our information get stored----

Q Yes.

A -- and there was a repository-- I understand a repository within Scottish Government.

Q We probably need to ask them, but we will do that.

A I understand that's our-- That was where all of our information at the end of our review was stored in their repository.

Q Now, given that you've mentioned Ms Vanhagen, can you help me whether Ms Vanhagen would have been supplied with a copy of the

individual report?

A No.

Q You can't help me or she wasn't?

A She wasn't. Yes, sorry. They weren't given to people within-- They were not supplied to people within GDC, as far as I'm aware. Because she worked for the organisation. This was a discrete report, as far as I understand. Professor Stevens will be able to advise you further.

Q I think I need to ask Professor Stevens some more questions about it, not least of which because I'm sure some information is to be found at the protocol and you weren't involved in writing it. So, what I want to do is to look at the methodology that you adopted and discussion around that, and we might go to page 1015 to do this because you've optimistically stated that your overall process is summarised in figure 3.2 and so I thought I'd ask you about your process.

So, let's just think about what you are and what you aren't, as it were, as a group. What is the closest analogy that you can think of from your experience in practice, or you're aware of in academia, to the process that you've carried out in these cases?

A So, we were a group of investigators, not dissimilar to an IMT process, following the process through, using a root cause analysis to identify any risk factors, anything that contributed to any of these infections, and we're doing this on a personal level for individual cases. We're not looking at it-- We're not looking at the outbreak, we're looking at individual cases as a sort of--

Any outbreak that you are investigating and you've used the process-- in this instance, they call it an incident management team. So, if we're looking at all the same data, we are actually working, much like an incident management team, reviewing all of the data, albeit in hindsight.

We're looking at where the gaps are; we're looking at whether there's any other information that could be utilised; we're using a root cause to get to the bottom of what we might think has caused the infection; we have a hypothesis presented to us, "Is there an environmental link?"

And so, what we're looking to do is to prove or disprove the hypothesis within that investigation. We're looking particularly to see: are there harms that have come to the children? Are there adverse events that might have impacted on the care of those children and their outcomes?

So, when you put all of that together, we are actually doing a full investigative review of all of the care that

they have had and whether or not due process was followed. Does that make sense to you?

Q At one level, yes, but I think we need to drill down further because this is quite an impressive process map. So, am I right in thinking that there are two sub-teams feeding in data to you, one being the HPS Team and one being the PTT Team?

A Yes, that's right.

Q Now, we'll deal with the PTT Team in a moment, but what data sources are the HPS Team aggregating for you?

A So, we tried to look at the data that we collected from environment and the data that we collected from the laboratories. Now, the environmental data that-- Now, if I just explain----

A We'll do that, but I'm going to go to a page in the document----

A Oh, okay.

Q -- that might help us understand that. So if we can go to page 1088. No, a bit further on, sorry. We'll go to page 1095, sorry. This is your list of documents. So, continue: what was the material you were looking at?

A So, we were looking at-- We looked at all of the files for any of the environmental samples, we looked at any water samples, we looked at all of the environment. So these samples that you've got in here, where it says, "Water samples," we looked all of those water samples that we were able to identify. We looked at environment-- it's not on this list. We looked at all of the-- we looked at maintenance records----

Q So that might be----

A -- for that environment.

Q -- on page 1097?

A Yes. We looked at environmental audits, we looked at all of the risk management – so the HAI-SCRIBE, which is the risk management document before any building works and things take place – and we looked at-- When we looked at the risk assessments, the risk assessments are fine in one respect, but it doesn't actually tell me what work has actually been undertaken, and so what was more beneficial to us as a group is to actually look at the exact maintenance records that were undertaken in those areas.

So, in Ward 2A, 2B, what maintenance was undertaken, and so, when we requested the data for the maintenance, there were huge numbers – I mean, very large numbers – of works undertaken and it became-- it was presented to us in a very complex way that was difficult to understand. There weren't dates, there weren't rooms attached to where the specimens or wherever.

For an example, there was a blocked sink, and if I wanted to relate a blocked sink to Patient A, I would expect it to say, "Was it in Room 6?" It didn't tell me it was in Room 6; it tells me it was on Ward 2A. Now, that isn't helpful when you have so many sinks and showers or a drain or whatever it was, or a toilet, so it doesn't actually help you. So we needed somebody to help us actually refine the data so that it was in a useable form.

Q This is what the HPS Team did?

A This is what HPS were. Then we had-- and they did the same sort of thing, I think, in supporting us with the water specimens.

Q If we go back to page 1015 and the-- So the HPS Team are collecting together their information from largely environmental sources?

A Yes.

Q Right. There's been some confusion about the PTT Team and what role it played. What were the PTT Team doing?

A So, the PTT Team looked at all of the clinical notes and they assimilated some of the data. Now, we use this system because----

Q What is the PTT?

A That's the "Paediatric Trigger Tool."

Q Right, and can we just go to page 1107? It might focus matters. Yes, so what is the PTT?

A So a paediatric trigger tool is a system whereby it identifies any triggers that may present a concern for the management of that patient, and it's something that is very well known. Now, until I'd come to this review, I'd never used a paediatric trigger tool before and, in all honesty, because it's so complex and because we needed to ensure the cases that we were reviewing – so the children we were reviewing – were anonymised, we used an intermediary who reviewed all of the patients' clinical notes and actually took the information from there and applied them to the paediatric trigger tool.

Q So was the paediatric trigger tool being used to select patients for inclusion in the cohort?

A No.

Q No? So what was it being used for?

A This has been used to identify were there any triggers that would have been-- were there any triggers that would have given you an indication that this person was at risk of an infection? Could you make it a little larger for me? Thank you. So if you're looking at, for example-- take tissue damage or pressure or something.

Q So that's PG2, yes.

A Yes, so we're looking at-- if we look at PG1 or 2, are there observations? Have they got a raised temperature, which could give you an indication that there is something amiss? Have they come-- so any of these. A re-admission to hospital within a month. That is a trigger for what's happened with this patient could be a risk factor.

So all of these are risk factors for any-- which could indicate that they were at higher risk of developing an infection and is a well-known trigger tool for paediatrics and in other areas. Now I understand it. It's not something I'd used before this.

Q But in this context, you're using it merely to have a standardised list of things to look out for?

A It's like a-- To put it very basically, it would be almost like an audit tool so that we have a consistent approach to how we review the notes. It's so that we have one-- the same level of questioning and takes away a little bit of that bias, because we can use this as well on the trigger tool. We've used the same questioning for each individual person.

Q So does this feed into Appendix D, which is page 1109, the data synthesis template, or is that something different?

A This is where we bring together all of that information. So the paediatric trig tool, this would be-- the data synthesis template would be how the data would then be presented to myself, and when I look through all of this-- when I've looked through all of this information, and then I say, well, actually, I need a little bit more of-- I need a little bit more information. So I'm just going to pick one on here, which would be on the microbiology, why was the culture taken? So I might want a little bit more information on why was the culture taken.

Q But if you go down to the bottom third of this page, you'll see an entry called "Paediatric trigger tool."

A Yes.

Q This would enable the trigger codes that apply to be entered in there----

A That's right, that's right.

Q -- and a score on whether it was an adverse event?

A That's right, yes.

Q Does it seem to be the case that the PTT Team are consolidating-- reading the medical notes, looking for things in the trigger tool and consolidating it into this format?

A That's right.

Q Right, so you don't know the names of any of these patients?

A Absolutely not.

Q You just know dates and events?

A I just know dates and we identified them by a unique number, which was linked to their CHI number, which is their hospital identifier.

Q Which is their date of birth.

A Yes, and we did-- I had no-- all I had was a date of birth for a child and no-- nothing else, and the episodes of infection and we had the history of those children. So when we looked back-- and although the report goes from-- we were asked to look at these from 2015, May 2015, to the end of 2019, we may have had to go back before 2015 within their medical records because we would need to know what the diagnosis was. They may have been diagnosed in 2010.

Q Indeed.

A So we may have looked at notes that extend beyond that period.

Q So if we go back to page 1015, please. Would we be right in thinking that, therefore, the process here effectively amounted to the HPS team pulling together everything that's outside the medical notes and the PTT Team pulling everything that's inside medical notes into a standardised format?

A Yes. Essentially, yes.

Q Then you carry out this box which you describe as-- That data synthesis clinical timeline, that's the document we've just looked at?

A Yes. The clinical timeline was created so that we could look at the patient journey. This is all about following the patient journey and their risk factors.

Q So this would have such-and-such date, admitted such-and-such date, infection such-and-such date? Right?

A Absolutely. That's it, and you look at the risk factors and anything that could have contributed to those in the meantime, but you also look at what was in the environment in the meantime. Hence, we're looking at what happened in the infection control audit; we're looking to see what the results of those were. We're looking to see were there any particular risk factors around the environment: did the room have a blocked shower? Did the room have a drain? Were there problems with the chilled beam? That's another issue. So we looked at all of those and brought them together in that data synthesis.

Sometimes there were gaps and we had to go back for further-- to ask further questions and for further information. But, for each of those cases, for each of those children, we actually followed a clinical timeline from where they're admitted to when they became ill to what their management was and what their outcome was.

Q So in the repository, not only will there be 85 individual reports for families, there'll be 85 timelines? You're

nodding again.

A Sorry, yes. Yes, they should be and you should have all the data synthesis-- would be the data synthesis and the----

Q Which is the form we just looked at?

A Yes, and the PTT forms all should be collated.

Q If we go to page 1110, what is this document, "Part 2 summary"? Zoom in a bit, please.

A Thank you. (Pause for reading) It literally is just a summary of what we've seen on the previous page: were there any key issues that we needed to look at? The tableau timeline is quite important because that gives us not just the infection of that individual, but we're looking to see were there any other cases that were related in that time period.

Q So what would you find in sort of broad terms? What would be written in a tableau timeline? For example, a patient with Stenotrophomonas in 2018, what would you roughly see written there, in broad terms?

A Well, you might see-- you might see this is Case 3 of 8 and they started on 1 January and the eighth case was on 31 March, and you would see where that case came in that timeline. So it could be that this was Case 3 out of 8 and you would be looking along that line to say where did it occur? What time did it occur?

Q Then what would the ICNet and Telepath boxes be for?

A So ICNet is an infection control-- I can't even think of what the word is now.

Q Database?

A We use it-- a database, yes, sorry. It's an infection control database. It actually pulls information on certain organisms out of the laboratory-- the LIMS website, so it pulls it out of the lab results. So if you've got a positive result of certain organisms, it will pull it into-- every 15 minutes it gets a refresh and it will pull that organism to say, “Actually, there's an alert. We have found an infection. Is there something that you need to do as an infection control team to investigate that?”

Q So this box would tell you whether there'd been such an alert in this case?

A Yes, so it will tell you whether or not it was in ICNet, and ICNet has a prescribed list of organisms that it pulls from. Now, that's not finite because you can actually add organisms if you have a local alert organism. When we say an alert organism, we mean something that actually, within your environment, is more prevalent than it is in other areas.

So you can add organisms to ICNet so that it will pull them off from the laboratory, so it would trigger a response to say, “Actually, we've just noticed there is a--” and it would trigger a response.

Q So, similarly, the Telepath entry would record what Telepath entry is for this patient?

A And Telepath will as well, and there is a note section, I think, within Notes, which is a note session which would also record any conversations or advice a microbiologist had given, and a microbiologist had given as well.

Q Similarly, IMT and PAG minutes, would that be a summary of relevant bits of IMT minutes in each case?

A Yes, it would be, you know, what was relevant? What wasn't relevant? Were there any recommendations? Was there a decision log? Was there an action log? Were there any results provided? Was there a PAG or an IMT?

Q So these sections could be quite long?

A Some of them could, but usually we kept them quite short, because the others-- this is just so that we could identify whether or not we needed further information. But this is just a summary of what would be on the other pages.

Q Then the----

A So was there a Datix, for example?

Q Yes.

A Was it reported via the Datix system? Was an adverse incident reported? So that would be "yes" or "no."

Q Right, and then the environmental microbiology would tell you what was going on in the environment in terms of surveillance?

A Yes: was there any? It could be were there any samples taken? Were we able to link the results: yes or no?

Q Where were they at that----

A Where were they, yes.

Q The HAI-SCRIBE was where you pull the maintenance record that HPS has----

A Yes, that's a risk assessment: was there a risk assessment undertaken for any building works that were on at the time?

Q Yes, and then there'd be other observations. Now, if we go on to the next page. Presumably, would this conclusion be written after you'd had your expert team meeting?

A Yes. So these are after we've all gone together, and the team got together to discuss every one of the patients and that was a minimum of twice and some of them were more than twice----

Q Yes, I got the impression you did it twice. Is there any particular reason why you did it twice?

A Because we got some data very late on and we had to go back. We got some data sent to us that we'd requested in December 2020, and we had to go back and review all of the cases again against some of that data that appeared in a very late submission because it could have had an impact. So we went back and reviewed every single one again.

Q Now, so that means that there will be a conclusion sheet for every single of the 84/85 patients?

A Yes.

Q Right, so how would you respond to the criticism that your approach is subjective?

A In respect of we reviewed all of these cases in line with a specific-- with specific tools.

Q The tools being the structure?

A The tools being the paediatric trigger tool. We looked at the-- we looked at it against their own policies, procedures, of the time. We didn't go back. You know, if we were looking at 2015, we looked at policies in place 2015 and so forth.

So, we tried to keep that as stable as possible, and when we're looking at, like you say, some of this subjective-- and

it is quite difficult to make a decision around whether or not is it possible or probable, and sometimes that is a little bit more complex to decide. But this is all based on the evidence that we were given. This is not based on-- we didn't make this up out of what we think it could have been.

Q No, but you've each got complementary expertise that you've described----

A Absolutely.

Q -- and to what extent is it fair to say that, effectively, you have-- it's an exercise in-- for each individual case, an aggregate opinion of the three of you?

A It's not just the opinion, it was based on what evidence we have and on probability, and probability is very difficult to define, but it is more likely to have happened than not happened.

Q Well, let's look at probability.

THE CHAIR: Just before we get to that, I think I'm clear, but when you're exploring with Ms Evans the word "subjective," what I think is established is that the material or the evidence, however one describes that, that you're working on is objective. There's no subjective----

MR MACKINTOSH: Yes.

THE CHAIR: -- decision as to whether a piece of evidence comes into the decision-making progress.

A No.

THE CHAIR: When we're using the word "subjective" and discussing it, that is the exercise of judgment as to what one makes of objective evidence. Sorry to be so pedestrian about this, but I want to clarify that we're at one on this.

MR MACKINTOSH: (To the witness) So your position is that the process of assembling the data to produce that report that we've just looked at is assembling data that is there----

A Yes.

Q -- and, in some cases, noticing what's not there, but it's assembling what is there, and that is grounded in reality as much as you can find it?

A As much as you can find it.

Q Then once you get to the consolidated data set and the three of you are sitting on your Teams call to discuss the cases, at that point, you're making a professional judgment on these issues around probability and causation that we're about to discuss.

A Yes.

Q Yes, and that professional judgment is an aggregated-- of three people with complementary expertise.

A Yes.

Q So it might be that you have a discussion where one of you says, "Maybe this is the case," or "Well, maybe not," and you reach a conclusion by some sort of iterative process.

A That's absolutely right, and there were occasions where, if we were not in agreement, we would go back, look at further evidence and come back again to discuss those cases.

Q So when we say it's an opinion, it's not an opinion on whimsy. It's an opinion applying-- reaching opinions based on objective fact?

A Yes.

Q Right.

A On the facts that we were presented with, so-- and we applied the same criteria to each one of those cases. So, every time we look at those, we apply the same discretion and the same critique that we would for-- If there was something that I didn't agree with, I don't know, in IMT notes, for example, we would go back, review that IMT note and actually look at the interpretation of that again to make sure that, actually, we were all focused and on the same page before we would reach a consensus that we could put into that conclusion.

Q Okay. Well, I'd like to move to a little discussion of probability now. If we go to page 1043. You produce your likelihood of assessments on this page, and what I wanted to do was to-- If you look at 1043, we see the table and we see these categorisations on the left-hand side, and you explain in this section

how initially you had more categories than were usable because “definite” never really got used.

A That's right.

Q Yes. Now, this Inquiry is conducted by lawyers, and so one of the consequences of lawyers is that His Lordship has adopted the approach that the test we need to apply is that of the balance of probabilities, and therefore the view that something is more likely than not to have occurred. If His Lordship is satisfied to that standard, he can determine what the facts are.

Now, what I want to do is understand where that line draws in this table, and I'll ask all three of you about it. So, if we start with “possible.” What does "possible" mean if you-- in terms of whether it's more likely than not or less likely than not?

A So it is possible because there are-- you can possibly relate it to other-- There are no other risk factors that we could identify, but there could be an alternative. There could be an alternative reason for that infection, but it is possible that it could be linked to the environment. But it could be that there is possibly an alternative----

Q It could, for example, have come from the patient's gut?

A -- an alternative source of infection that we just haven't found yet.

Q Right, so other things are possible in the case of “possible”?

A Yes.

THE CHAIR: Again, at risk of being very pedestrian, what's the threshold of possibility? Because we're talking about a particular case, an infection in relation to one patient, so----

A Because there may be other cases related: other cases of the same infection at a similar time that might have occurred in a similar time within that environment. It might not be in the same room. It might be in a room further down the corridor, but it is possible, but we don't have the evidence to make a further conclusion.

So we don't have a result, or we don't have a result that would link it to a specimen from a drain or a water tap or the environment or a swab. We don't have that, but we do think actually it is possible it could have come from the water, but, in the absence of another hypothesis, it could have come from somewhere else. It's possible.

THE CHAIR: Maybe I've not made my question very clear because that answer seems, to me, a different question, which is why is it not probable?

A Okay.

THE CHAIR: Now, can I start again? We're looking at 118, "Incidences of infection." Now, what is the threshold

for a particular case to come within the broader category of "possible"? Because I'm assuming that one has to start with "possibility" before one says anything about probability. I mean, anything that you conclude is probable must also be possible.

A Possible, absolutely.

THE CHAIR: So, how does one get within the group, the larger group, of possibility?

A So, if we look at that unrelated group, where we look at the unrelated cases-- because there is an alternative for those eight unrelated cases, so those we have excluded. For everybody else, we cannot exclude the environment, so if you cannot exclude it as a source of infection, they become possible.

THE CHAIR: Right, and how does one-- although I may be trespassing into what Mr Mackintosh is going to ask you. How does one exclude the environment?

A So, if we can find an alternative source of the infection or an alternative reason-- So, for some of those children, when we talk about endogenous and exogenous infection-- so we're looking at infections that come from within. So, for example-- and we've mentioned-- so typhlitis, which-- Professor Stevens probably will be able to give you a lot more detail on how these manifest.

But children who have come from another hospital, for example, who have come and had health care outside of GGC-- so they may have had health care delivered in another hospital or at home by another care provider. So the timing of that infection as well-- So if it's not-- if the infection has appeared immediately that they have been admitted, we would say, "Well, actually there is a cut-off date of 48 hours." We would look at whether or not there is a 48 hours after admission.

So, there are some timings around it, but quite often, unrelated was that these infections can be explained by other means, that maybe there has been a gut translocation of bacteria, so the infection has come from within that child. Does that make sense to you?

THE CHAIR: I'm no doubt being very slow about this. I think I----

A But in that case, it would not be related to the environment.

THE CHAIR: It would not be related to the environment because of the nature of the microorganism?

A The nature of the microorganism and because the child has symptoms that display that they have other reasons why it didn't come from the environment. So if you've-- Does that make sense to you?

MR MACKINTOSH: Well, I mean, I think the question that's crawling at the

top of my brain and I think I need to ask is this: please tell me if I've got this wrong, but are you effectively saying that, in some ways, "possible" is the default?

A In some way, if this is possible-- no, there has to be some sort of, “Is it possible that it could have come from the environment?” So we have some that are unrelated----

Q So this is time, place----

A But if there is-- yes, time, place and person. So if you have got a reasonable suspicion of time, place and person – that actually they were in the right environment, we have some evidence that this organism existed or-- but we cannot connect where this came from, and there could be an alternative source of the infection – it becomes possible.

Q So if we go back to the IMTs, in the IMTs quite frequently in their structure, there is a discussion of hypotheses.

A Mm.

Q We see, for example, a hypothesis that this infection is connected to the water system, and discussion about some tap or a sink. Is there really any difference between a conclusion that it's possible in your work and the on-the-ground hypothesis generation process in the IMTs that we've read about throughout this Inquiry in that, effectively, someone on the IMT has gone, "Well, time, place, person, other infections, water testing results, hypothesis." Is that not the same as "possible" there?

A Yes, so you're looking at-- each one of these, is the time, place and person-- is there a possible link between these cases? Can we possibly link those together? If there is a reason why these, in the unrelated cases-- and we go on to explain why they're unrelated cases. But this is-- what evidence do we have?

So, is it possible because there was a lot of environmental disruption, because there were a lot of cases that appeared? It might be that there was an organism where there were just two. I can't remember the complete details of them all now, but it is possible it could have come from the environment because we can link it to a time, place, person----

Q Right, so, it's basic----

A -- I think, and that is really important when we're looking at an outbreak investigation. Maybe I should have said that earlier. The time, place, person is the rationale between-- on which we base all of our investigation.

Q So, just sticking with "possible" for the moment; we'll come to the others. Please tell me if I've misunderstood. You seem to be saying that in order to reach a possible decision, you and your two colleagues, using all the data you've

collected, are applying what is, in essence, a conventional IPC decision-making process to the data you've collected. You've reached the conclusion that it is possible there is an environmental link. You haven't excluded it because there's an obvious non-environmental connection, and therefore it is a “possible.” Is that roughly right?

A That's right, and if-- (inaudible) exactly right. It is easier to take away those-- they're unrelated because we've found another reason.

Q Yes.

A And so if there is not another reason to explain it and we haven't got another hypothesis, we can't prove or disprove it. It is feasible it could have come from the environment.

Q So, before we get to “probable,” let's just pick up "strong possible" because that seems an odd piece of phraseology. What's the difference between "strong possible" and "possible"?

A This would have been that there was a little bit more information, so we might have had-- an example would be that we might have had a specimen of that-- the same bacteria. We might have had the same bacteria but in a different location within that ward. So, if we're looking at Room 6 but we've got a specimen maybe from Room 3, it's

possible. It’s a stronger possible because we have slightly more information.

Q But it's still in the same category of conclusion as those hypotheses and the IMTs that we read about?

A Yes.

Q Right. Let's move on to "probable." You've explained "possible" and "strong possible." I'm not even going to ask you what "weak possible" is because it seems to be self-explanatory. But "strong probable," what is it that makes something from the “possible” to the “probable”?

A Probable because-- usually because there are more cases, so it might be part of a larger cluster of cases. Within a time frame, we go back to the time, place, person. So, the time, place, person, there is an absence of any other risk factors that we could possibly identify with information----

Q So, for example, there aren't the suggestions that are consistent with a gut translocation in that case?

A No, there's nothing that would suggest that it would be linked to that. There may be some possible-- there may be some microbiological results that we can link to the environment but not necessarily to the right environment.

Q What do you mean by that?

To a different location?

A To a different location, so not, maybe, in that room but maybe on the ward or we've had some-- Let's say Ward 2 or Ward 6, whichever ward we're looking at there is a positive result, but we cannot, with a hand on heart, identify which locations those specimens came from.

So it might say Ward 2, Ward 2A, but actually, it doesn't say which room it was from, it doesn't say which location it's from, and when you're looking to make that an absolute definite, you need something that gives you categorical evidence, a bit like probability, that says, "Actually, that specimen came from that sink on the day that that patient was in that room."

Q So do you need that level of precision to get to “probable”?

A No, to get to “definite,” but to get to probable,” what you need is that but minus that bit of information that actually definitively links that that environment, so we can't do that.

Q So you might, for example, have a time, place, person infection that got off the ground as possible on a particular patient in a particular room in a particular ward at a particular time, and then you add in two or three other patients in closely related time in different rooms, or even the same room, but you still haven't got the sample from the sink, so you can't get to “definite.”

A No, you can't say it's definite, but then you would look at that environment and say, "Actually, we have no other-- we have no other hypotheses suggested. Is it coming from the environment?" But we haven't got the right level of testing to be able to prove that, but there is a strong suspicion based on the evidence of time, place, person.

Q What's the difference between “probable” and “strong probable”?

A Just the degree of evidence that we have. So it's probably probable, but if we had specimens that could link to the environment, to that area, then it would be a “strong probable.” It wouldn't necessarily link to the patient, and I think there was one case where GGC had actually said that they could link one of the cases – and Professor Wilcox will probably tell you more about that – but we couldn't actually link it in terms of time, place, person to that individual case.

Q So the sample in the environment----

A Didn't match.

Q -- couldn't be connected to the patient?

A We couldn't match it, and the reason some of this we couldn't match is that the data, which made it more

difficult-- was that the data that we were given was given to us in a very, very difficult-- We did use HPS to try and put it into a more manageable way of looking at the data.

So some of the data was quite difficult to ascertain dates, or it wasn't filed properly or, for example, an IMT would say a specimen should be taken and then we couldn't link the specimen back. So there were a lot of anomalies around data, which-- That is your belt and braces, and we didn't have that to be able to make----

Q To go back to our original question about our standard of proof, on the-- I think it's the next page, you have listed the actual organisms, and I'll go past that. You reached the conclusion----

A There they are.

Q There we are, sorry. That's it. Go back to page 1044. Yes, table 5.4 on 1044. You've come up with the idea of "most likely." It's described in the second paragraph on page 1044. For our point of view, however, we need to focus on "more likely than not," which possibly is different from "most likely."

If you had to draw a line, where does "more likely than not" come? Does it come between “possible” and “strong possible,” or between “strong possible” and “probable,” or somewhere else? This is a translation exercise.

THE CHAIR: You may or may not wish to----

MR MACKINTOSH: -- answer that question. But, in essence, "more likely than not" seems, from our point of view as lawyers, to be----

A I would say if we're going to say that it's “probable”-- it is possible, but we don't enough evidence to actually make it a “probable,” is what we're saying. And then, if it's “probable,” it probably did come from the environment, is what we're saying.

Q So it's more likely than not?

A It's more likely than not.

Q But “strong possible” probably isn't in that category.

A No, it didn't quite reach that category because we felt we needed a little bit more information to be able to say that.

Q So if we go to 1043, the bright line that we're forcing you to draw, albeit you didn't draw it, sits just between “strong possible” and “probable,” and therefore places 33 episodes into "more likely than not."

A That’s right. Yes.

Q Okay. We'll re-explore that with Professor Stevens, I think. What I want to do before the coffee break-- also to point out something to my colleagues, someone hasn't changed the clock on the other side of the room, so I'm now

anxious that it's twenty past twelve, but it isn't.

THE CHAIR: Well, if you look to your right, you'll get more reassurance.

MR MACKINTOSH: Thank you, my Lord. What I want to do is to talk about root cause analysis before the coffee break. So, in your statement on page 45 at paragraph 36, you discuss-- Page 45, please. Not the supplementary statement, the original one. Yes, 45. There we are. Bottom of the page, paragraph 36.

You discuss root cause analysis and you make an observation that this was instigated in late '19 as a methodology. I want to just check that you've seen a document that we've been looking at, which is bundle 4, document 45, page 190. I think, from the index sheet, it might be something you've seen, this report on the root cause analysis of 13 cases and 12 paediatric patients.

A Yes, I saw this for the first time earlier this week, but this is an SBAR based on a culmination of the author analysing root cause analysis for these cases. However, I've got some reservations about----

Q Before you do that, I just need to connect documents together, so can we look at bundle 6, page 1100? Zero, zero. Bottom of the page, "Root cause analysis." So these three subjects on the bottom of the page, "Root cause analysis," there's three entries. This analysis here isn't the document we've just shown you.

A No.

Q No, and so the document, is that a summary of it or--? It reads like that.

A That paper is a summary written in----

Q Back to bundle 4, please.

A It's a summary written in the format of what we call an SBAR: situation, background and so on. So this is a culmination of what people have found in using the root cause analysis to investigate the cases. Now, the root cause analysis, if we go to the bottom of the page, if you wouldn't mind, on the bottom of the-- Oh, sorry, the next page. If you go to the bottom of the page here, it does say that, in the methodology here, a root cause analysis was taken, but somewhere in this – and it may be that piece has been redacted – it does say what this is is a conclusion, rather than-- I don't know, is there another page following this?

Q There is.

A That's it. Thank you. It gives a conclusion that says it's not identified a single environmental source. However, further back it does say that, actually, there hasn't been an input to the root

cause analysis, either by a microbiologist or by the clinical team. So, in effect, what you've got is a conclusion of these 12 RCAs, but actually, the RCAs haven't been completed because there hasn't been a clinical input.

Q So if we can just try and do this by analogy, you've described you carrying out a root cause analysis. Your root cause analysis was carried out by-- I hope you don't mind, but there's an infection control nurse, a microbiologist and a treating clinician.

A Yes.

Q This root cause analysis was carried out by an infection control nurse.

A Yes.

Q Seemingly.

A Well, I don't know who the author of this was.

Q No, but they're professional-- They're on your line of professional skills, not a microbiologist.

A They are, but you're making an analysis without all of the information. You haven't had a clinical input to the RCA. You have to have a microbiology input to the RCA. An RCA is only as valuable if you've got all the right people making those decisions around the table. When we looked at undertaking our root cause analysis, we went away and found that information, and we went out and found additional information that we needed.

Now, there is no clinical input into this. This is an appraisal, and it just says, "The review has not identified a single environmental source." That's fine, but where is the recommendation out of this?

Q I think the then lead or acting lead ICD, Professor Leanord – I hope I'm not putting words in his mouth – would probably observe at this point that, when the decision was made soon after this was done to declare Ward 6A microbiologically safe, the sources of information comprised the root cause analysis this is summarising; his reports to the IMT about various matters, including his views on some of the whole-genome sequencing that was being done; an epidemiology presentation produced by, I think, Dr Kennedy; and the HPS 2019 October paper, which we've already looked at.

All of those together, along with some work from Professor Jones, were fed together to the IMT that reached the conclusion. So does that render it unnecessary for there to be, at this stage in the process, an input from a clinician and a microbiologist, because you'll get that in the IMT?

A No, but it actually says that the RCA should have that input, and it isn't there, and that might have an impact on what a clinician might think is a risk factor

or could have contributed to those infections. My other concern about these, while we haven't identified a single environmental source, is that the infections that you have are not common infections, and still we go back to, "What is the source of these uncommon infections?"

Q Well, that might be a useful topic to wrap before the coffee break. We've heard a lot of discussion about the concept of unusual microorganisms. Now, in the context of gram-negative bacteria alone, what should we understand or what should we think of as important about the concept of an unusual microorganism, from your point of view?

A It's whether or not it occurs frequently, whether we see this as a common source of an infection, which we don't see, and Professor Wilcox would be best to advise you on the numbers – that's his bread and butter every day – about how frequently they come through. All I can tell you is that some of these infections I've not seen in my career as a source of infection in a bloodstream infection in my infection prevention career.

Q We've had some discussion. I think I might have to ask Professor Wilcox – I'm not sure how I'm going to fit it in, but I'll try – about whether some of these infections do or do not have background rates. Is that something that you would be familiar with as a broad concept, even though I'm not going to ask you about individual organisms?

A Yes, and background rates, we do. We do see some background rate of infection, and I think sometimes we look at background rates of infection and get a little bit complacent because a background rate of infection should actually be looking to reduce a background rate of infection all of the time.

We shouldn't be complacent and just accept that that is the background rate. This is why we use quality improvement infection prevention-- is that you should be striving to reduce the numbers of that background infection, not accept that that's the norm.

Q How does that apply in the context of a microorganism that you might only see, as at least five people have said, once in a career?

A Well, you might see one-- It is exactly some of these that I had to ask about because I'd never come across these before, and if you get a "novel organism," is how we would describe it, that it's novel, we've not seen it before or-- it should ring some alarm bells as to say, "Where has this come from? Is it something new? Have we seen it

before? When was the last time we saw this?"

I think there were some infections, looking at the data, that they'd only had five in the whole year previously in the whole of Scotland, and yet we'd had three infections of the same organism in a very short period of time, and that should ring alarm bells with the team.

Q I'll put something to you now, so I'll set this up, which is that it's been suggested that, in the second half of 2019, the rates of potentially environmental gram-negative bacteria, taken as aggregate, were comparable to the rates in the previous building before the move or in the early parts of the operation of the hospital in '15 and '16, and that some reassurance can be derived from that.

There is a contrary view expressed that these are unusual microorganisms, they're very rare and one should be very, very alert about that. Is it legitimate to look at the overall rates of gram-negative, potentially environmental bacteria when, within that group, there are some very unusual organisms?

A I think you have to-- My opinion would be that you look at the very unusual cases of infection. Rates of infection in the old hospital: this is an old building with a worn environment. That brings with it, itself, challenges when the

building can't be kept clean for one reason or another. So, you do get some level of infection.

When you move to a brand-new build, which should be built to a specification that is all whistles and bells, so that, you know, you design out faults that you've experienced before, you would hope to see that you would decline in your infections overall.

Now, we are dealing here with a susceptible cohort of children who are very vulnerable to infection and will pick those up, but I do think that the novel infections that we've seen, the very rare, unusual infections, do warrant investigation and should be treated with that, and where have we got this from. It's a really unusual situation to be in because it's not just one, it's several.

Q Thank you. I would suggest more, but we take our coffee break now. I'm going to see what extra questions-- see if there's any informal rule lines in the room at the moment after the coffee break, but this might be a good time to break.

THE CHAIR: Right. As I said, we'll take a coffee break. Could I ask you to be back for about ten to twelve?

A Okay.

(Short break)

THE CHAIR: Mr Mackintosh?

MR MACKINTOSH: Thank you, my Lord. I wonder if we could just pick up something about the root cause analysis. So Ms Devine, who's currently the Director of IPC for NHS Greater Glasgow, explained in her transcript – just for the benefit of colleagues, paragraph 458 of her statement – that what was done in October 2019 was more of a "clinical review" rather than a root cause analysis. What would you understand by that distinction, if there is one?

A A clinical review would be reviewing all of the medical notes. I would anticipate the nursing notes, the medical notes, whereas a root cause analysis is actually the questioning. So I would be asking the question, "Why did we do this? Why did this happen?"

So I'll give-- if it's all right, I'll give an example of a root cause analysis from a line infection. So when you're looking at that, why did that person get a line infection? Because it wasn't inserted correctly. Why wasn't it inserted correctly? Because the clinician doing the insertion hadn't been trained.

Why hadn't they been trained? Because we don't have a training programme for doctors. We only have a training programme for nurses. This is hypothetical. Why don't you? Because their training comes from a different department.

And then, when you get to the "Why," so you go and say, "What's your recommendation?" And your recommendation is that you implement a training programme that crosses across all genders, so it's a different process from just reviewing the clinical records.

Q It's an iterative process of asking questions?

A It is. It's actually a device. It's an in-depth and usually in a-- to put it simply, it's a series of questions. You ask, “Why, why, why?” So the five whys is generally accepted as, “Why did this happen? Why didn't that happen?” Or it's a series of questions till you get to the very bottom of your reasoning.

Q Whereas a clinical review wouldn't necessarily have that?

A No, it would say, well, these are the notes and you might ask the question, well, "Why we did that?" but you're just reviewing a series of records rather than challenging. You could add some challenge in there. There may be some challenge in there, but you're challenging those records, but are you asking the right question if you're not asking about the environment?

So if you're just looking at the clinical records, what are you learning

about your environment? What are you learning about your IPC audits that might have contributed to that situation, whatever it is?

Q Right. I want to show you the list of micro-- (Mobile phone ringing) Sorry, that shouldn't happen. I wonder if you could look at the microorganisms at table 4.2, so that's page 1028 of bundle 6.

Since you gave some evidence about things being unusual, I thought what we might do is look at the list in table 4.2 on page 1028 of bundle 6 and ask you to identify which of these organisms, albeit I accept this is by genus, are either in of themselves novel in that you would rarely see them in the way you just described, or where some of the species within there are novel or unusual. So which are the ones where the whole genus is unusual?

A Okay, I wouldn't have come across Achromobacter.

Q Right.

A I wouldn't have come across-- well, maybe I have Chryseobacterium. I have maybe come across that one, but not-- it's not a common one that I would have come across. Aeromonas, certainly Elizabethkingia, Delftia.

Q So Aeromonas, Elizabethkingia, Delftia, Achromobacter, you're seeing as novel?

A Yes, and the one at the bottom. I have not come across those.

Q Herbaspirillum?

A Yes.

Q If we go on to the next page of the list on page 29, which of those would you see as something that you, in your practice, would either rarely or not come across?

A I can't even say it now: Raoultella----

Q Right.

A -- and Rhizobium, Roseomonas and Sphingomonas, out of that table.

Q If we look at the organism at species level, can you help? It's a long list, I appreciate that, but I think it's worth doing. Of the organisms listed at species level, which ones have you, until you got involved in this, not come across?

Q Achromobacter.

Acinetobacter, I've come across before, but whether it was baumannii, I don't know. I couldn't tell you that. Certainly, the Acinetobacter ursingii, I've not come across that before. Brevundimonas, I've not come across that one before.

Q Now, those ones you've just discussed, would they be, in your ideas of your definition of a novel----

A It would be-- Well, I would need to know a little bit more – whether or not we'd come across those before as

an organisation – to say is it novel because there are some situations where you would find those, but they're not ones that I have come across in my experience before----

Q Right. Is that a sort of level of-- creating a level of alertness when you see----

A Well, it does. If you've come-- if you find something, you think, "Oh, I don't even know how to pronounce that. That's really unusual," and I think what stuck in my mind was the Elizabethkingia one because I had never come across that one before.

Q So, just stick with the list. You were at Brevundimonas.

A Yes. I'd never heard of that before.

Q What about the last four on that page?

A I saw-- Citrobacter I've come across before. Chryseobacterium, I might have come across, but in terms of the species, I couldn't tell you----

Q Right.

A -- which species. I would tend to remember the first part.

Q Over the page? So maybe it's just any of them here that-- You mentioned Elizabethkingia. Anything else here that you would categorise as novel in the way your evidence----?

A I think because-- Citrobacter

we would've heard of, but there are so many-- look at all of the different species. Now, that would, to me, give me-- why have I got all of those? That's unusual. We have two Elizabethkingias. That would be unusual to me, to see two. So, two different ones where it's a rare organism anyway, and now I see there are two different species. Why would that happen? It would make me curious as to why they were there.

Q So, really, the point you wanted to get across is that this creates a sense of curiosity?

A Yes, and that's why I would go and say, "Well, where's that come from?" or "Why have we got that? Where do I get that from?" It would make me go and search that out as to why.

Q Okay. Is there anything else on this page that is in a similar category?

A So, the Herbaspirillum. Let's have a look further down. Raoultella-- the last four, I think. The Roseomonas and Serratia. I've not come across the liquefaciens before. That doesn't mean to say it doesn't, you know-- it isn't common. I've just not personally come across that.

Q Then the final, last page, assuming that----

A And Sphingomonas.

Q Paucimobilis?

A Yes.

Q Right.

A The Stenotrophomonas, I've have come across before----

Q Yes, and Serratia.

A -- and Serratia I've come across, yes.

Q Yes. What we take from this is that when you meet-- things are unusual, you should be asking questions.

A Mm-hmm.

Q Right.

A I would ask the question. I would want to know-- It would trigger a curiosity in me to want to know, "Where's that from?"

Q Now, if we can take that document off the screen and look at bundle 7 at page 267, which is the 2019 HPS report we were looking at. So this is in a section of that October 2019 HPS report we looked at at the very beginning. Do you see-- I mean, I presume you read this at the time?

A Mm-hmm.

A Do you see the “Comparison with Other Health Boards” section?

A Yes.

Q We have here, in the first paragraph:

> “When comparing the overall rate of positive blood cultures since the move to RHC to the combined rate of the other two Scottish Children's Hospital in Aberdeen and Edinburgh, the incidence of positive blood culture, using the case definitions 2 to 5, was higher in the Children's Hospital for environmental, including enteric group, but low in the gram-positive group, and no difference in the gram-negative group or the environmental group.”

This is something that-- one gets the impression that some of the witnesses think is rather important as a source of reassurance. If we look at the actual report of the case notes review, paragraph 8.2.3, which is page 1068-- sorry, of bundle 6. You discuss this data, and I think you've explained in your statement this arose partly in response to comments from Greater Glasgow in response to the draft of the report. Have I put the document-- two and two together and connected the right documents to the right section?

A I think so. Which paragraph are you referring to?

Q The description is in the middle, so second paragraph:

> “We are not intending to provide a critique of the report."

A That's right.

Q

> “However, its significance

loomed large in our discussion with NHS Greater Glasgow. We therefore added this short section summarising our view of the report's findings."

A That's right.

Q Then the second paragraph from the bottom:

"We do not see that this report would have provided any clear message or either reassurance or concern about past events, nor do we see it to offer the clearly interpretable and favourable comparison of the Scottish Children's Hospitals."

A Yes.

Q Remember this?

A Yes, I do remember this. Yes. Yes, and that is right, and what concerns me personally about the report from 2019-- and there does seem to have been some store set on the results of that report from 2019 by GGC, and there was a great deal of conversation regarding the relevance of that report to the organisation. I alluded to it a little bit earlier that I am always a little bit wary of trying to justify your levels of infection, which is what it feels like----

Q So that particular----

A -- in that particular thing. When the argument is that if you are looking at, "Are we the same as everybody else?" – and there is some store to say, "Are we the same as everybody else?" – what I struggle with in this report is actually the merging of two organisations to make the same amount of data to make it the same as----

Q So, in the HPS report, they merged----

A They merged the two sets of data.

Q If we can go back to bundle 7.

A And that, to me, isn't the same as looking at a different hospital which would have similar-- a children's hospital which would have similar demographics. So, if I wanted to look at a hospital, I wouldn't take two small ones and put them together because the demographics are different. The procedures that they undertake could be different. So I don't know these hospitals, but that's my interpretation.

I would want to look at a hospital that had similar demographics, had the similar number of children going through. So I might look at a hospital-- as a comparator, a hospital in another area. If there isn't one in Scotland, you'd have to look further afield around the UK.

I would want to be looking at, "Are there several, not just one?" But what is it-- "where do you sit in amongst your peers," rather than-- which is what I think

the intention was, but when you put the two groups together to make one set of data, that's not really the way that I would have approached it. I'm not an epidemiologist, but I certainly wouldn't have approached it that way.

So, I do think that when we looked at those, what it seems to suggest is that we're no worse than anybody else, but actually, is that what you want to achieve, being no worse, or do you want to strive to be better?

Q So you're not an epidemiologist. There wasn't actually an epidemiologist on the----

THE CHAIR: Excuse me, Mr Mackintosh. Just so that I'm keeping up. (To the witness) One point is your use of the word "demographic." What do you mean by "demographic"?

A So, the same type of children who would have the same type of procedures, similar numbers, similar types of treatments that they would treat. So, children's hospitals----

THE CHAIR: It's the similarity of the patient cohort----

A Absolutely. The cohort, yes.

THE CHAIR: -- as opposed to the wider population from which these patients are drawn?

A Yes, that's right, because the environment from which they're drawn-- they come from all over Scotland to the hospital, and the same that you would in a specialist hospital in London, Birmingham, Newcastle. They would come from anywhere.

THE CHAIR: Thank you. Sorry, Mr Mackintosh.

MR MACKINTOSH: It was just to note that you're not an epidemiologist. There wasn't actually an epidemiologist in the expert panel, was there?

A No, there wasn't.

Q How do you respond to the criticism that a flaw in the work of the Case Rote review is it didn't carry out its own epidemiological comparison with alternative hospitals?

A The review was never intended to be an analytical study. There had already been several analytical studies, and the organisation has its own people who are quite capable of pulling together an epidemiological study, and they were supported by HPS.

So, what we were asked to do-- and I think this is in the document, which is the protocol which says that it should have been-- I can't remember the word, but something like a descriptive study rather than an analytical study.

Q Right.

A It does say that it should been a descriptive study. This is the first study that had focused on patients- the children and the families, and we

included those families in that discussion and wanted to hear what their concerns were so we could address that through reviewing those clinical records, and it was a descriptive study. I think it says "descriptive," but it was a descriptive study.

Q Okay. Now, I want to move on to the issue you raise in paragraph 42, page 47 of your statement. This is about alert organisms, and you make this statement, which is, I suppose, a little bit more crisp than some of the discussion in the actual overview of your report.

A Mm-hmm.

Q You appear to have understood there was no verbal communication or regular meetings between IPCs and microbiologists because of a prior complaint. We have her letter, Ms Grant's letter, of 1 March in bundle 25, document 3, page 151. I really just wanted to understand which bit of the letter you're referring to because-- So if we could just look at this letter of 1 March.

A It may be that the second letter-- Have I made a mistake? Can you go to the next page, please?

Q Next page.

A Next page.

Q Next page. Do you see in the middle, there's some metallic text?

A Yes, that's it. That's the place.

Q So this is the paragraph after:

"We are, of course, unable to see this evidence."

A Yes. We didn't see the evidence of why things-- what had happened. We were just aware that a situation had arisen, but speaking to the infection prevention team – and I did that as part of my information gathering about their processes and how they worked – it was very clear that there was a disparity between the infection control nursing team and the microbiology team. And that had been going on for some time, and there was very little, so they said that they get their information----

Q Who's "they" in this context?

A Sorry, the infection prevention nursing team.

Q Yes.

A They gather their information and either it comes to ICNet-- and we did hear that there is an email address where information is passed between, but because of an altercation, for the want of a better word, with microbiologists at that time, there was no direct communication, or very little direct communication. We do understand, and we think we wrote this in the report, that we have seen an email which actually discourages at that conversation between the two.

Q Obviously, we've to a lot of the people that you would have spoken to,

but I really need to understand whether you've seen more than us, as it were. So, obviously, you've had conversations with infection control nurses and microbiologists.

A Mm.

Q You're nodding.

A Yes, we have, sorry.

Q This particular paragraph seems to make reference to an issue about the Royal College of Nursing being involved. Now, we have it-- we've had evidence of that happening in 2015, but, putting that aside for a moment, is that your only source of evidence about this particular thing?

A As far as I have seen, but I understand that Professor Stevens has seen correspondence.

Q Well, we'll talk to Professor Stevens about that. But from your point of view, the only evidence about this particular process or disagreement is in that paragraph?

A It's in that paragraph but also in the conversations.

Q In the conversations.

A In the conversations.

Q Now, were you involved in the meeting where you met Dr Peters and Dr Inkster?

A Yes.

Q Yes. Any particular reason that it took place quite late in your processes?

A Not that I'm aware. Not that I'm aware, there was any reason why it was so late. We spoke to other microbiologists, but I couldn't tell you why it was late in the day.

Q I want to go back to your statement at page 65, paragraph 108, where you're discussing the meeting that you had with Greater Glasgow. Page 65. Thank you. A telephone call.

A Yes.

Q With Ms Grant, Dr Armstrong, Dr Davidson, Mr Edwards and Ms Vanhagen. Now, from your point of view as the people who are hearing what concerns they have, what were the expectations of Greater Glasgow that they were trying to communicate to you that hadn't been resolved?

A What they were unhappy with, and having given us a lengthy-- I think in excess of 60 pages amendments that they thought were errors or things to be adjusted in the draft report, when we had the conversation – I'm going to be frank – this was about actually how this makes the organisation look bad, as though we didn't do anything, which is not strictly the impression that we thought we were giving, but actually what they wanted was, it felt like, to dictate what we wrote in that report. And it felt very--

We pushed back several times. To

be fair, it was Professor Stevens who did most of the talking on that conversation. I haven't got-- The only notes I have are the notes that I took at the time, but there was a conversation that was decidedly uncomfortable, that they vociferously disagreed with the information that we had put into the report.

Q They also seem to have an issue with methodology. If we can go to the next page, page 66, paragraph 111, you say that criticism of your methodology could have been raised earlier in the review as a point of concern. Now, how could they have been raised? Who did you discuss your methodology with before you got going?

A Well, at the point where the methodology was being agreed back in February 2020, when Marion Bain was part of that conversation and Marion Bain was the conduit between the two, there was opportunity then for conversation to come back and say, "Actually, we disagree with this style of methodology."

And Professor Stevens, I'm sure, will tell you a little bit more, but he met on a regular basis – by phone the majority of the time because COVID had hit – with the clinical teams to explain methodology.

Q So when you say the clinical teams, do you mean the paediatric oncology team?

A I do, yes. The paediatric oncologists, and that'll be the clinicians, the nursing team, anybody else that wanted to be included, and some of those meetings also included a senior member of the core project team, so that could have been Marion Bain. I can't say for definite, but it could have been somebody like Craig White. But somebody else could have been a part of those conversations, so there was opportunity for those concerns to be raised, either by those clinical teams or fed back earlier in that conversation.

Q I mean, I wondered whether there was something here in that the people you've mentioned are either the treating clinicians and nurses in the ward or they are people actually brought in by the Scottish Government, because Professor Bain and Professor White are Scottish Government people.

A But Professor Bain wasn't at the beginning, was she? She was still employed by GGC when we started the conversation.

Q That's your understanding?

A That's my understanding, is that because she was the director of Infection Prevention and Control at the time----

Q She wasn't brought in by the Oversight Board?

A She was part of the Oversight Board, but she was representing GGC, is

my understanding. At the beginning, during the period of our investigation, she did change roles and went to work for the Scottish Government.

Q Right, okay. I'd like to take you to the executive summary of the reports. That's bundle 6, page 982, and I'm going to this because it just seems quicker to do this. So the second bullet point, the one that begins "ICNet," and you see in the middle of this paragraph you discuss the National Infection and Prevention Control Manual and the nationally agreed minimum list of alert organisms. Do you see that?

A Mm-hmm. Yes.

Q Then you quote the guidance, saying the list is not exhaustive, which you've already mentioned.

A Yes.

Q Then, from five lines from the bottom, you go:

> "We have found little evidence, even as late as 2019, that, and despite assurance from NHSGGC, the alert list has been modified in light of the evolving experience of GNE bacteraemias. This resulted in frequent absence of alerts being triggered with ICNet and subsequent absence of IPCT input in some episodes of the GNE bacteraemia we reviewed."

Firstly, when you say evidence, would you have been looking at the actual changes in ICNet itself?

A No, we were looking to see-- So there were some organisms that they said had been added in 2018, and yet in 2019, when these organisms are found, they do not elicit an alert in ICNet, so either the alert has been added but not activated correctly, or it was not added.

Q Or it was added and taken out?

A Or it was added and taken out. Either way, yes.

Q Do we see an example at page 1072 of bundle 6?

A Yes, I think we did see-- we did stipulate that as an example, yes.

Q Yes, so you're not basing this on close questioning of the relevant people? This is an inference drawn from the data that you've been given?

A Yes, this is the data. We had somebody interrogating, for want of a better word, ICNet for episodes of infection, and that person-- and they were not available to us. It hadn't created an alert.

Q Now, if we go back to your statement, to page 48, you make various criticisms, I think, of the incident management team process within paragraphs 43 to 47. Would that be a fair summary of that section, in part?

A Yes.

Q Yes. To what extent is this a criticism of either the organisation of NHS Greater Glasgow or individuals within it, or both or neither?

A I think this is a criticism of process. So, when we looked at the process of the IMT, and sometimes – without going through this in extreme detail – when we looked at the process, so the process would be to-- If you are concerned that there may be an incident, we have two or more cases – time, place, person – we look at a problem assessment group, the PAG, which we've heard about, and then we undertake in there a risk assessment. So is there a risk assessment? That risk assessment will say, "Do we then go on to instigate an incident management team to investigate what we think could possibly be an outbreak?"

My concern is once you've got that-- So, some of the incident management teams don't take place for quite some time after, and I'm talking 11 days. Well, that's quite a lot of time for other infections to have occurred in the meantime. If you want to put in remedial actions or you want to put in control measures, in 11 days we could have a number of infections that have started to affect other children in that meantime, so time is of the essence.

We also look at a situation report, so how many people? We look at those notes of the meeting, so how many people are affected at this time, by date? So I would want to know, for example, how many occurred on the 1st, 2nd, 3rd, 4th. Usually, in my experience, that would be done in a sort of table so you can actually see whether or not we have an escalation going on, whether it's just two cases, when they occurred. So we would look at the number.

What I would expect to see, and what I didn't see in these IMTs when we got the notes of these meetings, was that consistency. So it might say, and I'm generalising here-- it might say, "We have six cases" or "We have four cases." Then you would go to a next IMT and it would say, "We have seven cases," but I don't know if these are seven new ones, whether it's one new one, one has got better or we've got another two.

So the way that you present the numbers of these children, we need an identifier to say, "It's this person," so Child A, B, C, D, but we don't know if Child A has gotten better because I don't have that commentary in that note.

Q I mean, in some cases we do see that because, for example, we went through an IMT minute for Serratia a few weeks ago and we looked behind some of the redactions, and they were

numbered S1, S2, S3 at that point.

A Yes, and that might be one that happened. I'm talking more generally. In the majority of cases, it was difficult to follow and I think we have put an example of that in the report.

The other thing that I didn't see from the IMTs-- and don't get me wrong, the IMTs are-- this is the way that we should investigate our outbreaks. We do need to look at what happens to our children, try to come up with a hypothesis, but I don't see in these-- when I requested to look at the IMT notes, I didn't see an agenda that's attached to this.

Now, an agenda is quite an important part of the process because it's not just about the date, the time. You want to know who was around the table. You want to know have you got the right people?

And in all of these investigations, what is common to myself is that you also have to have a comms person because should this be-- How do you manage? If this going to be a serious incident that you're going to look at, an adverse incident, how are we going to manage that comms? So you should always have a comms person to support you when you are looking at these. What's our message that we want to get across?

Q I wonder if I can ask you about a couple of bits of evidence that have come out in the Inquiry. So the first relates to who's at the meeting.

A Yes.

Q There seems to have been some debate at the time about who was there and why they were there, and whether they were contributing and whether it was helpful. Equally, along the way, there seems to be some discussion about a deterioration at some point over the period in the working relationships amongst people at the IMTs.

Obviously, you've not spoken to the individuals – you've only read the documents – but do you detect any change in attendance, efficiency, effectiveness, tone? You pick the adjective, but any changes in the way the IMTs are operated between '15 and '19?

A Yes. There was a difference in attendance. Now, in the minutes that I looked at, you'll have a list of names. Now, when you're looking at this retrospectively, you have no idea who people are and people will have moved on, so it's helpful when you're looking on reflection to actually have what the role of that individual is in that meeting. So is it a Chief Operating Officer? Do we have the Medical Director? Who is at the meeting? And we didn't get that.

But I did note as we went on that there were differences of opinion into causality. This is later on in those IMTs.

So there was a difference of opinion as to whether it was related to water, whether it wasn't related to water, and I can't remember at which point, but I do know that the ICD was actually removed from that post or left that post because of some of the difficulties.

Q Did you----

A That's a different conversation outside, and what I tried not to get involved in is that internal investigations as to what happened, but there were some changes to the ICD at the time.

Q Were you told people's views on why that happened?

A No.

Q No? Okay. Some of the evidence we've had from the lead ICD is the number of sessions involved, and I'm sure I'll be corrected in a few minutes if I get this wrong, but my recollection is that, for the entirety of the period that Dr Inkster was the lead ICD, she had five sessions as lead ICD and five sessions as a consultant microbiologist. My recollection is that, by the time we get into 2018, she's basically doing all her work as lead ICD.

We also had evidence that there had, at various points, been microbiologists with a couple of sessions, with responsibilities for sectors, one of which would be sectors, I think, at the hospital.

A Yes.

Q We'd also had evidence there would have been a lead infection control nurse for the children's hospital, one for the adult hospital, and then there would have been people operating it, just the whole Board in the form of Ms Devine.

In terms of the size of the team for the Health Board and the hospital, given that you're making criticisms of how the IMTs were managed, does that team sound the right size, too small, too big, or can you not tell?

A I can't really tell, but it does seem quite light for the size of the hospital for a half-time ICD for the size of the hospital, given----

Q No, that's an ICD for the whole Health Board.

A Oh, for the Health Board, sorry. For the Health Board, given the complexities and actually what was going on at the moment, and we did have, or they did have, considerable concerns that were being raised at the time about the safety of the environment.

Now, it did sound like – as we've gone on and looked at some of the IMT minutes – that, in some instances, it did sound like a lone voice at times, but there were concerns being raised about the causality of these bloodstream infections and the impact on these children, so I do think it was probably light. Infection

control nursing-wise, I can't say what the rest of the team-- We have one lead person, but how many is in the rest of the team? I can't say whether that was sufficient.

Q If we, as the Inquiry, wanted to get into the topic of, in terms of infection control doctors, whether the number of sessions allocated was appropriate, is there any resource you're aware of in England that could teach us the equivalents in large hospitals in England?

A No, I think you would probably get that from-- you'd probably get a better idea of the workload probably from Mark Wilcox, the microbiologist, because he would be able to tell you how much workload is involved, and especially when you're investigating a series of outbreaks, or potential outbreaks, that does take a considerable amount of your professional time and capacity.

Q I want to just pick up – we've got half an hour before lunch – on you mentioned in the discussion about probability that one of the factors that might put something into the “probable” group was there was, I think you used the word "cluster." We've heard criticisms, in written form and in evidence, that, to some extent, your methodology as a panel of three of you didn't amount to much more than seeing clusters, and a cluster would just make it inevitable that there was a probable link. How do you respond to that suggestion?

A Given that we spent a considerable amount of time interrogating the data that we were given and spreading that out into a timeline, it goes back to this-- what I keep saying, it goes back to that very original time, place and person: "Is there a link between these cases?" And you have the same organism, or similar organism, that, as far as we are aware, it is the same, and that-- it's based on the evidence. We're not just saying, "We think there's a cluster." There is. It's there in black and white. There are three cases within this time frame.

Q When you're doing your work, would you have looked at possible routes for transmission for each individual infection?

A Absolutely we would. We would have looked at whether or not there was a line, whether or not a child had been cared for elsewhere, whether or not there was a possible link with a family member who may have had an infection.

We would look to see whether or not-- especially whether or not symptoms suggested that there might be a gut translocation. We would look to see whether there were symptoms of that which would potentially exclude other sources, and also other sources of

infections, and I think I might have just said that about other family members who may have had an infection with something similar.

Q You did.

A So, we looked at all of those, whether or not they had an indwelling device. So, one of the biggest problems that we have, of course, transmission of infection, is actually lines, so what we call an "indwelling line," so either a central line, Hickman line, anything that invades the skin. It could be a catheter. So a urinary catheter, for example, is a very good source of access into the body for an infection, so we looked at all of those.

Q Well, I suppose the point that might be made is that, because of the structure of your work, the actual details in each case sit within those individual family reports----

A Yes.

Q -- not in the overall report itself?

A No, and I think, together-- Taking that together with what we observed from the environment-- and I'm possibly introducing something else now. So when we look-- I'm going back to the IPC, so if we look at audit, for example, of the environment, were there other areas of the environment that potentially could have contributed to a source of infection?

And we did look at whether or not

any of those audits of the environment, whether they included suboptimal cleanliness, and we did see some that had excessive dust, for example. Was the integrity of the fixtures and fittings-- was that robust? Could that potentially have been a source of infection? Things like, just to give you an example, a cracked sink where you get the hairline crack, that's obviously a line, a source of potential infections. We looked at all of that.

Q One thing I want to just check whether you looked at – I've been asked by one of the counsel – is did you look at the DMA Canyon Legionella risk from 2015 and 2017 as part of your work?

A I personally can't remember. I have seen them since. I have seen them since, but I cannot personally recall seeing them. It doesn't mean that I didn't-- they weren't given to the team, but I can't remember seeing them. But I do have, having looked at those-- and there is a risk assessment in there with a recommendation and action plan of what should be done.

But on those plans, there is no accountable person, there is no date for which-- for when those-- for when those actions should have been completed, and what bothers me the most is that there is no assurance that those actions have ever been completed, and some of those

go back to 2017.

Q I suppose, since you're here, I should try and ask you this question, which is, it's been suggested that, had the Infection Prevention and Control team of the hospital known about the contents of those two reports, particularly the 2015 one, it might have, in some way, changed the way they managed infections in the hospital. Do you have any thoughts on whether that seems reasonable or was wrong, or what?

A I would have expected some of those recommendations to have been picked up by a water safety group. I'm used to dealing with a water safety group. I did ask when I spoke to the Infection Prevention team about minutes from the water safety group, and they said we didn't have a water safety group----

Q For the hospital?

A -- for the hospital until 2018, March 2018, but I would have expected those. Now, while infection prevention nurses are not the experts, they do have a background working knowledge about what should happen within the environment and water, and are usually part of the water safety group.

But there was an omission there that that didn't happen at the time, but I think it would have had some impact on how they viewed and what they managed-- how they managed their infection prevention planning and their audit.

Q Thank you. I wonder if we can go to bundle 6, page 984, which is part of your executive summary, and do you see how, in the second paragraph, it begins:

> "We recognise that some families will be disappointed by our ability to identify links."

A Yes.

Q It's the second sentence I'm interested in:

> "This not only represents the limits of a retrospective review and the shortcomings we have described in the data we are able to access, but also highlights the fundamental challenge of identifying a specific source in all such infections."

Now, I haven't asked you about whole-genome sequencing because I'm very conscious that's not an area you're an expert in – I'll ask Professor Wilcox – but is it, from your perspective as an experienced infection control nurse consultant, always possible to work out whether there's a link?

A No.

Q Well, why is that?

A Because sometimes-- and I'll use this example: sometimes you can-- if we had taken all the specimens as directed, as we expected them to happen, sometimes when you take that

water specimen for whatever reason – the sink's just been cleaned, the taps, whatever it is that's happened – we don't always collect in that specimen the bugs we are expecting to see or would like to see. We don't always collect that.

That doesn't mean that it wasn't there; it just means it wasn't in that specimen. But given the absence of any other hypothesis and there is a probability, an overwhelming probability – it's more likely to have happened than not – that is where we say that, actually, we can't confirm it because we haven't got that, but there is no other explanation that we are able to find at this time.

Q Because there are two other explanations that I'm sort of aware of in submissions by the Board. One seems rather tight and so I'll put it to you, which is that the nature of the population from which this cohort of patients came was from the-- (inaudible) population in Glasgow has a high level of urban deprivation, and there's a correlation between that and negative health outcomes. Do you see that as a factor that has any connection to this discussion?

A I don't think I'm experienced enough to know that.

Q Okay.

A However, I would say, had we tested that against other similar demographic areas where we would see the same population-- because that's a hypothesis, but it's not a proven-- we haven't proven it either way.

Q The other suggestion, which is a bit more diffuse, is that – and I think I'll have to ask Professor Wilcox and Professor Stevens about this – could it not just be the case that what we were having here in this hospital in this period of time was a larger but, at one level, not particularly surprising increase in infections that are passed between patients or translocated from the patient's gut, and that the methodology of the Case Note Review is rather assuming there's an environmental link?

A Translocations would show-- you would have other symptoms and we'd be able to identify that.

Q What sort of other symptoms would you have?

A Well, I'm not the paediatrician here, so you'd probably have to ask-- you'd probably have to ask Mark, but you would have raised temperatures, you'd have fever, they'd be febrile, so you would have pain, potentially, so he would be able to explain that a little bit more to you. It's not my field of expertise, but-- What was the other part of the question, sorry?

Q The other part was about it being an unfortunate but not necessarily

unusual increase in numbers of infections, and that you're too focused on the environment as a Case Note Review. It almost becomes a self-fulfilling conclusion.

A Prophecy, yes, and I think, given the absence-- and we do have to look at what other hypotheses came forward at the time because these-- what you're putting to me now is since the occurrence, so since the review, but I'm not sure that a viable hypothesis was put forward or that we could identify an alternative, viable hypothesis at the time.

Q Okay. My final question's a bit cruel, but I'm going to ask you it anyway, which is that the Inquiry has had itself a question, and this is its key question 4. I'm going to read out the question and I'm going to adjust it for you because I think, in its current form, it's definitely too cruel to ask you.

A Okay.

Q The question we set ourselves is:

> "Is there a link – and, if so, in what way and to what extent – between patient infections and identified, unsafe features of the water and ventilation systems?"

I can't ask you that question because it seems too broad. What I propose to do is to rephrase it: not looking at the individual cases but looking at it from the whole cohort, to what extent can you, as a panel, say there is a link between the infections in the patients in the cohort and the environment they were being treated in in that hospital? Are you able to give us a sort of summary of your view on that topic?

A What I would say is that we've probably answered that question in our report by giving the number of cases that we think are more likely to be attributed to the environment than to not. We can't confirm either way that-- we cannot confirm that there is a definite link to the environment, but in terms of probability, it is more likely than not that more than-- and I can't remember the number now without seeing the table-- more likely than more than half the children were affected by the environment without any further evidence to suggest it.

Q Well, let's just put the table to you because I think it's probably not fair to get you to do it from memory. So it's bundle 6, page 1043. Yes, so do you want to do that again?

A I wasn't thinking that table, but yes. If you look at the text beneath the table and it says where the number of the number of cases that we were actually able to say-- we were unable to determine some of these ----

Q It's two pages further on that.

A Yes, so I think----

Q One back.

A We did-- There you go. We do actually describe in that table. That's the one I was thinking----

Q Table 5.4?

A Yes. We do actually describe in there where we think that it's most likely to have happened in those cases that there was a link to the environment versus the rest, and I think my opinion, having read anything else at the time, hasn't changed on those decisions that we made.

Q Thank you, Ms Evans. My Lord, that's the questions I think I have for the witness, but I wonder if we might take a few minutes to see whether anyone in the room has anything they'd like me to put to Ms Evans?

THE CHAIR: We'll do that. Ms Evans, what I need to do is check, or allow a check to be made, as to whether there's any other questions which other representatives would wish to put to you.

A Okay.

THE CHAIR: So if I could ask you to go back to the witness room. It might be 10 minutes or thereby. Okay?

A Thank you.

(Short break)

THE CHAIR: Mr Mackintosh?

MR MACKINTOSH: I have no questions from colleagues in the room, and I have nothing else I need to ask.

THE CHAIR: All right. Ms Evans, apparently there are no more questions, which means that that's the end of your evidence and you're free to go, but before you do, can I thank you for your attendance this morning but also for the work that is behind it now?

A Thank you.

THE CHAIR: That includes the work on the CNR review, but my specifics relate to the witness statement you provided. So, thank you for that, which is part of your evidence, and thank you for your attendance, but, as I say, you're free to go. Thank you.

A Thank you. Thank you.

(The witness withdrew)

THE CHAIR: We'll resume again at two o'clock.

MR MACKINTOSH: With Professor Wilcox, yes, my Lord.

(Adjourned for a short time)

THE CHAIR: Good afternoon, Professor.

THE WITNESS: Good afternoon.

THE CHAIR: Now, as you understand, you're about to be asked questions by Mr Mackintosh sitting opposite you, but first I understand you're prepared to affirm.

THE WITNESS: Yes, please.

Professor MARK WILCOX

Affirmed

THE CHAIR: Thank you very much, Professor Wilcox. I'm about to hand you over to Mr Mackintosh, but can I remind of the need for us all to hear what you say and perhaps speak a little more slowly than you might otherwise and a little bit-- at a little higher volume.

THE WITNESS: I'll try. Thank you.

THE CHAIR: Thank you very much. Now, Mr Mackintosh.

Questioned by Mr MACKINTOSH

MR MACKINTOSH: Thank you, my Lord. Professor, firstly, can I ask your full name?

A It's Professor Mark Harvey Wilcox.

Q Did you produce two statements for the Inquiry?

A Yes, I did.

Q Are you willing to adopt those as part of your evidence?

A Yes.

Q Thank you. What's your current post that you hold, Professor?

A I'll try and be brief because it's a bit complicated because I work for several different organisations. My prime organisation that pays me is the University of Leeds, but I hold positions at the Leeds Teaching Hospitals, which is affiliated to the University of Leeds and vice versa, but I also work two days a week for NHS England in a national capacity as an antimicrobial resistance and Infection Prevention and Control expert.

Q Thank you, and we want to ask you about your role in the case notes review. You've given an extensive statement, and we just heard the evidence of Ms Evans, a member of the panel. I'm not proposing to revisit areas that I discussed with her. I mean, not a few of them but most of them. What I really wanted to do was just to check a few things with you that she explained.

If we want to find an explanation about why you, as an expert panel, the three of you – her, yourself and Professor

Stevens – produced a particular conclusion about the probability of an infection linked to the environment for a particular patient, where would we find the rationale for a particular patient or an infection?

A The rationale will lie within the individual case records and our assessment form of each of those records. There would be another part way of doing that through the letters that were sent to each of the families, copies of which were sent to GGC if, and only if, the families agreed to-- for such copies to be sent. To this day, I don't know who did and who did not agree to that process.

Q So there wasn't an automatic transmission of those letters to NHS Greater Glasgow and Clyde?

A To the best to my knowledge, no.

Q Now, that means that we need to ask you some questions about your methodology and also about some criticisms, and I'm going to focus initially on the microbiology. But before I get there, I just wanted to-- I noticed that in the report, a reference is made to what are referred to as the Bradford Hill postulates. In the comments made on the draft, Greater Glasgow and Clyde suggested that this should receive some weight or prominence in your

methodology. We've been learning, as lawyers, a little bit about Bradford Hill, what he thought, but to what extent did those ideas of epidemiology form a part in your decision-making?

A So you'll have to direct me to-- It's only loosely familiar to me, the term you're referring to. It's not an accepted term.

Q Right. In that case, give me a moment, and I will open up the document.

A Thank you.

Q It's within one of the commentaries on it from GGC and not the report itself, which is at bundle 27-- Sorry. I'll come back to that. I think it's easiest to do rather than you wasting your time at the moment.

A Okay, thank you.

Q What I want to do before we do that is just to discuss the use of whole-genome sequencing, which is something that you discuss in a section of the report in section 8.3.1 of the overview report, which is bundle 6, page 1069. If we can go there. In this section, I read it as a discussion of the use of typing, which on the next page, turns – in the third paragraph – to the use of whole-genome sequencing. Now, what expertise do you have in this field of whole-genome sequencing?

A I've been practicing as a

consultant for nearly 30 years, and for probably the last 15 to 20 of those, as this technique became available, I've been used to using this technique. I've authored papers in New England Journal of Medicine, the Lancet and so on that have used this technology.

Q What, in a sense, do you understand was the suggested use that whole-genome sequencing should be put to in the sort of exercise the Case Note Review was carrying out?

A Well, we were reviewing all of the data available to us, and as whole genome sequencing data are viewed in general as the ultimate fingerprinting technique – you know, the equivalent of a fingerprint, literally – to determine relatedness – so can you rule in or rule out relatedness – then we were interested to examine any of the whole-genome sequencing data that were available. We met during the course, the later part of the course, of our case note review online with GGC personnel microbiologists to view what whole-genome sequencing data they had.

Q Which microbiologist did you speak to?

A Professor Leanord, Alastair Leanord. I can't remember who else was there, whether it was just Alastair, but certainly, he did most of the talking.

Q Right, and did the work that he reported focus on three particular groups of microorganisms?

A It did, yes.

Q What were those three?

A Stenotrophomonas, Enterobacter and Cupriavidus.

Q If we look at your conclusion-- I'm not sure if "conclusion" is the right word, but your text here on page 1070, what, ultimately, was your response to the suggestion that the work that Professor Leanord had done would assist you in your work?

A Okay. So, it's only partially on this page and I think it goes into the next one or two pages, from memory, where-- I authored this part of the report. In turn, with those three groups of microorganisms, I went through the data that was available, essentially to look at the robustness of the analysis that had been carried out.

The most convincing evidence for a relationship between the environment and patient infections was for Cupriavidus. I note there's actually been a publication, a peer-reviewed publication, from GGC and other authors on that issue, those cases. That was published in 2021.

For the other two groups, Enterobacter and Stenotrophomonas, there are issues with the analysis that mean that it is not possible to conclude

with any certainty that the environment was not linked to the patients' infections. I realise there's several negatives there, but I'm----

Q Could it be the point that's attempting to be made is that by analysing the relationships – and we'll come back to what that means in a moment – between isolates from patients, isolates in the environment, one can both draw a conclusion of how closely related those samples are, and from that say – Professor Leanord and others – that you can then draw another conclusion that there is not a connection between various samples?

A Yes, well, I disagree with those conclusions because there are some very clear omissions, drawbacks, limitations to the way the analysis has been performed.

Q Is this what you're setting out in these few pages of the report?

A It is. That's the start of it. There is more detail behind it, but yes, that's what I attempted to do for those three groups.

Q Now, clearly, we can read it, but as non-experts it's often easier to read something when you understand the core of the point. What is the core of the point that you're trying to make in these few pages?

A So, the first and, really, most fundamental issue is have you

fingerprinted, whole-genome sequenced, all the relevant isolates at your disposal? And if we look at Stenotrophomonas, for example, a third of the isolates causing bloodstream infections in the children – so that's 8 of 23 – were not included in the analysis.

Q Now, you've said that. Obviously that detail is mentioned, I think, in your text at the top of page 1071.

A Yes.

Q But what I wanted to do was try and connect that to some evidence that we've already heard. So when you arrived this morning, I had instructed to give to you a copy of Professor Leanord's report, which is in bundle 6, document 40, page 1195.

The reason I asked you to look at that is, one, because I figured that it might assist for you to read it, but also because I was hoping to see whether there was anything you could say about these numbers that are mentioned briefly at the top of that page----

A Yes.

Q -- in the document. The section on Stenotrophomonas begins on page 22 of the report, which will be page 1217. Oh, I can count, that's excellent news. Clearly, this is not your report, and the professor has been giving evidence, and he's talked about this report to some extent. If we can look at the next page

and we zoom out to get the whole flavour of it, without looking at the detail of what's going on here, what form is this figure in terms of a scientific tool?

A Okay, so it says in the first three words "maximum likelihood tree." A dendrogram is a different word, and essentially it's looking at the relatedness, the degree of relatedness, of isolates, in this case from humans and from various environmental – predominantly water – samples.

If the samples were all related, then there'd be a line right next to the text and only one vertical line saying that they're all closely related. As you move further away from right to left, you have little connected groups that are then less or more connected, so you move from right to left. And, essentially, you can see that there are some relatedness of samples that were taken----

Q But before we leave that, because we're going to get confused here, in a sense, if you were to flip this through 90 degrees, is it really just a family tree?

A Yes. Essentially, it is. Yes, it's a form of family tree.

Q The higher up you go, the more generations. That's not quite the right word, but the less connectedness there is from the joining point.

A Yes, the greater the number of

differences in the genetic code between the organisms. Yes.

Q Right, so it's not measuring generations, but it's measuring connectedness?

A Yes, according to the number of differences that you can literally count – one, two, three, four, up to hundreds or thousands or even more – in the genetic code between the Stenotrophomonas isolates.

Q Now, I interrupted when you saying there were some points where there are some connections.

A Yes, so you can----

Q We can zoom in halfway at this point. It might help.

A Yes, so we can see-- So if we look right in the middle of SMG-20-1656.

Q So let's just slow down so we can find this.

A Yes, if you keep going down, it's sort of in the middle, just slightly below halfway. SMG-20----

Q Let's go by their colours. So do you see where there's an orange, yellow, purple, yellow----?

A So in between-- there's several colours, and human RHC is yellow.

Q Yes.

A If you go down to the next colour, there's a big group in the middle of non-coloured isolates, and just below halfway you can see-- Look at the code

on the left.

Q "SMG-20-1656 is the basement tank, children's filter 2." That one?

A Yes, and the one immediately below that, 1636, look how closely they are related. You see? That just gives you a little example, a small example, of the relative-- Without knowing the scale, I couldn't tell you how many differences – they're called SNP differences; it doesn't matter – in the genetic code, but you can see from that figure they are relatively closely related.

But, as you then say, well, accepting those two are relatively closely related to each other as environmental isolates, how related are those to other basement tank isolates? The answer: not very. How closely are they related to human isolates? Not very at all. And that's how one interprets, broadly, the whole figure, the whole dendrogram here, the family tree.

Q So the more you have to go to the left to find the joining point, the less closely related?

A Yes, essentially, and the number of lines and connection points you have to go through, twigs and branches. The more of those, the less related they are, so you're moving further and further to the leaf at one end of a twig, and is that leaf related to another leaf on the other side of the tree on another branch and another twig?

Q Now, in your report, the case notes overview report at the top of page 1071 – don't leave this page, please – you described how there were 84 Stenotrophomonas-- Well, let's go look at it. We will go to it. 1071. So if we go back to 1071, what I want to do is look at that first paragraph.

A Yes.

Q If you could just tell us what's the important facts we need to pull out from that so we can go and compare it to the figure we were just looking at.

A Okay, so 84 in total----

Q So that's the number of Stenotrophomonas infections?

A No, these are isolates or strains. For the sake of-- They're essentially the same term here, ‘isolate’ and ‘strain.’ Eighty-four different Stenotrophomonas strains, isolates, obtained from a variety of sources. Some patients were not told in detail which ones and some from different environmental sources.

Q Now, that number, where does that come from?

A Eighty-four?

Q Yes.

A I don't know. I don’t know, but it does refer, I think, in the text to the appendix to this report. It says

"(Appendix 1)" at the end of the very first sentence of the Stenotrophomonas section on page 22, the prior page to the dendrogram, that is. It says:

> "A total of 84 isolates identified by the diagnostic laboratory as Stenotrophomonas maltophilia were sequenced (Appendix 1)."

I haven't appendix 1.

Q So, just to recap, because I got a little bit confused there, the 84 on page 1071 in your report that we're looking at on the screen, is that the same 84, you think, as figure 15?

A Yes, to the best of my knowledge it is, because I can remember seeing what appears to be the same diagram, and then some of the numbers match.

Q Okay, so what is the point that you're in this first paragraph on page 1071?

A Okay, so we know from our review that there were 23 Stenotrophomonas maltophilia bloodstream infections in children. Only 15 of those were included in this analysis. It doesn't tell me that in this report, but I know that from the information we were given by Professor Leanord.

Q I see, and that's why you said 15 up here at page 1071.

A Yes.

Q Right.

A If one looks in this dendrogram----

Q So if we go back to page 1217, 1218, the next page, and zoom out, please.

A So if you count the ones that are highlighted here-- I counted 25, but some of those isolates, there's no dates on here. I don't know whether that's to help preserve patients' anonymity, but obviously I have no idea which human RAH isolate this is referring to. I don't know whether it's the top one. I don't know whether it's from blood or somewhere else.

Whether that information is in appendix 1, I don't know, but there are 25 that are highlighted. But as I say, I know from the information that went into writing our report that only 15 of the 25 were from our cohort. In other words, 8 of the total of 23 isolates were missing.

Q So your position is that of the 25 isolates that were analysed, a third are not within your care? So they could be other children, adults or other hospitals?

A Yes. I mean, one of them-- It's the – three, four, five, six – seventh one down that is highlighted is purple, dark purple.

Q Yes, ACH VIC.

A I don't know what that is, but I don't recognise any of those abbreviations in relation to our case

review.

Q Right.

A The others, largely, I do. It's at the top one, "Human RAH." I don't know what that is.

Q Yes, because we know that RHC is the children's hospital and QEUH is the adult hospital.

A Yes, yes.

Q So that's your first point, that that a third of yours are effectively missing?

A Yes.

Q Okay. If we go back to 1071, are there any particular other issues you have with the analysis that's currently summarised in figure 15 in Professor Leanord's report?

A Yes, so it's not detailed. I could give more detail, but it's actually quite simple detail, but I think it is pertinent, if we could go back.

Q Okay, well, firstly, before we look at it, why is it not detailed in the overview report?

A That's a good question. Because I don't remember whether I had as detailed a copy of this figure on which to do the analysis. I cannot recall. You know, it's three years ago when I was reviewing the data available to write this text, and what I was trying to do in the reports was just to give some exemplars as to why one could make some inference but not other inferences robustly without going into chapter and verse. And actually, this was beyond our remit at one level, but at another level not, so that's why I can give you more detail now which I think is relevant.

Q Well, let's go back to 1218 again.

A Yes.

Q So what were your other concerns that you now see in detail here?

A Okay, so it's well known that drains in hospitals could be the source of contamination and, indeed, infection in patients, and it's gram-negatives because they live in water, essentially. And there are a total-- out of these 84, there are 11 isolates that were obtained from samples taken from wards, at ward level. Not tanks in roofs or basements; at ward level, close to patients. Eleven. 8 of those 11 were from the relevant wards.

Q So that's Ward 6A and Ward 2A?

A Yes. The peak of the Stenotrophomonas infections – and it was a very high peak – was in 2018. There were 12 infections in 2018, none or one in some of the other years, four or five in the other years, but a very clear peak in 2018.

Of those drain isolates that I just referred to, none of them came from 2018. So we only have eight from the

relevant wards, none of which were from 2018, which is the peak of the Stenotrophomonas infections in children.

If I just go one small step further, again, 2018, how many samples at ward level? Now, any water samples, not just drains, came from the cohort wards in 2018. The answer is two.

Q Where are they on the table?

A So, can you see, if you come up from the bottom, count one, two, three, four. Four purples. One, two, three, four purples. Go up to there, where the hand is, and look immediately below where the hand is, 1641 and 1615.

Q Is that two showers taken on the-- what must be 5 March?

A Correct, from Ward 2A, from the shower mixers, it says, or shower mixed, whatever that means. You can see there-- yes, as you say, both on the same day in March in 2018. That is the total number of isolates included in this analysis from water sources on the wards in 2018 when there were 12 infections throughout that year and some of those were very clustered in time within the year.

And that's why I conclude that it's just not possible to exclude water on, in this case, one of the cohort wards being related, or water sources being related, to any of the 12 bloodstream infections that occurred in that year.

Q Just before we leave that, if we remember, you took us to a row with a purple “Human,” Queen Elizabeth University Hospital----

A Yes.

Q -- and then, if we go two rows up, we have sample SMG-20-1676, “Env - Wd 2A.” That's a Ward 2A sample, isn't it?

A I don't----

Q It's a trough sink, whatever a TR room is, and it's a date on 9 September, so that's about just after decant.

A Oh, 5 September?

Q Yes, sorry, 5 September.

A Yes, I apologise. You're right. That's a trough sink and I’d missed that one.

Q Yes.

A That's the third one.

Q You're sure there's no other 2018 2As?

A To the best of my knowledge. I looked through this several times today to come to give those numbers, but whether it's two, as I said, and it's actually three samples in total from 2018 on a target ward, it's a very small number.

Q Now, if we go back to page 1071, your next paragraph dealt with Cupriavidus-- Cupriavidus, I always get it wrong.

A Cupriavidus, yes.

Q Cupriavidus. You seemed to suggest earlier on that you had a greater level of confidence in this piece of work involving Cupriavidus, or did I misunderstand?

A Well-- So, there's this information here, but there's also IMT information, which is referred to elsewhere in our report, that inferred that the same strain was obtained from a water source, and I think it was-- was it from an anaesthetic room where the patient had been briefly? I forget the detail, and the patient went-- the child went on to get a bloodstream infection. As I said a few minutes ago, there is a peer-reviewed scientific report from GGC authors about the Cupriavidus relationship between water sources and----

Q This is the aseptic pharmacy unit that we see?

A Yes, so----

Q There's another one, in fact, published in the Journal of Hospital Medicine about Mycobacterium chelonae as well.

A Yes, I think there is.

Q Yes.

A Yes, so there is a-- the numbers are much smaller that have been included in any whole-genome sequence analysis. So, as you can see here, a total of 263 isolates of

Cupriavidus from water or surface sampling, and yet only 18 made it to the whole-genome sequencing analysis.

Q So your point is that, firstly, not all the retained samples are being-- taken samples are being analysed----

A Yes.

Q -- and secondly, that some of the samples don't seem to have a connection in place and time to the suspected incidents?

A Yes. There is a potential cogent reason why you would include some isolates from elsewhere, or close but not exactly where you want to look, and that's to look in general and get a feel for whether there's any other links or just how far apart Stenotrophomonas or, in this case, Cupriavidus strains are to one another on a genetic basis.

So it's not a criticism that one might look at isolates from here and there and so on, but the number from the key place and time – "place" being the wards, "time", so we were discussing earlier, in particular 2018 – the limitations there are stark.

Q So, there is a point, I suppose, I have to put back to you is that, if we go back to page 1218 – yes, and taking up the whole page – while it may well be, as you say, that the number of samples from 2018 are low, the number of samples from the actual wards in issue are low,

does this sort of exercise have any value in answering the question whether there is a single strain infecting the whole water system, or is that the wrong question?

A I wouldn't say it's the wrong question, but I'd say it does answer that there isn't a single strain. It doesn't appear to be a single strain because where is it, despite all these different water sources? The premise that there is a single strain responsible for all the infections and all the contamination of a water system is naive.

What one would expect to find is-- because biofilms are what contaminate water systems. Biofilms are effectively collections of organisms of different species, sometimes the same species, but different versions within those biofilms, so it's far, far, far more likely that, if a water system was colonised, contaminated, and if that contamination went on to cause infections, that you would see a range of different organisms causing those infections.

Q Right. If we take that off the screen----

THE CHAIR: Just to follow that, when you say "a range of different organisms," do we mean different genera, different species, or are we down in the fine detail of strains?

A Both, my Lord.

THE CHAIR: Sorry?

A Both, my Lord. So, I mean a range of different genera and within species different-- within one species, Stenotrophomonas maltophilia, for example, a range of different Stenotrophomonas maltophilias. These are organisms which have many relatives, both within the species and then across species/genera.

THE CHAIR: Okay.

MR MACKINTOSH: If we just, for completeness, go to the bottom of page 1070 in bundle 6, where you dealt with Enterobacter, let's just understand what you're saying here in this final paragraph. What's the fundamental point to be made in this paragraph?

A Okay. Well, I mean, this is an analysis of a grand total of 42 isolates, only six of which come from the environment. Six. I've already mentioned that there are two IMTs that are referred to in our report – one in 2018 and one in 2019 – that implicate. One of those actually said the water was the source, the drains. This was an Entrobacter cluster, and yet we've got a grand total here of six environmental isolates.

So, with such a small number, it would be either incredibly good or bad – from one's perspective – luck to match one of six environmental isolates with any one of 36 patient isolates. The "needle in

a haystack" analogy is very pertinent here. You're just not going to find a match and, therefore, the fact that you don't find a match does not exclude a working hypothesis of contamination from the water causing infections in patients.

Q The next sentence:

"However, isolates from five of the children with Enterobacter were not included."

How many infections involving Enterobacter were in your cohort?

A I can't----

Q I don't know whether you want to look at 1030 if you can't remember?

A If you could go to 1030-- Well, I know it's table 4.2 on page 54 of our report. That's where the table is that tells us.

Q In that case, it's on page 1028.

A Yes, if you could scan-- Yes, so where are we? Enterobacter is there.

Q Table 4.2----

A 27. It says in the right-hand column. There were 27 in total.

Q So just under a fifth?

A Yes. That's organisms. The "5" is patients, so if a patient had more than one isolate, they could be-- you know, it could be more than a fifth, if you see what I mean.

Q One of the things that I certainly found conceptually hard to understand – and maybe I'm just being foolish, but I'll put it to you – is there seem to be two points that are being made by those who promote this analysis.

The first is that you can look at environmental samples and patient samples and notice that there is not a close relationship between the patient samples and the environmental samples. I can well understand, as we've just discussed, that where the patient samples are from, when they are from and how many they are might be relevant to that. I can conceptually understand that, so I'm going to park that and move to the next option.

A Yes.

Q If you have 27 isolates and you have samples for 22 – and looking at the bottom of page 1028, they're scattered sort of evenly over three years – why is it not right to look at the ones you have samples for and say, "Well, are they related?" Because, surely, if there was an environmental source of Enterobacter in the water system, then all the patients would have the same or similar Enterobacter in their isolates? Why is that wrong?

A Well, rather like the answer I gave to my Lord, if one knew nothing else about the cases but that Enterobacter were involved-- 27 Enterobacters were involved in these bloodstream infections,

I would not expect one Enterobacter to be responsible across five years.

I would expect multiple – absolutely expect multiple – and which one or ones were involved at any one point in time-- One could be involved, disappear – 'disappear' in inverted commas – still be in a biofilm, reappear or not, but one would expect, in a contaminated water system-- Virtually all plug holes, by the way, get contaminated. You would expect many, many different types over time of, in this case, Enterobacter.

Q Why would you expect that? What's the evidential basis for that?

A Because if one looks in the scientific literature of when people have sequentially sampled water or drain samples, swabs down drains or take the U-bend off, take samples out, you will find a variety of different organisms across different genera. You will find a variety of different organisms within individual species. It's a zoo. It's a microbiological zoo in the water.

Q Right. What I want to do now is to pick up a few other issues that have been raised about this whole-genome sequencing thing. So Dr Crighton, who's now the Director of Public Health and who wrote the commentary on epidemiology that's in-- public health commentary that you saw, she gave evidence – and, just for my colleague's benefit, it's in her statement at paragraph 199 – that she took the view that, whilst a lack of typing doesn't rule out a connection, it does make it less likely.

So what would you say to those who say, "Well, okay, this data or these conclusions aren't a way of excluding a connection, but what we see in Professor Leanord's work that you saw then and you saw now should at least be a factor to suggest there isn't or there's less likelihood of a connection. It's a sort of pressure on the scales, as it were.

A Yes. Well, it would be perverse to try and claim that the data had no value in refuting that hypothesis-- partially refuting. But my point is that such are the limitations of the data – the missing data, the limits and the number of samples from key likely areas of contamination – such are those limitations that it only very-- it's a very limited refute of that hypothesis. So better than nothing, but still in no way goes a long way to excluding the environment as a source.

Q One of the issues that came up in evidence over the Inquiry is that when one is-- one of the issues that must arise is the taking of the sample. Whether it's a patient isolate or an environmental isolate, at some point you've got to pick the colony off the plate that you've grown and decide what to

analyse.

We've had some debate. We've gone back to certain witnesses with the questionnaire, which we'll put out to the core participants next week, as to what's the right answer to this question, the question being, how many colonies do you need to pick off a sampling-- an agar plate you've grown on, grown the sample on, before you can be sure that you fully understand the diversity of the population of the strain in the sample?

A Okay, so just the preamble to answering the question is that this is one sample on one time point on one day, and then we're growing 24, 48, 72 hours down the line from that sample "something." And let's just assume, to make it easier, that the “something” is the same species, is Enterobacter cloacae, and manifest as a number of colonies growing on a plate. It could be one colony, it could be too many colonies to count. It could literally be hundreds on a plate.

Q Yes.

A Taking one colony is certainly not sufficient to say I've got a representative sample of all these, let's say, 100 colonies that are growing. The more colonies that are growing, the greater the number of colonies one would in reality need to pick off to have that degree of confidence.

In practice, in scientific practice, when one's trying to convince one's peers here, I would expect to see at least a double-digit number of colonies picked off on a plate. There isn't an absolute. If I try to claim the magic number is 14 or 36, that would be wrong. But it isn't one, it isn't two, it isn't three, and the more colonies that are growing, the greater the number.

And you can't just either – I'm sorry – just take a sweep across all the colonies because, if you do that, your genetic information will be a jumble. You'll have jumbled up potentially several different organisms into one genetic code.

Q Right. You said that you were doing it when trying to convince your peers. If you're analysing a sample from the environment as part of your monitoring or reactively – or you're, indeed, analysing a sample from a patient in order to treat them – is there a different requirement for the number of colonies one would pick, if your purpose is either monitoring or patient treating?

A Well, if this was a clinical sample----

Q Yes, a clinical sample. How would you (inaudible)?

A So, by and large, if it was a blood sample, for example, the great majority of the time, if there are bugs in

the blood, it's one bug, one type of bug.

Q Right.

A We just know that. Occasionally, you might find two or three different ones. That's usually in very, very sick people, and it may be a pre-death phenomenon, actually. Not always, but maybe. When it moves to environmental samples because of the zoo----

Q Just before we leave that, in that situation, you can just pick one?

A Yes, that would be accepted practice to pick one and, in fact, yes, that's exactly what one would do normally. If we move to environmental samples, because of the zoo analogy that I used, then, by inference, one would need to-- It depends on the exam question. If the exam question in that scenario is, “Is the water contaminated?” you might just have set a threshold and you want to know are there more than a hundred bugs in this 100 ml sample that I've spun down and put on the plate.

Counted? Yes, more than 100. It's contaminated. If the next level of exam question is, “But is there any Pseudomonas there?” then you've obviously got to go further, to further extremes, to look at the different colonies growing and you might have to use different agar plates.

Q We had some evidence from Dr Redding about that.

A Yes, yes, to look for just Pseudomonas or just Cupriavidus.

Q To some extent, is what you're looking for not quite what you find, but you only find what you're looking for?

A Absolutely, and a lot of the samples that we had access to – the results of the environmental samples, the water samples – a lot of them-- I can't remember the numbers, sorry. I do give some exemplars in the report; we give some examples. They'd only looked for one bug.

So they were particularly concerned at one time about Cupriavidus. So the samples had just been examined, it would appear, for one bug and one bug only. So, if that bug's not there, there could have been Bug Y, but they only looked for Bug X.

Q What I want to do now is to look back at Stenotrophomonas because I should have done it five minutes ago and I missed it out. If we go to page 1045, we looked, again-- You see that the striking excess of Stenotrophomonas, which is actually-- if we go the previous page, we see table 5.4.

A Yes.

Q You have 14 Stenotrophomonas in your “most likely” category.

A Yes.

Q We've heard from Ms Evans what "most likely" means, but you then go on to the next page, top of page 1045:

> "There is a striking excess of Stenotrophomonas spp. in the 'Most likely' group which is significant (Chi square test 14.80…)"

I can never remember what the 'p' means, but anyway. The point is, what do you say to the challenge there that because of the work by Professor Leanord, there's no connection between these cases, the human samples, and therefore the statistical significance is perhaps chance?

A Well, remember we talked earlier about there being the very marked peak of Stenotrophomonas bloodstream infections in 2018: 12. In 2015, the first year, there were none, and I think there was either none or one the next year, and it was three, four, five, approximately, the next year, 2017, and then 2018, 12.

You just have to look at those numbers in time and place, and either it's one large coincidence that a relatively uncommon organism in the blood-- you saw 12 examples of them in one 12-month period.

And actually, it was even more clustered than that. There was a lot of those 12 were clustered into one or two few weeks or few months. I forget the detail. That is a red flag for an event or series of events causing 12 times the number in one year than in some other years – 12 versus 1.

So then remember that one of the criteria for determining how likely we judged a bloodstream infection to be related to the environment-- one of the criteria was clustering in time and place.

Q Yes.

A And, of course, with Stenotrophomonas, I've just described clustering in time and place. There were other clusters in other years, but there was an absolutely clear cluster, or more than one cluster, in 2018.

So, one actually drives the other here, that we would-- Therefore, it's no great surprise, given that very large increase – 12 in 2018, from none or one in other years – that those infections by this organism are overrepresented in the "most likely" group, hence this significant excess in the "most likely" group.

Q The challenge about whole-genome sequencing is answered by the evidence you've already given about the quality of that work. Right. Clustering is an area which has I think received some criticism from the Health Board in their comments about your draft, I seem to remember. How do you respond to the suggestion that, to some extent, your work is effectively just seeing clusters

and finding a likelihood of probable-- of environmental connection when you see a cluster?

A There has to be explanation for the extremely marked clustering that we saw in some examples. That's the first thing I would say, and I won't repeat the Stenotrophomonas data, but there were other clear clusters, in time and place, of Enterobacter. As you get fewer and fewer infections caused by Cupriavidus or Morganella or whatever, then it's harder to see the clustering. So the clustering is either just very bad luck, or there's an explanation or series of explanations.

If you then, when you look at the individuals, find they're very unlikely just to have come into hospital, they've been in hospital for some time, they don't apparently have clear evidence of gut inflammation-- Typhlitis is one of terms used to describe that. That makes their gut wall leaky, in other words, more prone to endogenous bloodstream infection. If those are not present, we're building up evidence against the environment as a potential source here.

So does this represent absolute proof that the environment is involved? Of course it does not, but I can't stress enough that routine infection control analysis on a day-to-day basis in hospitals – or GP practices, for that matter – is based on time, place, person, and it's an absolute golden rule about how one initially sets a hypothesis and then looks to refute that hypothesis.

There are just too many, I would argue here-- too many pointers for particular clusters – Stenotrophomonas, Enterobacter being the prime examples – to refute with any confidence a relationship with environmental contamination.

Q Thank you. I mean, obviously there were criticisms in their commentary paper that the Health Board-- they saw the draft and they commented on the report and you made certain changes and you provided us with your workings and we can read that.

A Yes.

Q How do you respond to this suggestion? The Health Board received your overview paper in draft. They didn't receive the individual analyses because of the confidentiality constraint you've just described at the beginning of your evidence: they can only be given to the Health Board if the family has agreed. So is it not really surprising the Health Board were surprised and discombobulated? Because they can't see you're working.

A I can understand a sense of perhaps frustration that they didn't have access to all the material, but, you know, we'd spent 18 months – admittedly during

a pandemic, but 18 months nevertheless – doing this analysis. And we had to do this analysis and this review three times because of the lag in obtaining some of the data which we'd asked for. So it was an extremely thorough analysis, a redo and then a redo.

Their own IMTs, at least two – there were potentially others, but at least two; they're highlighted in our report – concluded that water contamination – and I'm using that term in its most general sense; it may include drains – were believed to be responsible for the infections.

So I don't think one could-- having concluded that internally, in an incident management team, the highest level of review about a potential safety issue-- If they concluded that, I don't think it could be a great surprise that the environment was potentially being implicated here.

I go on to say, the trust, GGC, went on to move the patients from two wards, treat the whole of the water system, try and decontaminate drains as well, as well as bringing in expertise and so on. You don't do that on a whim if you don't suspect – strongly suspect – an environmental aetiology.

Q Because one of the points that I think will be made in response is that those steps – the point-of-use filters, the decants, the chlorine dioxide, the increased water testing – were being made by the Health Board as examples of, effectively, the precautionary principle, and they shouldn't be seen as determinative. They've accepted there's a link to the environment at what one witness, I think, described last week is the corporate level of the Board. How do you respond to that?

A I think there are other things one could have done if one was only mildly suspicious, if I could put it that way, that the environment was involved here. You know, one could have set up, for example, a systematic sampling system which would have looked in far more detail, not just once every few months in any one particular point on a ward, but would have looked daily or weekly for a period of time, intensively examined those samples to give one the confidence that the drain samples or the water samples or the tank samples, whatever, were not contaminated.

That did not happen, and we are critical in our report about the non-systematic way in which the environment was sampled. So one could have done that. That didn't happen. One could have brought in experts-- I don't know, to some extent, how much this was done, but you could have brought in experts to say, "You're okay. We don't think it's the

water system involved," and others I could cite as well. But, no, that's not what happened and we actually----

Q Just on that about bringing in experts, would you have had access to the work of the Water Technical Group and the reports that were done by Dr Makin and Mr Wafer and others, Susanne Lee, in 2018, around the time of what was called the water incident, or would you not have seen that?

A I don't recall. I can't-- That's not an absolute, but I don't recall. I know one of the names quite well – one of the experts, Tom Makin – and I think I would have remembered because I know that person. I've worked with him previously.

Q Right, so one of the things that-- just while we're talking about sampling systemically, yes, you're right that in the time up until 2019, there isn't a systemic sampling program. There might have been one later, but what's wrong with simply going and finding all your historical samples and analysing them, which is effectively what they've done, to try and understand things? What's wrong with that approach?

A Because it's piecemeal by its very nature. So it's not wrong to have done it, but one must recognise the limitations of what one has done. That's all I'm saying, essentially. One has missed a certain number of key patient

samples. One has a very limited number of potential key water source samples. You put the two omissions together, and there's a big hole in one's level of confidence in any resulting analysis.

Q What I'd like to do is look at your statement and sort of deal with this systemic sampling issue, which is page 86 of the statement bundle, paragraph 41. So paragraph 41 starts off dealing with whole-genome sequencing, but the bottom half of the paragraph begins:

> "There was no systematic use of typing, either in real time or after the event. Of even greater concern, and this is detailed in the report, the sampling of the potential environmental sources was not systematic."

He just said, effectively, just that. What I wanted to put to you is, in addition to not knowing about whatever Tom Makin was up to and the others, would you have had any knowledge about the amount of resource being made available to the Estates department to do this work at the time?

A No.

Q No. Would you know anything about the staffing levels in Estates when the hospital opened?

A No.

Q No. A question that I asked of

Ms Evans was about the DMA Canyon risk assessment reports about the water-- Legionella risk assessment reports from 2015, 2017. Did you see those?

A I can't recall.

Q Well, I'm just going to show you the front page because it might speed things up if we can find it.

A Thank you.

Q So, if we go to page 122 of bundle 6. It's quite a striking image. Have you seen this before?

A I don't think so because the front cover is quite----

Q It's quite a dramatic format.

A It's quite memorable.

Q Yes, and they all look the same. They have the same style, so I won't-- That's fine.

A Yes.

Q Would you have received information about the-- where the responsibility lay for deciding the water test levels between the lead ICD, the Water Safety group, the head of Estates? You would not have known any of that?

A No.

Q One piece of evidence I asked Ms Evans about – she said you might be the person to answer, so we'll see how this goes – is, we've had evidence from Dr Inkster that, for the period she was lead ICD from '16 to '19, she had 10 sessions. Five of them were as lead ICD for the whole Health Board and five of them were in Microbiology.

We also had evidence, though, where it would have been sector ICDs – this hospital is effectively one sector – with a couple of ICD sessions and the rest microbiology. In addition, there would have been not only a director of-- director-level nursing-- associate nursing director at the top but lead nurses in each of the hospitals, and this hospital would have had two. So it would have had one for the children's, one for the adults', and then there would have been teams of nurses with-- under their supervision.

A Yes.

Q In terms of the ICD level of staffing-- I mean, you've been an ICD, I take it?

A I've been an ICD. I've been a DIPC – Director of Infection Prevention and Control – as well.

Q Right, so in terms of a hospital this size, is five sessions of ICD across the whole Health Board area and two sessions or thereabouts – two or three – for the sector ICD enough ICD, as it were?

A Well, it's a good question. Probably the sensible way to answer-- Well, I can give you two answers: (1) no, but (2) it's not beyond what one would still see to this day in large hospitals, and I could draw an analogy with some I know

very well----

Q So, for example, Leeds – incidentally, the children's hospital is one of our comparators in our epidemiology work, so it might come in handy – you wouldn't happen to know how many ICD sessions are in that hospital? If you don't know----

A It'll be-- it's approximately the same order of magnitude. It's certainly not 10. So 10 is a whole time equivalent: 10 PAs, four hours each PA, 10 fours are 40, per week, hours. So, I couldn't nail to the mast, but I would be surprised if it's more than five or six. When I was it, it was four.

Q Right, so it's getting better but slowly?

A Yes, and I think that's a trend, but it's not a mind shift to having two individuals whole time equivalent just dealing with ICD issues, for example.

Q Now, I continue to go back to bits of Stenotrophomonas I should have dealt with before. If we can go back to the statement bundle, page 87, paragraph 44. You say in the middle of this paragraph-- do you see on the left-hand edge the word "isolates" appears about halfway down, paragraph 44?

A Yes.

Q Then, a bit further on, after the second "Stenotrophomonas," the sentence:

"There could be 20 different Stenotrophomonas species in the water, of which only three ever get into patients, [it's so] complex."

Q Are those numbers just, as it were, grabbed, for example, or are they----

A Yes, they're numbers to illustrate the zoo phenomenon that I was referring to earlier.

Q Right. You make a criticism, on paragraph 46 on page 88, of the absence of, as it were, before and after systemic sampling around the time of fitting the chlorine dioxide system. Do you see that paragraph?

A Yes. Yes, I can see it.

Q Now, what difference do you think that would have made, if it had happened, to the utility of whole-genome sequencing data to you a year later, if you'd still been around, as it were?

A Well, can I answer the relevance of the whole genome sequencing data sort of----

Q By all means.

Q --- to what I'll say is that you've got a point in time intervention, the chlorination. It's a prime opportunity to look before and after at the effects of that intervention, and if you can show you go from – made-up numbers – 1000 to 1 levels of bugs in water, then you can say, "Look what we've achieved."

If you don't take that opportunity, you just simply do not know. It may be that the chlorination has killed free-floating bacteria that have been liberated from the biofilms but, actually, the biofilms themselves are still okay. They're still harbouring lots of organisms.

So, the relevance of that missed opportunity, if one didn't do that intensive sampling before and after, is that-- well, particularly if there are omissions in one's whole genome sequencing analysis, which we've discussed, then, had you at least been able say, "Well, look, we've gone from 1000 to 1 after. We've carried out this whole-genome sequence analysis. We've taken all the wands we could find after. Still infections going on in children, but none of these wands, you know-- there's virtually nothing there, but we've analysed everything that moves, and there's no link."

They didn't analyse everything that moved. There wasn't a systematic sampling process in place. There was a, "Look for this but not for that" variable with time and with sample, and this missed opportunity for vigorous sampling before and after acute intervention.

Q That's really helpful. What I want to do is move on to the possibly strange topic of comparative epidemiology. Did you ever see the protocol that set out the nature of the work of the case search review? Because I don't think Ms Evans did see it. We'll stick it on the screen. It's the separate PDF to my colleague at the (inaudible).

A Yes, I'm not sure what you're referring to, but if you could try----

Q Well, we'll just see what it is. So this was in bundle-- it's supposed to be in bundle 27, volume 6, document 24. That's it, yes. This was produced, we're told, in February 2020, and is the case notes review epidemiological protocol.

A Yes, I do believe I have seen this.

Q Yes. Well, I'm not going to take you through it because that would, I think, be unfair if you haven't seen it for years.

A Yes.

Q Just to ask you this question, is-- a criticism is made of the work of the case notes review by the medical director, Dr Armstrong – it's in the transcript, column 212 – that it's a weakness of your approach that the work was done without looking at a comparator hospital. Why didn't you do a comparison piece of work as well, alongside the analysis of the actual individual cases?

A Okay. So, as I understand it, our brief started with a minister standing up in the Scottish Parliament and saying there's going to be a case note review.

As I understand it, that's what happened and that's what we carried out. However, we did go further than simply reviewing each case and nothing else, as we've discussed today, and we went quite bit further.

So, first of all, why did we not compare GGC with St Elsewhere? Well, first of all, if you were going to do that, where am I going to get the data from? I had no access to the data. We had no access to the data from St Elsewhere A, B, C, D and so on. Simply comparing the data with just St Elsewhere A would not be a robust----

Q So you've got to compare it with multiple hospitals?

A Yes, it has to be multiple hospitals with – as close as you could achieve – similar case mix, which is difficult, very difficult, because GGC is a regional-- in fact, national referral centre for sick children with rare tumours, particularly leukaemias, who needed stem cell transplants, SCTs.

So there isn't another Glasgow, as I understand it, in Scotland, so you'll probably be having to go to other paediatric specialist hospitals south of the border. Okay, that would be possible, but we had no access to do that.

Even if one had done that, finding another unit that had an identical-- well, you're never going to find an identical case mix, but a similar case mix, that's a tall order. The interventions that happen in Glasgow, whether they use antibiotic prophylaxis – which we talk about briefly in our report – or not, whether they pre-treat individuals with radiotherapy or not, how they carry out their stem cell transplants. There's so many variables.

And if you are going to do that and try and compare with St Elsewhere A, B, C, D and so on, assuming you could find A, B, C and D, the scientifically robust way of doing that is by using a propensity matching exercise where you look for all the risk factors that are in your cohort of 84 children – I think it was 84 – versus the, let's say, 84 that are in St Elsewhere A and 84 or thereabouts that are in St Elsewhere B, and you try and adjust the data to take account of the risk factors for infection.

But you can only adjust the data for the risk factors you know about. So I'm trying to simplify what is a very complicated process, and can I just add one other element to illustrate how difficult this is? We mention it in our report how, in GGC, there'd been a real campaign to drive down catheter-related bloodstream infections.

Q This was the CLABSI work?

A Exactly, the Central Line-Associated Bloodstream Infections. CLABSI, exactly. Most of which you'd

expect to be caused by gram-positive organisms, so you would expect, on the back of a successful campaign – and there was apparently some success there – to drive down your CLABSI-related bloodstream infections, which would be caused by gram-positive organisms.

So your overall rate of infection might go down, but if at the same time you've got an excess of gram-negative infections, your rate comes back up to the same as it was had you not been successful in one part of the story. So you compare your rate with St Elsewhere A or B or C, and you find, "Oh, our rate is comparable." That doesn't tell you you haven't got an excess in one place and not the other.

Q So is there any value in doing this? You decide you're only going to deal with gram-negatives; you are going to compare with more than one centre; you're going to pick tertiary haemato-oncology wards; you're not going to worry about any of the detail that you've just discussed between them; and you're just going to get as much information as you can for a handful of wards across England and Wales. If you did that, what would you need to find in terms of a signal for you to be confident that it wasn't, as it were, just lost in the differences?

A So you'd have to look both qualitatively and quantitatively at the numbers, and what I mean by that is you would, yes, work out the rates in GGC, work out the rate of bloodstream infections, just the gram-negs, in St Elsewhere A and B and C.

But within those rates of – now your analogy – just gram-negative bloodstream infections, you would need to look, "Yes, but which gram-negative bloodstream infections?" Because some of those risk factors I talked about, whether they're using antibiotic prophylaxis in one centre but not the other, could drive down some gram-negs but have no effect on the others. They could even encourage others.

And so you'd have to look amongst the gram-negative bloodstream infections with an apparently similar rate to see if Stenotrophomonas or Enterobacter were overrepresented in one centre versus another.

Q Okay, and is this why you didn't do this?

A Well, we didn't do it because it wasn't our brief. We had no access to the data to allow us to do it. Had we had a lightbulb moment and said, "We absolutely need to do this," there was a pandemic going on; it would have been virtually almost impossible to do it. But it was way beyond our brief and it seemed so far beyond our brief that it was not

integral to being able to draw the conclusions that we drew.

Q Thank you. What I want to do is pick up a few discrete topics and then see if there are any other questions in the room, because we're nearly at the end. One of the things that Professor Leanord raised in his evidence on 9 October was an observation that he explained he'd reached that meropenem use earlier in the cohort of patients might have, later on in 2019 and 2018, caused an increase in some of the infections that they were seeing, so in the sense that the change to the population of the microorganisms in the patients was, to some extent, driven by antimicrobial-resistant microorganisms reacting to meropenem.

Now, I've not shown you the graph that he looked at with Ms Harvey-Wood. We've asked her for a supplementary statement and we'll do that. We can just stay at a very high level of principle here. If something like that was going on in a unit, if there was an increase of organisms caused by antibiotic resistance and it was meropenem, how would you know? I mean, if you were in that ward, what sort of things would you be looking for to see that it had happened?

A So, is that plausible, that antibiotics can select the microorganisms and then you get an excess of infections? Yes. But getting an excess of bloodstream infections where the bugs have got to come from somewhere – either from within the gut, usually, or without – that's quite a bit more tenuous.

But the key thing that refutes that hypothesis is that you would not expect clustering in 2018 with Stenotrophomonas, then the clustering goes away or reduces significantly. You would not expect very clear clusters – six, seven, eight cases across a few weeks, two or three months – which then go away because your selection pressure, if the hypothesis is correct, would surely still be there, the antibiotic selection pressure. So I don't think that's tenable.

Q There's a related hypothesis that the infections that were seen, to a greater extent than perhaps you and your colleagues have found, had their origin in the patient's own flora or infections brought in from outside by patients. If that was going on in a haemato-oncology paediatric ward, again, how would you know that that was going on? What would you see?

A Well, if that was going on, you wouldn't expect the very clear clusters in time and place that I've just referred to. If that did happen, if you-- It is feasible you could get clustering in time and place.

Let's say someone had brought in Bug X from the outside, developed their

own infection or not, given it to another patient via a healthcare worker or directly by playing with the other child, whatever, but when you typed those organisms, you'd expect to find very easily the same strain that's gone from A to B to C to D Child.

Q Because you only get one strain per patient at one time, most of the time?

A In the blood.

Q In the blood, yes.

A Yes, whereas what we can see is more analogous with a zoo, with the organisms coming from a much more diverse population, not just one person bringing in her Stenotrophomonas, another child bringing in his Enterobacter species, which then runs around the unit.

Q Because in that case, everyone's going to have the same thing?

A You'd find much less diversity, expect to find much less diversity.

Q Okay. That brings us into the-- I think you actually answered that, so I shall cross that out. I want to look at something you've said in your statement at page 77, paragraph 18, and it relates to what we've just discussed. You say:

> "I have been asked to explain how we reached the conclusion that there were no potential signals of an environmental source elsewhere. This was my assumption and was formulated from what we were told initially and the focus on bacteraemias caused by gram-negative environmental bacteria."

What sort of assumption is this? Is this an underlying assumption to your work or--? Because assumptions seem important.

A Well, I think I said earlier, gram-negative bacteria like to live in warm, wet conditions, so, you know, plug holes are ideal, pipes and moist parts of our bodies. They're not on the dry, inhospitable skin but inside our guts, warm and wet. So if one's looking for an environmental source of gram-negative bacteria, one would naturally hypothesise that it would be water types of sources, as opposed to tabletops, floors, ceilings and so on, or air conditioning systems.

I then go on in the paragraph to mention, or it is mentioned, that Cryptococcus cases, which-- if one just was asked to say three or four words that come into my mind as soon as I hear Cryptococcus, you'd think the air, pigeons, contaminated air systems, lack of positive pressure ventilation. None of those things are, say, waterborne sources.

Bugs can often have very-- well, not often-- very often have very preferred habitats. The preferred habitat of a

Cryptococcus is very different from the preferred habitat of the gram-negative bacteria.

Q Well, what I'm concerned about is that-- I appreciate, if we ignore Cryptococcus and focus on the gram-negatives, that if your normal assumption is – and I don't think anyone's disagreeing with this – that if they're not in the-- The gram-negatives want to live somewhere warm and wet. That will be your gut, a drain, the water tank, a puddle sort of thing. The way you phrased it does run the risk of looking like you've assumed there's an environmental source. Is that what you've done?

A No. Well, first of all, our hypothesis, our remit, was to examine the cohort of cases and determine if we could deduce there was likely to be an environmental source, so that was our remit. So there is a risk there of an assumption in that remit.

However, I would like to believe that most of my type, including Gaynor and Mike, my compatriots, are natural sceptics, and so we actually look for reasons to reject a hypothesis at least as much, if not more, than we look for reasons to accept it.

It's just that-- I think I've explained why, I think, runs in weeks and months of the same bug occurring again and again and again and then it goes away, that's

not-- doesn't sing endogenous infection, so it says exogenous. Where's it going to come from if it's not a water source?

Yes, you could say, "Well, all the saline bags that have been produced just for Glasgow had been contaminated with different Stenotrophomonas maltophilia isolates and then they have this phenomenon." It just is not going to happen, so there's a very limited actual number of broad conclusions one could come to in this scenario with this degree of epidemiology and clustering.

Q What I want to do is turn to page 99 of your statement, paragraph 75, when you discuss your interactions with the whistleblowers. Now, I've discussed this in some detail with Ms Evans, so I think I can probably take this relatively quickly with you, which is in this section, you're discussing:

> "During our review we engaged with a number of key staff involved in the IPC at NHS GGC who advised us that they had been denied access to water sampling and testing information despite multiple requests.
>
> This information was coming from whistleblowers, with whom we met on more than one occasion [I get that and that's what they've told us]. Clearly, we had to be careful about what we were told and what we said in those meetings, and I believe we were

careful."

Why did you have to be careful?

A Well, it was a two-way process. I think we had to be careful to listen to what we were being told, but to then ask questions either real time to the person/persons telling us that, or discuss separately the plausibility of what we were being told.

I think, clearly, we were carrying out a case review with anonymised patient data. That fact alone means there was a need to be careful about, you know, would we home into one particular patient who might have had a very severe outcome?

So, I think that-- I've been involved more than once with a scenario of someone, let's say, a whistleblower or someone taking a different viewpoint, and one has to, I think, be very cautious in receiving and giving information in that context. That's what that means.

Q Would you have been given information by those who decidedly were not whistleblowers, who worked for the Board, that explained the Board position about this issue? Because I think that comes up in the letter from the Chief Executive on 5 March.

A Yes, I can partly remember. I can't remember the exact wording. So, Pro 10, during our review, I don't remember us being-- you know, someone

proactively from the Board, from GGC, saying, "Just need to make it clear that you may come across individuals A and B who are saying X, Y, Z. Our view is that there's an error here or you need to understand the context." That didn't happen.

Q So when you have stuff in your draft report where you discussed, "There was an absence of this, we couldn't find such-and-such, the IMT didn't do that"----

A Yes.

Q -- that's all drawn from the documents you were looking at, not from interviews with senior people on the Board?

A It is, but we had to go back, sometimes three or four times, to ask for information.

Q What I'm trying to say is you weren't being briefed; you were reading it yourself?

A Correct, and obviously the-- ultimately, there was the-- we produced our report and there was the opportunity for GGC to come back, and they did about some things, but it was a relatively limited list of things that they took issue to. Some of them might be bigger than others, but it wasn't on everything we'd said did they take issue.

Can I just-- To this day, it still sends a shiver down my spine, is the first-- when I read the first sentence in this

section, paragraph 75. I have never, ever come across a colleague telling me that they have been denied access to absolutely core information to enable them to do their job.

Q But that source is a person, not a document?

A In this case, that was a person telling us that, yes.

Q Okay. Well, obviously, we've spoken to the people involved, so we'll make our own minds up, but that's very helpful.

A Yes, I'm just saying that that is a real standout moment in this process. Not "the" standout moment but a standout moment.

Q If we just go back to paragraph 72, I think you've actually already answered this question but I think it's probably worth just doing it. We talked about Mycobacterium Chelonae and I want to just show you what I think is the report that's published on this piece of work----

A Okay.

Q -- and just see if you read it, just join the dots. So it's actually in bundle 18, volume 1, document 52, at page 3550. I suspect you'll recognise it. Have you ever seen this paper before? I mean, I realise it's a bit of a cruel trick to play, but----

A Yes. Have I read it, you know,

first to last sentence? No, I haven't, but I have seen this and I have read the abstract, which is admittedly an overview. But yes, I am aware of it.

Q So it's not by VNTR typing? It is whole genome sequencing typing?

A Correct.

Q Your concern that you express about the validity of the connection, is that based on reviewing this paper first or----?

A No, I wasn't aware of this until after we-- I mean, this was published in 2021.

Q Yes.

A I don't recall-- I don't know when in 2021. I was somewhat otherwise occupied in 2021.

Q I appreciate that.

A So I probably saw this way after we submitted----

Q So just getting the chronology, the discussion in the overview report about this particular infection and its sequencing and its linkage – and the slight degree of scepticism that you express as a group about that – predates the publication of this report?

A To the best of my knowledge. I don't recall ever being aware of this pre-report, yes.

Q That's very helpful. Right. What I want to do is now just to take you back over your report itself to bundle 6,

page 984 and the second paragraph. Now, this is almost the very end of your executive summary. Now, do you see how you've reported:

> "We recognise that some families will be disappointed in our ability to identify a link between their child's infection and the hospital environment with greater certainty than has been possible."

It's a sentence that follows that that I'm interested in, where you've gone:

> "This not only represents the limits of a retrospective review and the shortcomings we have described in the data we were able to access, but also highlights the fundamental challenge of identifying a specific source in all such infections."

Given that, approaching it from a different end of the telescope, this Inquiry has also been set the task of working out whether there is a connection between the hospital environment and risk to patients, to what extent is what you were doing or what we're doing actually possible to get an answer?

A It's a very good question. So, like us, you are unlikely to be able to get to absolute proof of an answer and you'll have to, like us, weigh up the lines of evidence and make a conclusion. Now, the level of certainty you, my Lord, will have in making that conclusion, who knows, but it's a very similar process in lots of respects.

You might use different terms and you might take issue with "most likely" and "very probable" and so on, but on the grounds-- I am very, very used to the term "on the grounds of possibility--probability" – Freudian slip there – but we deal with possibility, probability, not necessarily in the strict legal context on a day-to-day basis in Infection Prevention and Control.

Q Well, if you're going to say this, I'll take you to your table because I think it's going to make life slightly easier.

A Okay.

Q So if we go to-- (After a pause) Of course, I've shot past it, but I'll get back to it. Page 1043, table 5.3. Do you want to continue? Because now you've got it in front of you.

A Yes. So it was an iterative-- It would have been helpful, I think, if we'd said that. We allude to this; I don't think we say it as clearly as what I say next. It was an iterative process to ascribe level of certainty – the level of certainty, of course, not absolute certainty – around whether the environment was or was not involved per case.

Early on in that iterative process, I think we were possibly over-ambitious in terms of “weak possible,” “possible,” “strong possible” and so on. Well, in

retrospect, I don't "think." I think we were over-ambitious, but it was done with good intention and it was to try and at least record real-time in our process the relative degrees of certainty or uncertainty in our conclusion per case.

In the report and, you know, in our ultimate analysis, we then condensed some of those six groups. Well, it's five, actually, if we exclude “unrelated” and “definites.” So we then tried to coalesce them. Had we done that from the outset, I think we could have equally been criticised to say, "Well, hold on a minute, you're putting all these ‘probables’ together, but you're putting all the ‘possibles’ in one basket. What about the ones that were almost a ‘probable’?"

So, I think by using this iterative process of describing and trying to measure the degree of certainty, I think that gave us confidence. And remember, as I say, we did these case reviews three times, so that gave us the opportunity, for better or for worse, to revisit whether this really was a “strong possible” or, in fact, when you look at this and you add that extra piece in the jigsaw, it's a “probable." So, I think it looks over-ambitious here. In the context of the whole investigation, it was probably a reasonable part of an iterative process.

Q Seeing I've got time, I'll ask you, where would you draw the line of

“more likely than not” in that table?

A Well, technically, it's 51 per cent or more.

Q Yes, so where (inaudible)?

A We do not do that in day-to-day Infection Prevention and Control. One takes-- looks at the evidence and one takes a consensus view. It's rarely one individual. You take a consensus view, you discuss, you go through the evidence, as we did as a threesome, and you say, "Okay, do we think"-- and, as far as we're concerned here, "probable" is 51 and above, and then "strong probable" was a number higher than 51.

I'm not going to try and claim, "Well, it had to get to 75.2," because that'd be making it up, but "probable" meant we were concerned sufficiently that this was, on the grounds of probability, more likely than not – 51 per cent or more.

Q Thank you. I'm going to also take advantage of a little bit more time to ask you another question. So there has been some evidence about the mechanics of what happened in 2018 and 2019 in the management of these events, and I don't think you will have necessarily seen this because you've not heard people, you've just read the documents, but given that you've been a director of Infection Prevention and Control and you're a professor in the field, I'll just take the opportunity of asking you.

There was some evidence from Dr Inkster that, early in 2018, she had suggested that there would be some form-- in addition to the IMT, there'd be some form of executive control group that would sit above the IMT it would report to, as would the various groups dealing with the water systems and changes they were going to make.

Then, when the decant happened in September that year, we had evidence of a group of executive members ultimately making the decision to go ahead with the decant, after some reflection. Then, when there was a small decant in 2019 to this clinical decision unit, there's some evidence of a meeting where an IMT decision was then discussed with executive members.

What I want to ask you is this: in IPC and the connection between IPC and management, what role should the two be playing? Because, ultimately, a big decant like this seems like a big decision for a lead infection control doctor to make. So where should the line be drawn in terms of management? Who, ultimately, makes these decisions?

A Okay. Well, your description was-- there's nothing wrong with the description, but I didn't recognise-- I've not come across that scenario as you described it. If that scenario was going to happen, I would expect some key

individual or individuals in the IMT process to be part of the other Board, "the managers" you refer to it as.

Q Yes.

A Because otherwise, how can the managers make an informed decision, a truly informed decision, based on the facts? If that wasn't the case, then I have a fundamental problem with that, knowing nothing else.

So the reality, to answer your question, is that the whole point, if you have a robust system – remember we've got this problem assessment groups, PAGs – deciding is this an instance of sufficient concern to constitute an IMT-- Yes, you've got an IMT. If you've got a functioning system, then the IMT should be capable of managing the incident or not and needing to, in this case, escalate it.

Then the normal route of escalation there would be, if the DIPC wasn't part of the IMT, then the ICD – infection control doctor, usually, or whoever's leading the infection prevention and control team – would communicate with the DIPC, who usually is required, according to national documents, to be a Board member.

So it's then a Board decision. To have another group created in between IMT and Board seems a bit-- seems odd to me, and that's what I said I didn't really understand.

Q I think we might have a difference between England and Scotland here.

A Possibly.

Q So we have evidence that the infection control manager is not an infection control nurse or an infection control doctor.

A Okay.

Q And that his replacement, as director of infection control, is an infection control nurse, and that the Board-level responsibility in the Scottish system sits with the HAI infection lead, who at that point was the medical director. So that seems a very different system to the one you're describing.

A It is, yes.

Q Right, well, in that case, I'll stop asking you about the English system at this stage. Thank you very much for that. But one final question – before we have a short break to see if there are any further questions – which is, we asked ourselves a question as an Inquiry, which-- I'm not going to ask you the whole thing because that's possibly unfair, but I'll tell you what it is. It's our key question 4, which is, is there a link – and if so, in what way and to what extent – between patient infections and identified unsafe features of the water and ventilation systems?

I'm not going to ask you that question because you don't know what the features of the system are, but to what extent do you, as a panel, say there is any link between the environment in the Royal Hospital for Children and the infections in the patients of your case note review cohort?

A The evidence suggests strongly to me – and, I believe, us – that the clustering in time, person and place of these organisms and two or three species, in particular, are strongly suggestive of a link between aspects of the environment, almost certainly waterborne, and some of the infections that occurred in children.

Q Thank you. My Lord, I've got no more questions for Professor Wilcox, but it may be that people in the room have questions. I wonder if we might take a short minute to find out?

THE CHAIR: Before we do that, Professor Wilcox, can I come back to your use of the word "iterative" or perhaps the phrase "iterative process"? You used it in about the context of ascribing “possible,” “probable” and variations on that. Can you just maybe tease out so that I could, as fully as I can, understand your process of reasoning or analysis that you described using the word "iterative"?

A So, when one starts an exercise like this – and I've never done a

case review as large as this, and I don't think any of us had – we know the principles. We know how to carry out the review, so we knew sort of the pieces of the jigsaw. I guess the bit we were less confident about was how to ascribe and describe levels of certainty regarding a conclusion. “Environment, yes/no,” to put it bluntly.

So we attempted to divide up our levels of certainty and around the word "possible" and "probable," probably to a greater extent than we would do on a day-to-day basis when we're trying to decide have we got an outbreak, a cluster of infections or not. Is the environment involved: yes or not?

And I think I've explained why we took that process. It was so that we-- the first case you're doing, we've split these cases up. The first, let's say, five cases I did, there's going to be five more and five more and five more. If you don't have granularity, more granularity rather than less with your first-- when you're reviewing your first cases, then you've potentially lost an opportunity.

What we didn't know in real time is that we were going to have to go back and review those cases twice more. We were assuming we'd be doing this once, so I think that was another reason why we had more granularity, if that's the right word, in our "scoring system," for want of a better term, for degree of certainty.

And we-- as I've said, we had to review the cases twice more, and then we became more confident, having done this 84 times, times three, in what we believed to be a "probable" versus only a "possible." That's why we became-- we felt it was reasonable to coalesce, contract some of those subcategories of certainty into a simple, "possible” and “probable." That was the iterative process I was referring to.

THE CHAIR: The word "iterative" suggests to me, at least, a taking of steps along a pathway. I was trying just to ensure that I-- I mean, if that was how you were using the word, in order to help me understand your mental processes, what these steps and what that pathway might be----

A So, to me, though, an iterative process is not a pathway that's laid out in front of you which you can describe now into the future. It's a pathway which you travel down and learn as you go along. That's what I mean by "an iterative process." I think it's possible semantics, but the difference is interpretation, but that's why I was using the word "iterative."

THE CHAIR: Sort of an accretion of insight or knowledge?

A Yes. It's a learning process. Perhaps I should have said "learning."

"Iterative" was maybe too inflated, but I still think it-- if I said that to my colleagues to describe what we did, I think they wouldn't have taken issue with that. I think it's perhaps your expertise coming at it from that word versus mine.

THE CHAIR: Thank you. Now, just as a matter of administration when it's in my mind, do we have a bundle number for the protocol or----?

MR MACKINTOSH: We do. It's bundle 27, volume 6, document 24. The page number, I don't know, but a new version has been put on to the Objective Connect spaces for all the core participants. It will need to be updated on my Lord's laptop.

THE CHAIR: I ask because, I mean, I haven't----

MR MACKINTOSH: I have a horrible fear that all the remaining page numbers after document 24 are now going to be out, but yes.

THE CHAIR: All right. Well, I'll pursue that. Professor, as Mr Mackintosh has said, I need to check with the room as to whether there's any more questions, so if I could ask you to return to the witness room, and I hope to be back in about 10 minutes.

A That's fine. Thank you.

(Short break)

THE CHAIR: Mr Mackintosh?

MR MACKINTOSH: I have no questions from colleagues here or remotely in respect to Professor Wilcox.

THE CHAIR: Thank you, Mr Mackintosh. Thank you for waiting, Mr Wilcox. I understand there's no further questions that we would wish to put to you, which means you're free to go. But before you go, can I thank you for your attendance today but also in the work involved in providing us with a written statement, which of course is another part of your evidence. So, thank you very much indeed, but you're now free to go. Thank you.

A Thank you very much.

(The witness withdrew)

THE CHAIR: We resume tomorrow at ten.

MR MACKINTOSH: Ten with Professor Stevens, who's set down for the whole day.

THE CHAIR: Well, if I can wish everyone good afternoon, we will see each other tomorrow, all being well.

(Session ends)

16:13