SCOTTISH HOSPITALS INQUIRY

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## Hearings Commencing
## 19 August 2024

Day 45
Tuesday, 12 November 2024
Dr Sara Mumford
Ms Linda Dempster

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**10:03**

**THE CHAIR:** Good morning, everyone.

**MR MACKINTOSH:** Good morning.

**THE CHAIR:** Now, we, today, will have an innovation in the sense that two of our witnesses will be giving evidence at the same time, in the sense that they will both be in the hearing room and will answer questions from Mr Mackintosh, not speaking at the same time but alternately. I think the plan is that Ms Dempster will sit on my left----

**MR MACKINTOSH:** Yes, my Lord.

**THE CHAIR:** -- and Dr Mumford will sit in front of me. Legal representatives, no doubt, will position themselves in such a way as they can see either the screen or the witnesses as they as they wish.

**MR MACKINTOSH:** It's perhaps worth observing, my Lord, that the reason for this is that these are joint report authors, and I'm keen to capture their evidence in one sitting without the inconvenience of having to revisit matters----

**THE CHAIR:** All right.

**MR MACKINTOSH:** -- if that became necessary.

**THE CHAIR:** Very well. Good morning, Ms Dempster----

**MS DEMPSTER:** Good morning.

**THE CHAIR:** -- and Dr Mumford.

**DR MUMFORD:** Good morning.

**THE CHAIR:** Now, as you understand, you're about to be asked questions by Mr Mackintosh, but first, I understand you're both prepared to affirm. First, Ms Dempster, sitting where you are, would you repeat these words after me?

**Ms LINDA DEMPSTER**

**Affirmed**

Thank you, Ms Dempster. Now, Dr Mumford, can I ask you to do the same thing?

**Dr SARA MUMFORD**

**Affirmed**

The schedule is that you will be giving evidence today and tomorrow. We'll take a coffee break at about half past eleven. We'll take a lunch break at one. However, if during the course of the day you wish to take a break, we can do that.

I would hope that you're properly assisted by the microphones positioned in front of you, but could I encourage you both perhaps to speak a little louder, maybe a little slower, than you would in conversation? I'm a bit hard of hearing, and I have to say, Dr Mumford, I found your voice just a little light. The fault is no doubt mine, but I wish to hear what you

have to say, as do everyone else in the hearing room. Now, Mr Mackintosh.

**MR MACKINTOSH:** Thank you.

**Questioned by Mr MACKINTOSH KC**

I just want to take your full names first. Before I do that, I'll perhaps explain how I'm proposing to deal with the two of you at the same time with questions, partially for the benefit of those watching on the YouTube channel, for yourselves, for core participants and for the person who's taking the transcript of this evidence.

In the initial section, I will deal with questions directly to one or either of you and I will address it accordingly. Once we get past that initial section, where we work our way through your reports, I will effectively direct each question first to one of the two of you and then the other. I will try and use your names in my questions so that the transcript writer can work out who's about to respond. No doubt, they will learn your voices.

From the point of view of the technical team, if you're coming in to respond to something that your colleague has said – and I will give you always an opportunity to comment on or add to what your colleague has said – I will ask you just to sort of, as it were, wait a beat before speaking because the camera positions and the microphones do need to be switched over. It all happens behind the scenes.

If, at the coffee break, you feel that there's anything about this that isn't working, please do report the matter back to our witness support team who've been dealing with you this morning, and that message can be passed back to me so that I can learn from the experience. What I'll do is I'll start off with you, Ms Dempster. I wonder if I can take your full name?

**MS DEMPSTER:** Linda June Dempster.

**MR MACKINTOSH:** What's your current occupation, Ms Dempster?

**MS DEMPSTER:** I'm retired.

**MR MACKINTOSH:** What was your occupation before you retired?

**MS DEMPSTER:** A registered nurse. I still am actually on the register, but a registrant.

**MR MACKINTOSH:** What was the last role you held as a registered nurse?

**MS DEMPSTER:** In my full-time employment, it was head of infection control for NHS England.

**MR MACKINTOSH:** Thank you. Dr Mumford, what's your full name?

**DR MUMFORD:** Sara Louise Mumford.

**MR MACKINTOSH:** What's your current occupation?

**DR MUMFORD:** I am medical director and director of Infection Prevention and Control for Maidstone and Tunbridge Wells NHS Trust.

**MR MACKINTOSH:** Thank you. Is that the only appointment you hold at the moment?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Now, what I want to do first is to just identify, for the purposes of the transcript, your three reports. So we have your main report, which is in Bundle 21, Volume 1, Document 4, page 96, which is dated 24 May 2024. We have your addendum report of 30 October 2024, which is in the same bundle but it's page 773, Document 11, and we have your Direction 5 response of 11 August 2024 – Bundle 21, Volume 6, Document 4, page 118. That's your response to our questionnaire that we sent to you under Direction 5. Dr Mumford, are you willing to adopt these reports as part of your evidence?

**DR MUMFORD:** I think we have two small corrections which Ms Dempster has got on our main report.

**MR MACKINTOSH:** Well, I'll ask her to deal with them. Ms Dempster?

**MS DEMPSTER:** Yes, it's just a couple of dates that we had not got correct.

**MR MACKINTOSH:** Of course.

**MS DEMPSTER:** So the first one, I've got it as page 7 in our report, but obviously you'll have a different bundle number, won't you? It's under my-- the information about me.

**MR MACKINTOSH:** Page 104.

**MS DEMPSTER:** Yes. So on the fourth bullet, I actually started that role in January 2015 and not '17.

**MR MACKINTOSH:** So it's the second line of the----

**MS DEMPSTER:** Oh, I've-- It's corrected there. It's correct. It's 2015 and not 2017.

**MR MACKINTOSH:** So it reports that you-- in January 2015, you moved to the Trust Development Agency and was the regional IPC for the south of England?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Yes. What's the second change?

**MS DEMPSTER:** It's under the-- It's moving and in the document. It's under "Definitions."

**MR MACKINTOSH:** So that's on page 108.

**MS DEMPSTER:** I haven't got it as a bundle number, sorry. It's 9.2 in Definitions.

**MR MACKINTOSH:** 9.2?

**MS DEMPSTER:** Yes, where we had got the date of the National Infection Control Manual wrong. We had put January 2013, but it's actually 2012.

**MR MACKINTOSH:** So it's on page 131? It should be which year?

**MS DEMPSTER:** It should be 2012.

**MR MACKINTOSH:** 2012, so 13 January 2012?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Thank you. Well, I'll return to Dr Mumford in a moment, but Ms Dempster, are you willing to adopt these two reports as part of your evidence? These three reports?

**MS DEMPSTER:** The three, yes.

**MR MACKINTOSH:** Yes.

**MS DEMPSTER:** I am.

**MR MACKINTOSH:** Dr Mumford, yourself?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Thank you. What I want to start off with, for you, Dr Mumford, is did you have any connection with the Queen Elizabeth Royal Hospital for Children or NHS Greater Glasgow prior to being instructed by this Inquiry?

**DR MUMFORD:** No, I didn't.

**MR MACKINTOSH:** In fact, did you have any connection with Infection Prevention and Control in Scotland prior to being instructed by this Inquiry?

**DR MUMFORD:** No, I didn't.

**MR MACKINTOSH:** Thank you. Ms Dempster, did you have any connection to the Queen Elizabeth Royal Hospital for Children prior to being instructed by the Inquiry?

**MS DEMPSTER:** Yes, I did.

**MR MACKINTOSH:** Have you addressed that in the main report at page 106 of the bundle?

**MS DEMPSTER:** Yes, I have.

**MR MACKINTOSH:** Now, I want to ask you a couple of questions. Can you explain precisely what work you did do for the independent review, other than this site visit?

**MS DEMPSTER:** Prior to the visit, I met with Dr Fraser, who explained there was infection issues at the hospital, and he asked myself and a microbiologist from another organisation for some general advice, if you like, about what is the role of Infection Prevention and Control, what does a team look like, what would they do and what would they be expected to do. So we did that, and then we came on a site visit to the Royal Hospital for Children when 2A was actually closed. It was a complete building site, if you like.

**MR MACKINTOSH:** You mention in the section that you, at the bottom of page 106, that you met Professor Leanord.

**MS DEMPSTER:** Yes, I did.

**MR MACKINTOSH:** Yes, and it mentions that you met the infection control manager. Who was that?

**MS DEMPSTER:** It was Sandra Devine.

**MR MACKINTOSH:** Right, and prior to that site visit, did you see any documents about the infection control system in Glasgow as it was actually run?

**MS DEMPSTER:** Not particular to GGC. I obviously knew about the National Infection Control Manual, but not individual guidance.

**MR MACKINTOSH:** After the site visit, what connection did you have to the independent review?

**MS DEMPSTER:** When we left the site, myself and the microbiologist, we gave some very high-level feedback because we experienced a very good visit and walked around and met with people and saw the Ward 6A where the children were then, and it was just some high-level feedback about what we saw on the day.

**MR MACKINTOSH:** Can you remember what the high-level feedback was?

**MS DEMPSTER:** I believe it all to be very positive. The ward the children were in was clean and it was a good visit. There was nothing that hit me in the face as being awful or anything. It was----

**MR MACKINTOSH:** Can you help us with the date? Because you didn't actually provide a date in this section of your report.

**MS DEMPSTER:** I think it's February 2020, from----

**MR MACKINTOSH:** So just before lockdown?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right.

**THE CHAIR:** You said the high-level feedback was positive.

**MS DEMPSTER:** Yes.

**THE CHAIR:** I don't know if you explained the content of the high-level----

**MR MACKINTOSH:** Yes, what was it that you said to Dr Fraser and his colleague in this feedback?

**MS DEMPSTER:** Yes, I have not got access to that email, but I remember writing an email back saying, you know, we'd walked around, the ward we'd been to was clean, it was tidy, the staff we met were very competent in explaining the care of the children very well.

We had met with, in the morning, I believe, the Estates team, who explained the work that had already been undertaken on the water system and on the ward and what they were doing in 2A. Then we did meet with the infection control team and we then went on a visit around 6A. There was nothing I saw that I-- In my previous roles, I've visited many, many hospital wards and sites, but there was nothing that I thought concerned me.

**MR MACKINTOSH:** Who in the Estates team did you meet? Do you remember their names?

**MS DEMPSTER:** I don't remember them. I think I met Professor Steele, but the rest of the room I cannot remember the names.

**MR MACKINTOSH:** Given that you've probably seen a lot of these names mentioned----

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** -- in documents, that hasn't jogged your memory?

**MS DEMPSTER:** Not who I actually met that day, no.

**MR MACKINTOSH:** No.

**THE CHAIR:** Again, if I can just follow this----

**MS DEMPSTER:** Yes.

**THE CHAIR:** If I understand your answer, Ms Dempster, when you talked about the high-level feedback, you sent one email----

**MS DEMPSTER:** Yes.

**THE CHAIR:** -- giving a resumé----

**MS DEMPSTER:** Yes.

**THE CHAIR:** -- or summary of what you'd done that day----

**MS DEMPSTER:** Yes.

**THE CHAIR:** -- in the visit.

**MS DEMPSTER:** It was literally a bullet-point email, and so did my colleague, who was the microbiologist, because he'd obviously taken a bit of a different tack when we were there, was talking about prescribing and probably a bit of a difference to the role that I-- I was looking more from an Infection Prevention and Control nurse's point of view.

**THE CHAIR:** Thank you.

**MR MACKINTOSH:** After sending that email, did you have any further involvement with the independent review?

**MS DEMPSTER:** I think, after the visit, we did actually see the draft section. There was a-- some of the section on IPC and-- of the report. That was all I saw.

**MR MACKINTOSH:** Did you make any comments on it?

**MS DEMPSTER:** I think I might have done, but I cannot swear on that, what I did or said.

**MR MACKINTOSH:** You can't remember?

**MS DEMPSTER:** No, and I have no access. It's not that I don't know; I can't check back. Because that was when I was working in my previous role, so everything was via my NHS mail, which I don't have access to.

**MR MACKINTOSH:** Do you understand why it was that you stopped any further involvement, other than reviewing that draft section?

**MS DEMPSTER:** I understand it was because our piece of work was completed.

**MR MACKINTOSH:** Right. In respect of the other section that's

mentioned in your declaration, which is your work for the case notes review----

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** -- you've described that in the third bullet point of page 107.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** Now, we can obviously read that, but it occurred to me that we should probably connect your explanation there to the case notes review process map, which is in Bundle 6, Document 38 at page 1015. This is Figure 3.2, if I've got the page right, of the case notes review overview report from March 2021.

Now, we had some evidence from Professor Stevens and Gaynor Evans and Professor Wilcox about how this worked, but can you explain where you fitted into the process, either by using this figure or, if it's not helpful, just by explaining more, where you fit into the generation of data and the discussions?

**MS DEMPSTER:** Yes, so my role was to look at-- Either Professor Stevens or Mark or Wilcox or Gaynor Evans would say, "We're looking at a period of time, maybe a cluster of infections," then I would look at the information that was provided about that period of time.

So somebody from Health Protection Scotland, I believe, would then provide me – well, it was on a system; we had it all on an electronic system – with information about the ward at that time. So it might be the IMT, the PAG, Infection Prevention and Control audits, cleaning audits, Estates issues. Then I would be looking at that information to provide some feedback upon what was found.

**MR MACKINTOSH:** So the individual documents were grouped chronologically and by place, and you looked at particular ones that seemed relevant?

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** So do you perhaps fit into the data synthesis clinical timeline box within the large blue box on the right-hand side of that figure?

**MS DEMPSTER:** Yes, that would be right, because after we'd looked at the information, we would then-- we would hold a-- there was regular meetings held, weekly meetings, and then I would give that feedback to the group of us that met.

**MR MACKINTOSH:** Would you have produced reports, or would you have filled in elements of their pro forma? Or was that other people who did that?

**MS DEMPSTER:** I honestly can't remember filling in a pro forma.

**MR MACKINTOSH:** Well, why don't we just, to be absolutely sure, just look at the pro forma, which is on page 1109. This is the data synthesis template, and there's a data set. I'll show

you the whole thing and I'll ask you a question. Then there's a summary page, which we're told-- next page, which we're told involves more information from various data sorts. Do you see that the fourth whole row cross is "IMT & PAG minutes"?

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** I just wonder whether you might have entered data into any parts of these forms?

**MS DEMPSTER:** I don't think I did, no.

**MR MACKINTOSH:** Right, okay. We've heard evidence from the three expert panel members that they would meet together to discuss each individual infection and reach a conclusion, and they did this multiple times. Were you involved in those meetings?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** No?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** When you were reviewing the material in order to do the task you've described, would you have had anything other than contemporaneous records from the time to look at?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** So the IMT, PAGs, audits, cleaning----

**MS DEMPSTER:** Sorry, I'm interrupting you. Somebody did pull out any information that was available on the ICNet system as well, so we would look at any comments that would've been made by the Infection Prevention and Control team, who may have done a visit to the ward or----

**MR MACKINTOSH:** Would you have looked at emails?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** Would you have looked at SBARs?

**MS DEMPSTER:** I don't remember an SBAR, no.

**MR MACKINTOSH:** Okay, thank you. Well, what I want to do now is to ask you both a simple question. I'll start with you, Ms Dempster. Conscious that your views and opinions have developed during the productions of these documents – and we'll discuss these changes these evidence – are you prepared to adopt the final version of your reports as setting out your opinions and part of your evidence?

**MS DEMPSTER:** Yes, I am.

**MR MACKINTOSH:** Yes? Same question for you, Dr Mumford.

**DR MUMFORD:** Yes, I am.

**MR MACKINTOSH:** Thank you, and Dr Mumford----

**THE CHAIR:** Mr Mackintosh, if you're leaving the-- Ms Dempster's----

**MR MACKINTOSH:** I am, my Lord, yes.

**THE CHAIR:** -- involvement with the case note review, can I just ask you about the way you formulated the fourth bullet point on the page we've been looking at? You've been asked to look at the third bullet point----

**MR MACKINTOSH:** I think, my Lord, her evidence was that she hadn't----

**THE CHAIR:** Sorry?

**MR MACKINTOSH:** Do you mean on page 107?

**THE CHAIR:** 107 on our copy.

**MR MACKINTOSH:** I was told it was the other page.

**THE CHAIR:** 107 on our copy.

**MR MACKINTOSH:** Yes.

**THE CHAIR:** Yes. There's a reference to "I attended regular meetings." Now, the word "regular" is used fairly loosely. How many meetings, or roughly how many meetings?

**MS DEMPSTER:** They were weekly meetings, so for the duration of the work I had with the----

**THE CHAIR:** Over what period of time? Roughly.

**MS DEMPSTER:** A few months.

**THE CHAIR:** A few months?

**MS DEMPSTER:** Yes.

**THE CHAIR:** So weekly meetings over a period of a few months?

**MS DEMPSTER:** Yes.

**THE CHAIR:** Right, thank you.

**MR MACKINTOSH:** Thank you, my Lord. What I want to do, Dr Mumford, is to ask you about your visits to the hospital that have been arranged by the Inquiry. I wonder how many times you visited the hospital?

**DR MUMFORD:** We visited once.

**MR MACKINTOSH:** When did you make that visit?

**DR MUMFORD:** In March 2023.

**MR MACKINTOSH:** Who from amongst the Inquiry's experts was with you on that visit?

**DR MUMFORD:** Ms Dempster and Jimmy Walker.

**MR MACKINTOSH:** What parts of the hospital did you see?

**DR MUMFORD:** So we did a general kind of tour just to get the layout of the hospitals. We visited a ward which was the cystic fibrosis ward. I can't remember the number.

**MR MACKINTOSH:** On the seventh floor, perhaps?

**DR MUMFORD:** Yes, and we went to 6-- no, 2A/2B, because that was open at that point, and we also looked at other areas within the children's hospital. I think they-- we went to the cinema, for example, and we went to another children's ward, and then we also went up to at least two plant rooms and looked around those.

**MR MACKINTOSH:** Do you recollect whether those plant rooms were

up on the 12th floor of the main tower or part of the children's hospital?

**DR MUMFORD:** So one of them was the new plant room for 2A/2B.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** And the other one, I cannot remember where that one was.

**MR MACKINTOSH:** With whom did you speak on the visit?

**DR MUMFORD:** So we had meetings with several groups of staff. There was a group of infection control and microbiology. There was a corporate group, which was Board members and other corporate roles. There was a meeting with Estates and Facilities, and there was another meeting, which was the clinical team.

**MR MACKINTOSH:** So if we could work through that in reverse order. In the clinical team meeting, do you recollect who was in that meeting? Was, for example, Professor Gibson present?

**DR MUMFORD:** She was.

**MR MACKINTOSH:** Any members of the-- other members of the paediatric haemato-oncology clinical team, as far as you can recollect?

**DR MUMFORD:** There were, and I cannot remember their names, I'm afraid, without checking.

**MR MACKINTOSH:** Were there any non-paediatric clinicians who were present in that meeting?

**DR MUMFORD:** I don't think so.

**MR MACKINTOSH:** When it comes to the Estates team, do you recollect who was in the meeting from Estates? Obviously, we've heard evidence from lots of people and read about their names. Can you help us who was present in that meeting?

**DR MUMFORD:** I haven't got the list that we met with me, but certainly, the director of Estates at the time was there.

**MR MACKINTOSH:** That's Professor Steele?

**DR MUMFORD:** Mm-hmm, and there was somebody who was responsible for water, somebody who was responsible for ventilation, but beyond that, I can't remember.

**MR MACKINTOSH:** When it comes to the corporate team, do you recollect who was in the meeting for the corporate team?

**DR MUMFORD:** There was lots of people in the corporate meeting, so the chief executive was there, Dr Armstrong was there. We had the comms director. We had-- I think Professor Leanord came to that one, as well as the micro and IPT one. There was the operating officer.

**MR MACKINTOSH:** Mr Archibald?

**DR MUMFORD:** I think he was there.

**MR MACKINTOSH:** Yes.

**DR MUMFORD:** So there was a

good-- there was a good spread of the corporate team.

**MR MACKINTOSH:** When it comes to the Infection Prevention and Control team, who was there?

**DR MUMFORD:** Professor Leanord. Dominique Chaput, who gave a presentation to us.

**MR MACKINTOSH:** Are these the presentations we've seen in the bundles?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** And other microbiologists, and I can't remember who they were. The people we didn't meet were Dr Inkster and Dr Peters.

**MR MACKINTOSH:** I'm going to just turn to Ms Dempster. Can you recollect any of the other names of people present other than the ones that Dr Mumford has just described?

**MS DEMPSTER:** I remember Sandra Devine was at the meeting for----

**MR MACKINTOSH:** With the Infection Prevention and Control meeting?

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** Right.

**MS DEMPSTER:** And I can't remember what meeting we were with, but there was the lead nurse for-- the unit was there, wasn't there, and----

**MR MACKINTOSH:** Ms Rogers?

**DR MUMFORD:** In the clinical.

**MS DEMPSTER:** Yes, in the clinical.

**MR MACKINTOSH:** Would that have been Ms Rogers?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. I'll return to Dr Mumford in a moment. Ms Dempster, in the Infection Prevention and Control meeting, was there, in some form, a presentation? Broadly, what information was imparted to you?

**MS DEMPSTER:** What we had gone with was some questions for them as well, some semi-structured questions. I haven't brought them with us and we asked some questions about what had been going on: could they explain what had been happening and where we were at now, kind of thing, where they were at now.

**MR MACKINTOSH:** Right.

**MS DEMPSTER:** And then we did have a long presentation on the water results.

**MR MACKINTOSH:** With Dr Chaput?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right, which is the one we see in the bundle?

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** In the corporate meeting, do you recollect whether there was a presentation or whether there was an attempt to impart

information to you?

**MS DEMPSTER:** It was-- I mean, there was a two-way discussion in the meeting, and I remember, particularly at the end, we-- Sara got up-- Dr Mumford asked for feedback from each of the people at the meeting about anything, sort of learning and how things had gone, and it was very forthcoming, I felt at the time. We were given a lot of----

**MR MACKINTOSH:** Is any particular bits of that feedback relevant to the subject of your report?

**MS DEMPSTER:** No. Well, the-- I think-- Well, there was one thing that we did pick up on when we were there. We had asked about training, about water safety, and that's probably-- the key piece that we asked for a bit more information on about was the cleaning of sinks, and the team at GGC offered an SOP-- they would send us the SOP about how the sinks were now cleaned and about training on-- for staff, other than Estates staff, and knowing about the flushing of water outlets and the practicalities of working.

**MR MACKINTOSH:** Then, when it came to the Estates meeting, do you remember what information was being imparted to you there?

**MS DEMPSTER:** I think it was mainly a summary of the work that had been completed, but there's nothing that actually really sticks out in my mind, if that makes sense.

**MR MACKINTOSH:** Then when it comes to the final meeting with clinicians, do you remember anything from Professor Gibson and her colleagues about their views that seems-- that sticks out to you?

**MS DEMPSTER:** I think it was the discussion about how difficult it had been for this team of the clinicians, the staff working in that area, and obviously the children and the families, how difficult the time had been and the difficulties of moving to a different area and the consequences.

**MR MACKINTOSH:** Dr Mumford, anything you want to add to those observations about what was said in the meetings?

**DR MUMFORD:** I think, from the clinical team, they were very keen to share with us how pleased they were with the new facility and how the infection rates had gone down and that that was quite-- very striking from their point of view. I think, from the corporate team, we asked them for their reflections on the whole-- the events since the move into the hospital, and I think it was clear that it had been a difficult time for everybody involved. There was no-- they didn't say anything controversial or critical.

**MR MACKINTOSH:** Could you

explain, perhaps, for the benefit of the Inquiry – and to be fair, we didn't ask you to do this, but this is prompted by questions from some core participants – why you haven't set out in detail this meeting in your report? Is there a particular reason for that?

**DR MUMFORD:** I don't think that we gleaned any information from the visit apart from what Dr Walker found visiting the plant rooms, which, you know, it's not our area of expertise, how a plant room works, although it was very interesting for us to kind of understand a little bit of it. I don't think any of it was not available to us in any other form, and so we concentrated on the documentary evidence.

**MR MACKINTOSH:** Ms Dempster, is there anything you want to add to that explanation of why a detailed narrative of these meetings isn't in your report?

**MS DEMPSTER:** Well, I don't think the aim of us going-- we never went there with the ambition of writing a report about going there.

**MR MACKINTOSH:** Right.

**MS DEMPSTER:** We went to see the hospital, to see the wards, to see what was going on. I think, sometimes if you're just reading papers and you haven't been to a hospital, a ward, to actually visualise where you are is really important to understand the issues, and I think that really helped.

**MR MACKINTOSH:** Is there any aspect to the visualisations that you might say you'd only have acquired by visiting? Things that strike-- stand out for you that you really only understood because you visited?

**MS DEMPSTER:** I think if I hadn't been before-- You know, it's a big, big, new hospital. It was a big facility, and I think the size of the plant rooms, for somebody who doesn't spend all their life in plant rooms and to understand chlorine dioxide and dosing machines, and probably didn't need to know that, but it gives an understanding of the scale and complexity of the issues.

**MR MACKINTOSH:** Thank you. Dr Mumford, is there anything you'd want to add to that comment about what you gathered by visiting, as opposed to-- and seeing it, as opposed to speaking to people?

**DR MUMFORD:** I think when we were in the ward areas, it was quite striking that there was still a lot of point-of-use filters around. We were-- noticed on the cystic fibrosis ward that they were still using bottled water rather than tap water. We also had the opportunity to try out some of the new sinks and the new taps and to observe the lack of splash and, you know, the difference that that had made. But beyond that, I think it was

just getting an overall view of the facilities actually made it real in our minds.

**MR MACKINTOSH:** Thank you. What I'm proposing to do now is to turn on to your experience, Dr Mumford, in healthcare-associated infections and prevention control and management, and I'll do similar but for Ms Dempster.

Now, we obviously have your background and experience set out in Part 2 of the report, which is on page 100, and we can read that, but a couple of questions arise based on evidence we've had. I'd be grateful if you could provide us with an explanation of what the role is of a DIPC, D-I-P-C in abbreviations?

**DR MUMFORD:** So a DIPC, a director of Infection Prevention and Control, is a statutory role in England and Wales which was brought into being by the Health and Social Care Act initially of 2008 and then revised in 2015. And the Act also contains the Code of Practice for Infection Prevention and Control, also known as the Hygiene Code, and this is that Act, which specified that every registered provider of healthcare in England and Wales has to have a nominated director of Infection Prevention and Control. What it doesn't do is specify what the job role of that person has to be and what the experience of that person has to be.



**MR MACKINTOSH:** Right.

**DR MUMFORD:** So-- but that person, the director of Infection Prevention and Control, is responsible for the strategic and operational provision of infection prevention services for their organisation, for monitoring those services, for monitoring healthcare-associated infections. They have to produce a compliance statement for the Hygiene Code, which has to be available publicly and updated on an annual basis, and they also have to provide their board with an annual report which covers the activity of the Infection Prevention and Control team.

**MR MACKINTOSH:** Where do they sit within the organisation? Are they, for example, a board member or below that?

**DR MUMFORD:** They would usually be a board member, but they can be below that.

**MR MACKINTOSH:** What relationship must they have or do they usually have with the medical director?

**DR MUMFORD:** So not necessarily any relationship, apart from reporting into the Board. So if the director of Infection Prevention and Control was a nurse, then they don't have any line-reporting responsibilities to the medical director.

What the Hygiene Code specifies is that they must have a direct line of report to the chief executive, but they're not

necessarily associated or directly reporting into the medical director. And until I became the medical director, I didn't have a direct line in that role of reporting into the medical director. I reported directly into the chief exec.

**MR MACKINTOSH:** We've had some evidence that in Greater Glasgow and Clyde – and the impression is given this is conventional in Scotland, but I can't say we've had evidence of that – that not only do individual doctors have organisational line reports through the organisation, they also have a professional line report to the medical director. If a DIPC is a doctor, would they have a professional line report to the medical director?

**DR MUMFORD:** Yes, along with every other doctor in the organisation.

**MR MACKINTOSH:** Right, so that's not different?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Does a DIPC have to be a doctor or a nurse?

**DR MUMFORD:** No.

**MR MACKINTOSH:** So they can----

**DR MUMFORD:** Ideally, they would be. I don't know of any that are not, but that doesn't mean that-- it's not laid out in the Act that they have to be a doctor or a nurse.

**MR MACKINTOSH:** Do they have to have a professional background in Infection Prevention and Control?

**DR MUMFORD:** No.

**MR MACKINTOSH:** I recognise that this question can only be the vaguest answer: is it conventional for them to do so in hospital trusts?

**DR MUMFORD:** I think in England and Wales it is more common for them to be an executive member of the Board who doesn't necessarily have any background in infection prevention other than what-- It would usually be a director of nursing or a medical director. Now, other than the level of infection control training that they had gathered during their career, then they wouldn't-- they don't need to have any more training than that.

**MR MACKINTOSH:** You're both the DIPC and the medical director. Is there a particular reason that's come about in your hospital?

**DR MUMFORD:** I've been the DIPC for 17 years. I was brought into the organisation at a difficult time when they'd had a very large C.diff outbreak and a very critical healthcare commission report, and I was brought in because I was working in public health at the time and I was brought in by the then medical director, who I knew from a previous organisation and who I'd worked with previously. And he brought me in as a subject matter expert, probably because

I'm quite bossy, to turn the situation around.

So that was why-- that was how I came to be a DIPC. At the time, I was also able to join the executive team and I was-- started to attend the Trust Board, and both of those things were because of the seriousness of the situation.

**MR MACKINTOSH:** But not because you were necessarily a DIPC? Not simply because you were a DIPC; it was the local circumstances?

**DR MUMFORD:** Oh, no. Well, it was the fact that I was the DIPC that I then joined the----

**MR MACKINTOSH:** Right.

**DR MUMFORD:** -- both the executive and the Board, yes.

**MR MACKINTOSH:** Then you became medical director later in different circumstances?

**DR MUMFORD:** Yes, I climbed up the hierarchy in medical management.

**MR MACKINTOSH:** Now, in your report, you deal with this, I think, on page 116, which is at 3.27, where you report that:

> "Communication between the Infection Prevention and Control team and the DIPC is vital where the DIPC is not a subject matter expert."

What sort of features would a successful communication strategy between a non-subject-matter DIPC and an Infection Prevention and Control team have?

**DR MUMFORD:** So I believe that a non-subject-matter expert, DIPC, has to have a strong subject-matter-expert deputy, who is identified as their deputy. Whether or not that is an infection control nurse or whether it is a doctor, an infection control doctor who would usually be a microbiologist, it probably makes little difference, but they need to have that very strong subject-matter-expert deputy who can then be that channel between the rest of the team and them, and advise them. It's that advice which is really important so that-- because it's the DIPC who is speaking to the Board. They have to be on top of the subject at that point, so they need a very strong relationship between them and their expert deputy.

**MR MACKINTOSH:** I recognise that the Scottish situation is different. We have had a HI infection lead role.

**DR MUMFORD:** Mm.

**MR MACKINTOSH:** The medical director at Glasgow was the HAI infection lead. How should a medical director ensure that they know enough to either, in England, work with their DIPC or, in Scotland, be the head of healthcare infection lead if they're not an infection

control subject expert, the medical director? How can a medical director have the necessary knowledge to that part of their job properly?

**DR MUMFORD:** I think that's recognised widely in England and Wales as an issue. I think, if you hold a role like that, you need to do some professional development on an annual basis related to that role. Quite recently, and I think probably as a result of COVID, there are now DIPC masterclasses, which are being laid on specifically to upskill the DIPCs.

**MR MACKINTOSH:** What about upskilling medical directors? Is that something that needs to be done as well?

**DR MUMFORD:** If the medical director is the DIPC, then yes.

**MR MACKINTOSH:** But if the medical director's not the DIPC, is it more of an issue or less of an issue?

**DR MUMFORD:** I don't think so. It depends who your DIPC is and whether or not they develop skills and whether they have that strong deputy who can transmit knowledge to them.

I think the medical director's role is big, but they don't necessarily-- they're not going to be the person reporting to the Board. They could be the person who challenges the DIPC at Board level, at executive level, and therefore needs some knowledge. But whether they need to have really detailed infection prevention knowledge, over and above what they would have gathered as part of their working lives as a physician, surgeon or whatever their specialty was, I don't think that that is absolutely crucial.

**MR MACKINTOSH:** Okay.

**DR MUMFORD:** It's having the role which is the important thing.

**MR MACKINTOSH:** I'd like to move on to the role of a medical director. Now, how long have you been a medical director?

**DR MUMFORD:** Since January of this year.

**MR MACKINTOSH:** So given that relatively short period of experience, can you explain to me-- Are you also the responsible officer at your Health Board?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** What does that role involve?

**DR MUMFORD:** So that's a role which is also statutory, and that person is responsible for ensuring that the doctors working in your organisation who are connected to you-- and that won't be all of your doctors because some will be trainees who are attached to a deanery-responsible officer rather than----

**MR MACKINTOSH:** Is it perhaps worth explaining what a deanery is at this point?

**DR MUMFORD:** So doctors in training who are in training programmes----

**MR MACKINTOSH:** This is everything up to consultants but not consultants?

**DR MUMFORD:** If they're in a training programme.

**MR MACKINTOSH:** So we would call them registrars?

**DR MUMFORD:** Yes, or foundation doctors or, I think, probably resident doctors is now the catch-all phrase. So the resident doctors who are in training programmes are attached to a deanery, which is an educational organisation. It usually falls to the dean of that organisation to be their responsible officer. That's because you can find a conflict of interest between that training role and the working role.

**MR MACKINTOSH:** So the responsible officer as the medical director would be the responsible officer for all the consultants and all the staff-grade----

**DR MUMFORD:** And everybody who was locally employed, yes.

**MR MACKINTOSH:** What is the responsibility of a medical director as a responsible officer for those doctors?

**DR MUMFORD:** So the responsible officer has to ensure that the doctors who are connected to them are fit to practise, and that is done by an annual appraisal, a multi-source feedback on a five-yearly cycle basis, and knowledge of complaints, incidents and any other intelligence that you gather about that doctor, and then make recommendations as to whether or not they should be revalidated, which happens once every five years.

**MR MACKINTOSH:** Thank you. Now, in respect of issues around the management of Infection Prevention and Control in Scotland, how have you acquired your knowledge about how we do things here, as it were, in Infection Prevention and Control?

**DR MUMFORD:** So, through the papers that the Inquiry has provided to us and through reading documents like the National Infection Control Manual and so on, so publicly available documents which have described----

**MR MACKINTOSH:** I'm going to turn to Ms Dempster now and ask you that question first and then go to some of the other issues. How have you acquired your knowledge of how Infection Prevention and Control matters are managed and dealt with in Scotland?

**MS DEMPSTER:** Probably through the links through the National Infection Control Manual, and then you go on to--you end up clicking on the next link and you find out information in that----

**MR MACKINTOSH:** So it's a

largely web-based system?

**MS DEMPSTER:** Yes, definitely, yes.

**MR MACKINTOSH:** Now----

**MS DEMPSTER:** On the back of that, some of the documents we've been in have described internal structures for GGC, for example.

**MR MACKINTOSH:** So your source is documentary in that respect?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. I wonder if we can just look at your discussion of your professional background, which is at page 104 of the report, and we can obviously read that. What I wanted to understand is you started your career in general medicine and then you became an infection control nurse, I think, in the 1990s.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** What I want to understand is, we've heard quite a lot of evidence in Scotland, in Glasgow, particularly from Mr Walsh, about the things that infection control nurses can't do, ventilation and water being two things that he's discussed. We've also heard quite a lot of discussion about microbiology and unusual infections.

I wonder if you can help us about how one goes as an infection control nurse from being somebody for whom those statements might be true in the early part of a career to the position you ultimately held as lead infection control nurse. What I'm sort of assuming-- you probably would be perfectly happy to talk about water and ventilation and microbiology, to some extent.

**MS DEMPSTER:** In very general terms, but I would never consider myself to be the expert on the level of somebody like Dr Walker or, you know, Dr Bennett. As an Infection Prevention and Control nurse – I'm showing my age, I suppose – you used to come across into the profession, if you like, that skill set, with some general knowledge. You probably would've been a ward manager or a ward sister in those days, so you would've come across with some general managerial responsibility; you've been an experienced nurse.

But I think that began to change, certainly in England. I'm sure a similar sort of thing in Scotland is that, traditionally, now the way in is you come in as a lower-graded nurse and you work your way up, so----

**MR MACKINTOSH:** Within Infection Prevention and Control?

**MS DEMPSTER:** Yes, so you might come across as what we would call a Band 5 nurse, then you would do some competency-based training, and then you would-- you know, once you'd met some skills and development, you might then

go on to become the Band 6 nurse or the Band 7. Organisations like the Infection Prevention Society have some good developmental structured training resources that people can follow to help progress----

**MR MACKINTOSH:** Because there's-- Sorry. Carry on, please.

**MS DEMPSTER:** Well, what I was going to say-- so there is the piece about what you learn academically if you go off and do a diploma or a degree, but there's also a wealth of opportunities in whatever organisation you're in to learn more.

So my background, I'd worked in intensive care, but I had never worked, for example, in a renal dialysis unit, so you would then-- I personally then spent time with that speciality to understand more and more, so perhaps that's the way I learn as well. As I said before, I do like to see things to understand the issues.

**MR MACKINTOSH:** We've had a lot of evidence from senior nurses. I suppose, just to pick three-- four, rather, there would be yourself, Ms Devine, Professor Wallace, Ms Rankin, Dr Imrie. All have had different career structures. They haven't fitted through a sort of-- We've just heard the training system for doctors described relatively concisely.

From the point of view of the Inquiry, is there anything that you would say sets apart the senior-directors-and-above levels of infection control nurses from their less experienced colleagues? Any particular step in their experience or something that we can see what makes you, as it were, different from the people who are leading a team or leading a ward or leading a hospital?

**MS DEMPSTER:** Well, I think, first of all, I did do all of those things.

**MR MACKINTOSH:** Of course.

**MS DEMPSTER:** So you probably have moved your way through, but there's also the broader experience. So my career started in a small district general hospital. I worked in the public health laboratory service, as it was then. I moved to a primary care trust, which covered GP premises, prison health, you know, dentistry. I moved back to an acute trust, covered a mental health trust.

So I think you gain-- That would be a bit different in Scotland because many of those things are in one health board, aren't they, anyway? But it's about how you move around. For me, it is. It's about how you gain further experience and you move on to a different area.

Probably wherever you work, there's some core things you do need to understand and know about, so you need to know how infections would spread, what precautions you're going to take if a patient comes in with infection A, B or C.

If there's an incident or an outbreak, how are you going to deal with it?

So there's some core things that we have, and then some practitioners, Infection Prevention and Control practitioners, might decide to go more into the public health side of infection prevention and the wider health of the community, or they might decide to focus on decontamination, a really complex situation around decontamination and water safety and endoscopy.

There's so many different things, but I think you have to be very wide read. Equally, if you don't know the answer, you have to find somebody who does know the answer. In complex situations, it's probably about looking outside your organisation for help and support if you need that.

**MR MACKINTOSH:** In terms of those looking outside, we've heard a lot of evidence, and I think the impression that it's, in this organisation, been tense at times-- What's the relationship that you would consider ideal between microbiologists, those microbiologists who are infection control doctors, and infection control nurses? How is that relationship supposed to work, from your point of view?

**MS DEMPSTER:** I think no different to any other professional relationship: you have to be able to work professionally with your colleagues. In England, we do have designated infection control doctors, but equally, any microbiologist who's on call, who's working the weekend, who's covering will actually have to be giving Infection Prevention and Control advice if an incident happens when they're covering, if you like, and the infection control doctor's not there.

Now, certainly in England, the many infection control teams now work a seven-day week. They're seven-day working, which helps things as well because, historically, Infection Prevention and Control services were Monday to Friday, and then there was far more out of hours, but we all know there's more out of hours than in hours in any healthcare system.

It is about good communication and respectful working for each other, and the microbiologist will have certain expertise, and perhaps a nurse who's recently been working in a clinical area will understand far more about the practicalities of a Hickman line than the consultant microbiologist who's never probably cared for one. So I think it's about working jointly, and that's really important, to get joint working and communication.

**MR MACKINTOSH:** We've seen various documents – although, to be fair, no witness has agreed with this

statement – which have suggested that-- the documents, at least, have suggested that Infection Prevention and Control in Greater Glasgow is a nurse-led service.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** Now, to be fair, Ms Devine has resiled herself from that, but would you-- how would you comment on this concept of Infection Prevention and Control being a nurse-led service?

**MS DEMPSTER:** I think every organisation probably has a slightly different structure to their Infection Prevention and Control team because there's no set model that-- how many nurses you would have, or how many microbiologists or infection control doctors or how many antimicrobial pharmacists.

So I think people see it as a nurse-led service because, in any team, there's probably far more nurses than any other specialty. So, on a day-to-day basis, working, dealing with the issues, visiting the clinical areas, visiting patients, talking with patients, staff, probably the nurses are doing the bulk of that work. In all my roles, even in the acute trust, I've led the team working with microbiologists or pharmacists or Estates people.

**MR MACKINTOSH:** Thank you. Dr Mumford, anything else you'd like to add on the relationship between microbiologists and infection control nurses?

**DR MUMFORD:** I think the relationship has to be close. So wherever I've worked as a microbiologist, we've had-- the team has been co-located so they're very close at hand, so you don't have to send an email; you can just pop around the corner and there's your infection control team, which is hugely helpful because those informal chats, you know, "Oh, we've got this new-- you know, this interesting case. We've got a meningitis. Could you pop up and go and have a look at it?" The result may well not have come through electronically and landed in the ICNet inbox, but you can talk to people and say, "We've got this."

So it's got to be a very respectful and close working relationship with a lot of trust involved in it as well, so trust that the microbiologists are going to tell the infection control team things, but also that the infection control team are able and competent to go and deal with that, because microbiologists don't go and do the do, by and large. They get involved where there's a tricky problem, where the patient is something unusual, and they need to go and have a look or there's a funny rash or, you know-- and they go and see the patients or they would need to go and do a ward round.

But the nurses-- Obviously, Linda's said that there's usually a sizable team. They go off to the wards and do the do. They're doing the audits. They're doing the checking on people and then coming back and saying, "Actually, could you just go and have a look at this patient? I don't think they're doing very well, and I think they need your input." So there has to be that two-way, close, trusting relationship, and I think it's really important that that is the case.

**MR MACKINTOSH:** Right. What I'm proposing to do now is just look at some of the sources in your report, because obviously your first report precedes a number of other documents, and a couple of documents you haven't mentioned and I want to see whether you've read them. I won't get into the nitty-gritty of what they mean at this stage. I just want to check that you've actually looked at certain documents.

If we can go, please, to page 123 of this bundle. Now, in this section, you have discussed the reports of Mr Walker and Mr Poplett, and Mr Bennett's report on ventilation. I notice, Ms Dempster, that this section doesn't contain reference to Mr Poplett's report on water or Mr Bennett's review of Cryptococcus. Am I right in thinking that?

**MS DEMPSTER:** I don't think we'd had those reports at the time----

**MR MACKINTOSH:** No, indeed.

**MS DEMPSTER:** -- that we'd written it, but we have since.

**MR MACKINTOSH:** You have read them?

**MS DEMPSTER:** Yes, definitely. Sorry.

**MR MACKINTOSH:** Right, well, we'll come back to what they might mean later.

**MS DEMPSTER:** Yes, sorry.

**MR MACKINTOSH:** Then the second body of evidence, which is on page 123 in the middle of the page, lists various sources, and 6.7 is the blood culture results. Dr Mumford, am I right in thinking that's a very, very, very large spreadsheet?

**DR MUMFORD:** It's a very big spreadsheet, yes.

**MR MACKINTOSH:** And this is the one that's been used by Mr Mookerjee?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. We obviously have all the reports by Mr Mookerjee. That's the quantitative report, which you had when you wrote this, his Direction 5 response, his supplementary report, his addendum and his final chart. Have you seen all those, both of you?

**DR MUMFORD:** Yes.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** There was a document that I want to check that you

had seen both of. I think one of them is mentioned in your report. So you mention in a footnote Dr Peters and Ms Harvey-Wood's report, which is at Bundle 19, Document 19, page 143 – if we just put that on the screen – of 10 October. That's the one that you mention in your footnote, Ms Dempster?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Yes. I want to just check, Dr Mumford, if you've seen the presentation, which is at Bundle 27, Volume 6, Document 9, page 107. Dr Mumford, is that something you've been through?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right, thank you. If we go back to your report on page 124, you list the third body of evidence, and obviously most of it is PAG records, IMT records and SBARs, and then you've got various reports. Now, if we could just look from 6.14. So the first bullet point there, you have 31, 32, 33, and these are SBARs. Now, if we go to the next page, please, we then have----

**DR MUMFORD:** I don't----

**MR MACKINTOSH:** -- clinicians on whom GGC has relied upon and external reports. Now, what I wanted to check there is some things that we've covered since then. When did you first see the presentation by Dr Kennedy and Ms Rogers to the IMT, which is Bundle 27, Volume 13, Document 13, page 77? Dr Mumford, do you remember when you first saw this?

**DR MUMFORD:** I don't remember the date, but I think it post-dates the report.

**MR MACKINTOSH:** Were you aware of Professor Evans's three reports of whole genome sequencing? Have you read those?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** You read those, and Professor Leanord's report on----

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** You read that. I think you've already mentioned Dr Chaput's reports. Have you considered those in preparing your report?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Ms Dempster, I wonder if you could help us about whether you've seen the HPS GGC situational awareness assessment from-- it's dated June '19, but it might be older than that. Bundle 7, Document 5, page 194, and this has an Appendix 4 at page 205. I wonder if that has been included in something you read before your report was produced?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. I think you were aware of both copies of the 2019 October HPS report?

**DR MUMFORD:** Yes.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. Now, the other one, finally, before we move to external reports, is I think you provided reference in a footnote to Ian Storrar and Annette Rankin's draft report in respect of the water contamination incident, which is Bundle 19, Document 21 at page 174. Is this a report you've read?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Now, Ms Dempster, NSS wanted to point out that it's a draft report, it's not been finalised. Can you help me about how you used it, what sort of information you gathered from it?

**MS DEMPSTER:** I think it-- Reading through it just generally gave a summary of the background of what was going on in the organisation.

**MR MACKINTOSH:** Did you rely on the opinions expressed by Mr Storrar and Ms Rankin?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** Thank you. We've then got some external reports. You've mentioned the case notes review, the Oversight Board and the Independent Review. I want to just check that the Suzanne Lee report you both refer to is the one I think it is. If we go through Bundle 8, Document 32, page 134, is this the report that you think you read from Suzanne Lee?

**MS DEMPSTER:** Yes.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Thank you. Now, what I want to do now, before we move on to the substance, is slightly surreal, but this obviously is a public inquiry. It's on video, and you've had the opportunity of watching some of the evidence. What I'm keen to do is to find out which witnesses you've watched or, in the case of Ms Dempster, listened to possibly while doing your gardening.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Because it'll help us put their points to you later on. Now, what I have is a list here, and I might just go through it. I'll start with Dr Mumford and then I'll come back to you, Ms Dempster, if that's all right? Did you watch the evidence of Mr Walsh?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Pamela Joannidis?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Annette Rankin?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** David Stewart?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Dr Peters?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Lynn

Pritchard?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Suzanne Lee?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Dr Deighan?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Karen Connolly?

**DR MUMFORD:** I think I did. Yes.

**MR MACKINTOSH:** Professor Dancer?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Dr Crichton?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Sandra Devine?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Dr Armstrong?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Mr Mookerjee?

**DR MUMFORD:** Yes, in part. I didn't get quite to the end of----

**MR MACKINTOSH:** In part. Gaynor Evans?

**DR MUMFORD:** Again, in part, yes.

**MR MACKINTOSH:** In part. Professor Wilcox?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Professor Stevens?

**DR MUMFORD:** I watched a very small part of his.

**MR MACKINTOSH:** Small part.

**DR MUMFORD:** Yes.



**MR MACKINTOSH:** Professor Wallace?

**DR MUMFORD:** I can't remember. I think so.

**MR MACKINTOSH:** Is there anybody else who I haven't mentioned that you might have watched evidence from?

**DR MUMFORD:** I don't think so.

**MR MACKINTOSH:** Did you watch, for example, any of the Estates witnesses?

**DR MUMFORD:** No.

**MR MACKINTOSH:** No. Professor Steele?

**DR MUMFORD:** No.

**MR MACKINTOSH:** Ms Dempster, in terms of listening to people----

**MS DEMPSTER:** I did watch some.

**MR MACKINTOSH:** You did watch some?

**MS DEMPSTER:** I've listened to many, yes.

**MR MACKINTOSH:** Mr Walsh, did you listen/watch?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Pamela Joannidis?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Annette Rankin?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Susan Dodd?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** David Stewart?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Christine Peters?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Lynn Pritchard?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Suzanne Lee?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Dr Deighan?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Karen Connolly?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Professor Dancer?

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** Dr Crichton?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Sandra Devine?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Dr Armstrong?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Mr Mookerjee?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Gaynor Evans?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Professor Wilcox?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Professor Stevens?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Did you listen to Dr Inkster?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Did you listen to Dr Inkster, Dr Mumford?

**DR MUMFORD:** Yes, I did.

**MR MACKINTOSH:** Back to Ms Dempster. Did you listen to any evidence by Dr Walker, Mr Bennett or Mr Poplett?

**MS DEMPSTER:** Yes, all of them.

**MR MACKINTOSH:** Dr Mumford, did you listen to any of those three?

**DR MUMFORD:** I've-- Probably the first hour of Dr Walker, but other than that, no.

**MR MACKINTOSH:** No, all right. That's very helpful. What I want to do now is to turn to chapter 7 of your report, which starts on page 125. Now, the purpose for this is you provided an explanation of what is a relevant infection, but it occurred to me that we've seen in reports a lot of references to groups of microorganisms described sometimes in ways you'd expect, like gram-negative, and sometimes in sort of constructed groups, like environmental bacteria, and there are lists of bacteria.

What I'd like to do is to look at these groups and to understand, for each of them – and there are quite a few – in

each case, three questions: to what extent do they have the potential to be connected to water or ventilation systems?

Secondly, does the group contain microorganisms generally unconnected to the environment, in the way, when you're normally treating patients, you might meet them through breakthrough from guts or on skin and so on and so forth? And to what extent you'd expect an association relationship of causation between this infection-- these infections and contamination of the water system?

So there are three questions. The first is just a potential connection to ventilation. The second one is, does it contain organisms generally unconnected to the environment? And the third, is there any form of feeling that there's an association that often occurs with the environment, including water?

I'll walk through each of them in turn, and what I'm proposing to do, since it feels a little microbiologically, is generally direct this to Dr Mumford and to come back to you, Ms Dempster, on each category, if that's all right. But I will start, Ms Dempster, with a simple question for you, which is, what do you understand by an "unusual microorganism"?

**MS DEMPSTER:** It would be one, for me, personally, that I hadn't heard of before.



**MR MACKINTOSH:** It's as simple as that?

**MS DEMPSTER:** Yes, then I would need to find out about it. So I think we're talking back to before. When you're working daily in Infection Prevention and Control, there's certain organisms, bugs, that you hear of regularly, and you would know what they were, what was the potential for infection, what you needed to do with them. So an unusual one, for me, would probably be when I needed to think, "I don't know what to do with that. What do I need to find out about it?"

**THE CHAIR:** Do you mean that quite literally, that "unusual" is something you haven't encountered before?

**MS DEMPSTER:** Probably, for me, if I'm working in Infection Prevention and Control, and somebody said there's organism whatever and I hadn't heard of it before, for me, personally, that would be unusual, whereas perhaps if I was the microbiologist, I would have seen many of these.

**THE CHAIR:** Mm-hmm.

**MS DEMPSTER:** And I suppose, as your experience develops, you get to find out about more and more organisms as you progress. Some----

**MR MACKINTOSH:** That raises the question----

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** I mean, you

were eventually head of Infection Prevention and Control for NHS England.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Are you saying that the number of what is unusual microorganisms depends on who is asking the question and, therefore, a Band 7 infection control nurse might have a different understanding from you, at the top of your career?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right, so it's a subjective measurement, in your mind?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. Dr Mumford, do you have any view of what is an "unusual microorganism"?

**DR MUMFORD:** So, as a microbiologist, I think an unusual microorganism would be (A) one that a biomedical scientist comes running out of the lab and saying, "Guess what we've got." That would make it an unusual one. Secondly, something that is, as Linda says, unusual in that it's not the everyday.

So there are certain organisms which you-- So, for instance, Neisseria Meningitidis, which causes meningococcal meningitis, that's uncommon, but it's not unusual. Everybody knows about it. Kids have been vaccinated against it. I wouldn't call that unusual.



Something like a Fusobacterium necrophorum, which is an organism which affects young men and forms cavities in the lungs and abscesses in the lungs, that is unusual because you don't get to see very many of them in your career. It is rare, but it's fully recognised as, if you grow it, you absolutely know what's wrong with that patient immediately.

So, for me, an unusual one is one that you see growing, that you-- that comes as a complete surprise, that you don't-- it doesn't attach itself to a recognised syndrome, and it's something that, as a microbiologist, would make you sit up and go, "I'm going to go and see that patient because that's an interesting one."

**MR MACKINTOSH:** Is there anything about the frequency of its occurrence that makes it unusual?

**DR MUMFORD:** Yes, but as I-- You know, I think you can have something that's really uncommon but not unusual, but then you can have something that's uncommon but is still definitely unusual. And I think that that's a tricky-- it's a tricky concept because, for instance, if you had a--

So some of the environmental ones which you might recognise absolutely as being environmental and you recognise it immediately and you know what it is, that

would be unusual in a healthcare setting. So if you had a-- I think it does depend-- Sorry. It does depend on the setting and it depends on the situation.

**MR MACKINTOSH:** So something that would be not unusual in a drain might be unusual in a tap, and would definitely be unusual in a----

**DR MUMFORD:** In a patient.

**MR MACKINTOSH:** -- bloodstream sample?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Does "unusual" have any connotation of "not understood"?

**DR MUMFORD:** It can, I think, particularly with the environmental group of organisms, because some of the very rare ones, there's very little literature on infections related to them. There's very little resource that you can go to to help you with treating the patient, and so some of the environmental ones are much more difficult.

**MR MACKINTOSH:** If an organism is on a national reporting list because the government or agencies decided to monitor it, does that preclude it from being seen as an unusual microorganism?

**DR MUMFORD:** I don't think so because there's a difference between unusual in the UK and unusual in other parts of the world. So if you had a patient who came back from foreign parts with Ebola, that would be unusual, but it's still on a reportable list.

**MR MACKINTOSH:** I suppose there's a risk with this sort of conversation-- is that one forgets that each of these infections are in a patient.

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** The way you've just described a biomedical scientist coming in and saying, "Look what we've got," I suppose, for a lawyer, we have a similar thing. You might find an unusual piece of procedure or unusual piece of law being used and be quite interested in it, and that somehow separates from the patient. It becomes geeky or specialist.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Is there an element of that in it, where you haven't seen-- just literally, you haven't seen one on a plate before and it becomes almost a teaching opportunity in ==

**DR MUMFORD:** Yes, yes.

**MR MACKINTOSH:** Is it possible to write down a list of what's an unusual microorganism?

**DR MUMFORD:** I don't think so because it depends on the circumstance.

**MR MACKINTOSH:** Right. Well, let's look at some of these lists. We'll start with a nice, simple one. If we go to Bundle 7, Document 6, page 214, which

is the draft October 2019 HPS report, and if we go to page 219, we see a list.

Now, we're going to look at all five of these-- all four of these categories in a moment, but I first want to just start with gram-negative bacteria. So, firstly, when we read gram-negative bacteria, you've described that's obviously resulted-- by the staining they demonstrate.

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** To what extent does this group have the potential to be connected to water or a ventilation system?

**DR MUMFORD:** It's too diverse a group to be able to answer that because there will be members of that group which are environmental organisms.

**MR MACKINTOSH:** When it comes to the question, does this group contain microorganisms generally connected to the environment, that's true, but it's not----

**DR MUMFORD:** It's true, but it's not the whole story.

**MR MACKINTOSH:** So it's, therefore-- it's too broad a definition?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** So I don't even need to ask you, would you expect an association of a relationship or causation or association between rates of this group and contamination in a water system? Or, again, is it too diverse?

**DR MUMFORD:** Yes, it is. It's far too diverse to be able to say that.

**MR MACKINTOSH:** Okay. Let's look at the next one, which is gram-positive bacteria. Now, we've seen that defined there on page 219. Apart from the staining issue, to what extent does this category have the potential to be connected to water or ventilation systems?

**DR MUMFORD:** There are certainly gram-positive bacteria which are related to or can be related to the environment and water, and again, the gram-positive bacteria that aren't are much more numerous than the ones that are. So, again, it's too diverse to be able to make a generalised statement.

**MR MACKINTOSH:** In terms of connection to the environment, is there anything that can be said about this group's connection to the environment?

**DR MUMFORD:** I think the same applies, to some extent, but if you look at cross-infection related to environmental contamination – not necessarily from water or ventilation but from, you know, "I've touched you, then I've touched that and then I've touched that, and now I've spread it all around" – gram-positives survive better in that.

**MR MACKINTOSH:** So there's a slight element of being associated with dry surfaces?

**DR MUMFORD:** So, yes, they-- I think you're more likely to see a gram-positive in a cross-infection episode than you are----

**MR MACKINTOSH:** Now, both of these have been included in both HPS sets of reports as categories, and they appear elsewhere quite widely in reports that we've looked at. What are the risks of looking at rates of just gram-negative bacteria in general and trying to draw conclusions?

**DR MUMFORD:** Well, gram-negative bacteria contains organisms such as E. coli, which is the most common gram-negative organism that you will see in patient infections, and outweighs others by many times. So if you just look at gram-negative, you won't see the small nuances that could be caused by an environmental organism.

**MR MACKINTOSH:** Okay. Before we leave these two, Ms Dempster, is there anything you'd like to add about the utility of looking at rates of gram-negative and gram-positive bacteria in the context of is there an environmental connection?

**MS DEMPSTER:** No, I agree with what Sara said.

**MR MACKINTOSH:** So what I want to do, before we look at the next two lists, I want to look-- step away----

**THE CHAIR:** Mr Mackintosh, I'm sure I should know the answer to this, but it occurs to me I don't: you talked about cross-infection from the environment, and this is in the context of gram-positives and association with picking it up from hard surfaces. It occurred to me that I don't understand the expression "cross-infection" in that context, so could you help me with that?

**DR MUMFORD:** So if you take an organism such as MRSA, so Methicillin-resistant Staph Aureus, we have all sorts of mechanisms in place to avoid transmitting it from one patient to another, but via a-- something in the environment, such as a contaminated surface or a piece of equipment which becomes contaminated and then isn't cleaned, that would be an example of how you transfer it from one patient to the other, and we would call that cross-infection.

**THE CHAIR:** Yes. All right, and the surface is, as it were, the vector?

**A** Yes, yes.

**THE CHAIR:** Right. Thank you.

**MR MACKINTOSH:** Now, what I want to do before the coffee break is to look at Mr Mookerjee's list and then come back to these two lists here. So I wonder if we can go to Bundle 21, Volume 1. His report is at page 3, but I want to look at page 25.

So he provided a summary table of the infections that he was looking at. Now, what role did you, Dr Mumford –

and I'll ask Ms Dempster in a moment – have in choosing or creating or designing this list in his report?

**DR MUMFORD:** So this list is based on the positive blood cultures in patients on 2A and 2B, and we only included in the list ones where we had a positive blood culture, so-- And then we went through the list of all of the positive blood cultures and picked out those that are related to the environment.

**MR MACKINTOSH:** So, when you say "those that are related," is that they have a potential to be related or they always are related?

**DR MUMFORD:** I think those that are recognised as being related or can be related. So things like Klebsiella, obviously, that's also in a patient's gut, but we know that it can also be related-- be found in the environment-- --

**MR MACKINTOSH:** So it was more that they could be, rather than they definitively always were related?

**DR MUMFORD:** Yes, because there's that-- in the other reports, there's that what they call the environmental plus enteric group. So this is our, in that kind of language, environmental plus enteric list.

**MR MACKINTOSH:** Right, and things are only on the list if they're in the sample list?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** And you've sought to only include things that either have an obvious connection to the environment or can have an obvious connection to the environment in the literature?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Did you look at the HPS list when constructing this list, or are they-- is this, your creation, a separate process?

**DR MUMFORD:** So we created the list and then I remember that we had a Teams meeting where----

**MR MACKINTOSH:** Is this Mr Mookerjee and Ms Dempster together?

**DR MUMFORD:** Yes, and I can't remember if Jimmy was on the call as well or not, but then we had a spreadsheet with our list – the list that we thought it was – and other lists, and we went through and where there were discrepancies in other lists having something that we didn't have, then we would ask ourselves, "Did we need to have that organism?" just so that we were confident that we had included everything that we needed to include.

**MR MACKINTOSH:** So does your and Mr Mookerjee and Ms Dempster's list, this list here-- is this longer than the list used by HPS or similar?

**DR MUMFORD:** Similar, but I think,

to my recollection, each of the other lists have additional ones that didn't appear in the blood culture list and, therefore, we didn't include them.

**MR MACKINTOSH:** Right, because that's ultimately the final check.

**DR MUMFORD:** Mm-hmm, yes.

**MR MACKINTOSH:** It has to be in the blood culture list in the spreadsheet. Right. Why is Aspergillus not on this list? Because there's lots of Aspergillus discussed in PAGs and IMTs and there-- presumably there were infections?

**DR MUMFORD:** But not in blood cultures.

**MR MACKINTOSH:** Not in blood cultures? Right. Why is it that Mycobacterium chelonae is not on this list?

**DR MUMFORD:** Because it's gram-positive and not gram-negative.

**MR MACKINTOSH:** Is that the only reason?

**DR MUMFORD:** Yes, I think so, because we only had-- Yes, it is the only reason.

**MR MACKINTOSH:** Why not include a gram-positive as well into the data set? Is there any particular reason?

**DR MUMFORD:** Because if you start including gram-positives, then there's more than just one----

**MR MACKINTOSH:** You'd have to include more?

**DR MUMFORD:** -- that we would have to look at.

**MR MACKINTOSH:** Any particular reason not to do that?

**DR MUMFORD:** Because I think the emphasis was very much on gram-negative, and that was the lead that we followed.

**MR MACKINTOSH:** Is there a particular reason, based on the literature or the practice of microbiology, that you took that approach?

**DR MUMFORD:** No.

**MR MACKINTOSH:** Why is Cryptococcus neoformans and the other Cryptococcus not on this list? Because if we go on to the next page, we see that fungi are on the list.

**DR MUMFORD:** Yes, so my recollection is that we didn't have a Cryptococcus. We did have-- We had in-- we had Cryptococcus cases, but I don't think we had a blood culture with a Cryptococcus.

**MR MACKINTOSH:** Because we know that there was a Cryptococcus case in Ward 6A.

**DR MUMFORD:** But there was no blood culture, as far as I can remember, but I could stand corrected on that one.

**MR MACKINTOSH:** When it comes to Mycobacterium chelonae, was there any issue about the way that these infections were described in the data set?

**DR MUMFORD:** Well, we later found out that, yes, there was, and there was-- So there had been a total of three patients with four infections with Mycobacterium Chelonae, and the second of those three patients, their Mycobacterium Chelonae was not described as Mycobacterium Chelonae on the database.

**MR MACKINTOSH:** Right, and we've had some evidence from Dr Inkster about why that might be. It's not something I was aware of until I was asked these questions, but why is Fusarium not on this list?

**DR MUMFORD:** Because it's gram-positive.

**MR MACKINTOSH:** Why is Mucor not on the list?

**DR MUMFORD:** Because there were no positive blood cultures.

**MR MACKINTOSH:** Right, but you're very much limited to what----

**DR MUMFORD:** That's true for Fusarium as well

**MR MACKINTOSH:** Right. NHS GGC have asked me to ask this question: they're concerned that the Candida infections are included and point out that the majority of these yeast infections would be from commensal flora and not from the environment. Firstly, do you agree with that, and secondly, why were they included?



**DR MUMFORD:** I think the potential for them to be commensal is reasonably high. They were included because we knew that Candida had been identified from showerheads when showerheads were tested, and so that's why they were included.

**MR MACKINTOSH:** Is there a risk that, by including the yeast, you're confusing matters and wouldn't it be safer just to stick at the gram-negative environmental bacteria?

**DR MUMFORD:** To some extent, but I think the numbers were sufficiently low that, actually, it makes little difference in the overall data, and we think they were included in the comparator hospital's data as well.

**MR MACKINTOSH:** I mean, what I'm wondering is, if you're going to include Candida, why not include Aspergillus, Fusarium, Mucor, and you've given the answer that they weren't in the sample.

**DR MUMFORD:** Because they weren't--

**MR MACKINTOSH:** Right, okay. How, in Mr Mookerjee's methodology, which you've had some input into, was the risk that enteric organisms were included, managed, in his methodology and, therefore, that you were counting infections that had an enteric route within the data set? How was that dealt with by

the methodology that he developed with your help?

**DR MUMFORD:** I don't think I can remember why-- that they were managed any differently ---

**MR MACKINTOSH:** I suppose the question is that you've got a number of these-- You mentioned Klebsiella yourself.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** You mentioned organisms that can be in the patient's gut----

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** -- and we've heard evidence that, in circumstances, there can be a breakthrough into the patient. I suppose it's possible as a hypothesis that some of those Klebsiella infections were enteric and some of them were environmental. How would you be able to tell-- how would his methodology be able to tell the difference?

**DR MUMFORD:** You can't through the methodology that Sid used. You could only do it with clinical input and you would need the clinical input from the clinicians caring for the patients in order to be able to distinguish between the two. But interestingly, in all of the INTs, it was hardly mentioned anywhere that a particular patient was thought to be a translocation rather than related to the environment.

**MR MACKINTOSH:** This idea of having the help of clinicians, is that similar or different to the approach taken in the case notes review?

**DR MUMFORD:** Well, they did, of course, have full access to the case notes, which we didn't have, so they could make some judgement in those cases.

**MR MACKINTOSH:** Right. Ms Dempster, is there anything you'd like to add about the methodology of Sid's report or the construction of the list before we have our coffee break?

**MS DEMPSTER:** No, I think it's just, to go back on what Sara just said about the case note review-- was able to look at individual patients, individual children, individual blood cultures, whereas we never set out to do that----

**MR MACKINTOSH:** No, we didn't ask you to do that.

**MS DEMPSTER:** Yes, no.

**MR MACKINTOSH:** My Lord, this might be an appropriate place to have our morning coffee break.

**THE CHAIR:** We'll take our coffee break, and can I ask you to be back for five to twelve?

**(<u>Short break</u>)**

**THE CHAIR:** Mr Mackintosh.

**MR MACKINTOSH:** Thank you, my

Lord. Dr Mumford, I wonder if we can just return to Mr Mookerjee's list, as it were, and just ask-- explore the decision not to include gram-positives – or any gram-positives – in this list.

So I think you said before the break that had a decision been made to include Mycobacterium chelonae, that would've prompted the question of whether you considered including other gram-positives. What would the other gram-positives have been, in broad terms?

**DR MUMFORD:** Well, off the top of my head, there's one called Chryseobacterium, which I think is gram-positive. There's some cocci. I think there's a Rhodococcus, but, you know, these are unusual organisms and I haven't got them on my tip of my tongue, I'm afraid.

**MR MACKINTOSH:** I'm just wondering whether the question of whether to include these or not is actually made simpler by the fact that you only include the ones that were found. Might it not have been more sensible – and, of course, the Inquiry didn't challenge you on this when you produced the report – to, rather than construct the list from, as it were, first principles, simply to adopt the case notes review list of organisms and study that? Is there any particular reason why you didn't do that?

**DR MUMFORD:** Well, to some extent, we did, but we excluded those ones where we didn't have a positive on 2A/2B.

**MR MACKINTOSH:** But you did have a positive, or at least two positives, on 2A, 2B, 4B, 6A of Mycobacterium chelonae.

**DR MUMFORD:** But they weren't on-- There was one which was on the list and then there was one which wasn't obviously on the list, and the third case was a skin-only, so there wasn't a blood culture related to that either.

**MR MACKINTOSH:** Right, and so that's basically your reason you didn't include it?

**DR MUMFORD:** I don't think it was as clear as that. I mean, it could have come down just to an error, to be honest.

**MR MACKINTOSH:** Because what were you trying to do in constructing this list?

**DR MUMFORD:** We were constructing a list which Mr Mookerjee could use to make comparisons with the other-- with the comparator hospitals.

**MR MACKINTOSH:** So in order to be a successful list, what sort of attributes did it have to have?

**DR MUMFORD:** So it needs to be comprehensive for where we were. I mean, I can see that there's an argument for just throwing everything into it, but I suspect that could be a little bit

unmanageable.

**MR MACKINTOSH:** So there's a practicality aspect here as well?

**DR MUMFORD:** Mm.

**MR MACKINTOSH:** All right. What I want to do is go back to Bundle 7 and page 214 again, which is the list of infection-- You were there already: 214, please, and then page 219. Yes. I think, Dr Mumford, you've already briefly touched on, looking at these two lists, the environmental bacteria group and the environmental including enteric group. If we look at the environmental bacteria group, to what extent does this category have the potential to be connected to the water and/or ventilation systems?

**DR MUMFORD:** So they are all-- the environmental list are all known to be found in the environment and to flourish in that environment, so related to water, soil, etc.

**MR MACKINTOSH:** To what extent would you expect or be surprised if you found an association or relationship of causation between these bacteria and contamination to the water system?

**DR MUMFORD:** I think some of them are more unusual than others, but certainly, they are all organisms which have been seen in water contamination.

**MR MACKINTOSH:** Right. If we then look at the final group, the environmental including enteric, which adds in Citrobacter, Enterobacter, Klebsiella, Pantoea and Serratia, again, if you look at the whole group of the two-- last two combined, to what extent does that group have the potential to be connected to water and ventilation systems?

**DR MUMFORD:** Again, they do. Enterobacter, you would expect to find-- and, to some extent, large extent, Klebsiella as well, you'd expect to find in drains rather than in water supply, preferentially, but all of them could contaminate a water system.

**MR MACKINTOSH:** Is there any issues around whether they are associated with infections derived from water systems?

**DR MUMFORD:** What do you mean by "issues"?

**MR MACKINTOSH:** Well, for example, you've mentioned that Klebsiella can be seen also through gut translocation.

**DR MUMFORD:** Mm.

**MR MACKINTOSH:** Do the same sort of multiple causes, as it were, apply to the others?

**DR MUMFORD:** So four out of the five of them – so the Citrobacter, the Enterobacter, Klebsiella and Serratia – are not uncommon in clinical infections. So Citrobacter and Serratia are less common in bloodstream infections –

you'd find them more in urinary tract infections – but Enterobacter and Klebsiella, I think you would commonly find them in blood cultures.

**MR MACKINTOSH:** I think we probably should come to it later when we get to the data, but I just wondered, if a hospital with paediatric oncology patients had a problem with gut translocation infections, would you expect that to have a particular pattern that was in any way different from the pattern of infections around a water system-related infection?

**DR MUMFORD:** I think you would see more of a preponderance of E. coli. Enterobacter, Klebsiella, maybe Proteus, would be the commoner organisms which you might see in---

**MR MACKINTOSH:** So these would be mixed in with some other things?

**DR MUMFORD:** Potentially.

**MR MACKINTOSH:** Right, and therefore you would look for the presence or absence of those other things to help determine whether there was a gut translocation problem?

**DR MUMFORD:** That would be difficult to-- The fact that you might find E. coli blood culture and bloodstream infections would not automatically say that's a translocation. It would say this patient has an E. coli infection for whatever reason. It could be based in a urinary tract infection, which would be the commonest source of it, so one doesn't necessarily lead to the other.

**MR MACKINTOSH:** No, I suppose what I'm trying to get at is that if there's a pattern here that one looks for, if you had to describe the sort of mix of microorganisms you would see in a ward where gut translocation infections were happening at a higher rate than you would want, what would you see in terms of the sort of mix of microorganisms that were growing in number in that ward?

**DR MUMFORD:** You would see Enterobacter, E. Coli, some Klebsiella, possibly some Proteus, but that would be much less common. Possibly some Pseudomonas.

**MR MACKINTOSH:** Can you imagine a scenario where a unit had a higher-than-hoped-for level of gut translocation infections where you were only seeing the Klebsiella and Enterobacter; you weren't seeing the E. coli?

**DR MUMFORD:** I think it's possible, but E. coli is the-- makes up more of the gut microbiome than any other organism.

**MR MACKINTOSH:** Thank you. What I want to do, looking again at the sorts of infections, before I do that, I want to just turn to Ms Dempster. Is there anything you want to add about this

environmental bacteria or environmental including enteric group, compared to Dr Mumford?

**MS DEMPSTER:** No, I don't think so, and I think the bit about gut translocation would be, importantly, made by the clinician caring for that child.

**MR MACKINTOSH:** They would notice, in a sense?

**MS DEMPSTER:** Yes, they would be looking and know what was going on. It wouldn't just be, "We've got a blood culture positive for this." They would-- their clinical assessment would be key in making that diagnosis.

**MR MACKINTOSH:** Because is it possible that, in our analysis of these events, we have been listening to infection control doctors and nurses and experts and data scientists, and perhaps the voice of the clinicians and what they're seeing has got a bit quieter?

**MS DEMPSTER:** Yes. I think that is really important, and when we-- The bit with me, when we're talking about data-- each one of these is a child with a bloodstream infection, as you said earlier on, and they would've been looked at very closely by their clinicians caring for them, the consultant with responsibility for their care, at a time when they would've been very sick.

So I think a lot of decision-- We could perhaps-- We're looking a bit more



black and white than looking at the whole child and the whole clinical scenario that the clinician would've been faced with, and we didn't have that kind of information to make decisions----

**MR MACKINTOSH:** But if the clinicians were forming the view that a number of these infections had a gut translocation or transfer between-- gut translocation as a cause, would you have expected to see that information percolating into the IMT and PAG minutes?

**MS DEMPSTER:** Definitely, yes. I was going to say-- and they were very well represented at those PAG meetings, yes.

**MR MACKINTOSH:** Thank you. What I want to do is go to a little bit earlier this bundle, which is the earlier HPS report, Appendix 4 of the-- It's dated June 2019 draft, and this is on page 210. No, it's not. If we can pop back to the previous page. No, sorry, 209. 208? 207? 205? Yes, it was 205. Sorry, my mistake.

So we have a list here that this earlier report has looked at. What I want to do first, I think, probably, Dr Mumford, is do you see that, at the bottom of this page, Staphylococcus has popped into the list? It's not a category that's examined by the later reports. Is there anything about Staphylococcus that

would, from your point of view, encourage you to include it in such analysis or discourage you from including it in such analysis?

**DR MUMFORD:** I think if you were looking for a water or an environmental cause, you wouldn't include it. If you were looking at central line-associated bloodstream infections, you absolutely would, and it might be helpful to pull it out separately.

**MR MACKINTOSH:** Right. If we look at the environmental group that they have constructed here, it seems to be a-- How would you compare this to the Mookerjee list?

**DR MUMFORD:** I think the ones that are on this page are very-- it's very similar.

**MR MACKINTOSH:** Over the page. No, there's only the first-- the list on the top of the page.

**DR MUMFORD:** Yes, and some of-- Yes, those we didn't include.

**MR MACKINTOSH:** If you go to 205, please. I mean, is this a shorter list than the Mukherjee list, or----

**DR MUMFORD:** It is shorter.

**MR MACKINTOSH:** It is shorter, right. Again, to what extent does this group, as a group, have the potential to be connected to the water and/or the ventilation systems?

**DR MUMFORD:** Oh, absolutely, yes, they would be.

**MR MACKINTOSH:** Right, and to what extent does this group contain microorganisms that are generally unconnected to the environment?

**DR MUMFORD:** None of them are completely unconnected.

**MR MACKINTOSH:** Right, and to what extent would you expect there to be an association of relationship of causation between rates of this group of infections and contamination of the water system?

**DR MUMFORD:** There is potentially association with that, yes.

**MR MACKINTOSH:** Right. Now, if we go back to the next page, where they then looked at a non-environmental bacteria group-- but would you agree with that description, Dr Mumford, of that being a non-environmental bacteria group? Or would you want to comment on that?

**DR MUMFORD:** Well, apart from the Mycobacterium – because obviously some of the non-tuberculous Mycobacteria are associated with the environment – and Raoultella, I think, and Roseomonas we've found associated, but the rest of them, yes, I would accept that they're not.

**MR MACKINTOSH:** Right, and then fungi appears to be a direct-- similar read across to your yeast list.

**DR MUMFORD:** Mm.

**MR MACKINTOSH:** I'll have to note that as a "yes" for the transcript because----

**DR MUMFORD:** Sorry, yes.

**MR MACKINTOSH:** Yes. Right. When you look at the fungi list-- I think I want to deal with this now because it's not going to come up again. If we look in this report and go to page 210, there's a little bit of mention-- It's the next page, sorry. No, go back one page. I'm going to have to find my notes because I think I've got a label wrong.

**DR MUMFORD:** I think it was on the next page. It's at the bottom--second paragraph from the bottom.

**MR MACKINTOSH:** Yes, it is. Sorry, it is. It's that final paragraph. So this particular work by HPS appears to reach the conclusion that comparison of the overall incidence of fungal positive blood cultures before and after the move did not change after the move in either group. That's, in its case, 2A, 2B and the rest of the whole children's hospital?

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** What I wondered, whether-- to what extent you would consider this fungal group has an expected association with the environment, and in a sense whether you were right to include it in Mr Mookerjee's work.



**DR MUMFORD:** I think it's difficult. Clearly, Candida was found in the environment. Rhodotorula was found in samples taken from chilled beam, but they wouldn't be at the top of my list of environmental organisms. Far from it.

**MR MACKINTOSH:** No.

**DR MUMFORD:** You wouldn't-- Certainly Candida, you would----

**THE CHAIR:** Dr Mumford, could I----

**DR MUMFORD:** Sorry.

**THE CHAIR:** Just for my benefit-- I mean, it's difficult. You're being asked to look at the screen. Therefore, you're looking in the wrong direction, but----

**DR MUMFORD:** I think----

**THE CHAIR:** I'd appreciate it if you would keep your voice up.

**DR MUMFORD:** I'm sorry, yes.

**THE CHAIR:** Thank you.

**DR MUMFORD:** I think Candida in particular is an organism which-- It's very common. It's very common, and it's possibly less associated with the environment than the others.

**MR MACKINTOSH:** Right. What I want to do is look at Dr Kennedy's list, so this-- He produced two reports in 2018 and one in 2019, and this is in Bundle 6, page 121. The reason is this is the list that he attached as an appendix to his 2018 report.

I'm going to ask both of you the same set of questions here, which is-- If you recollect, I asked this question of Dr Inkster and a handful of other witnesses. I'll start with Ms Dempster. What on this list – I'll ask two questions – would you consider to be an unusual microorganism? Remember, someone's got to take a note.

**MS DEMPSTER:** And I can't spell them out without looking. Could I do it the other way and say which----

**MR MACKINTOSH:** Which aren't unusual? That would be perfectly acceptable.

**MS DEMPSTER:** Obviously Stenotrophomonas is something----

**MR MACKINTOSH:** So that's not unusual?

**MS DEMPSTER:** No. Well, I'm not saying it's okay to have it everywhere, but it's something that people would've heard of. Serratia, people would know about. Maybe not fontilola (sic). I can't even say the word, but Serratia and its genus, people would've-- I would've known about, as I would Pseudomonas. And Morganella Morganii I would know. Klebsiella, Enterobacter and Acinetobacters at genus level.

It's very hard now because, having read so much information with all of these names in, they appear more familiar to me than they probably would've done at the beginning of all this.

**MR MACKINTOSH:** Thank you. I'll turn to Dr Mumford.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Dr Mumford, I've got two questions for you. One is, which one of these would you consider to be an unusual bacteria? The other one is, do any of these have a background rate? You might remember that question asked of Dr Inkster.

Can we start at the top, and for each one tell us whether you consider it to be an unusual bacteria and whether you consider it to have a background rate? If you remember, there was a discussion in 2019 seemingly about whether infections were at a background rate. So, for the first one, I'm going have to ask you to pronounce the first one because I can't do it. Is that an unusual microorganism?

**DR MUMFORD:** Achromobacter xylosoxidans----

**MR MACKINTOSH:** So is that an unusual microorganism?

**DR MUMFORD:** -- is unusual.

**MR MACKINTOSH:** Does it have a background rate?

**DR MUMFORD:** No.

**MR MACKINTOSH:** No. Why do you say it doesn't have a background rate, just in general terms? Because if a question's coming up, we should have your logic.

**DR MUMFORD:** Because, you know, in all my experience as a microbiologist, it's-- that's one of the ones that-- you wouldn't see it. You would see it once, twice, three times in a career. You wouldn't-- If it's not causing an infection, you would not see it.

**MR MACKINTOSH:** Okay, so Acinetobacter lwofii----

**DR MUMFORD:** Lwofii.

**MR MACKINTOSH:** Lwofii, is that an usual infection?

**DR MUMFORD:** It is, but it's not as unusual as the Achromobacter.

**MR MACKINTOSH:** Does it have a background rate?

**DR MUMFORD:** I would say not.

**MR MACKINTOSH:** Why do you say that?

**DR MUMFORD:** Because although you see it from time to time, it it's very, very sporadic and you wouldn't-- it would still be unusual.

**MR MACKINTOSH:** The next Acinetobacter, ursingii.

**DR MUMFORD:** Ursingii.

**MR MACKINTOSH:** Ursingii, sorry. Is that an unusual bacteria?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Does it have a background rate?

**DR MUMFORD:** No.

**MR MACKINTOSH:** In fact, do any of these-- No, I've leave that. We'll go along. If you could tell everyone just a simple yes/no, whether they are unusual and don't have a background rate, and then we'll go into the detail. So the next one, Brevundimonas, is that unusual? Does it have a background rate?

**DR MUMFORD:** It's unusual and it doesn't have a background rate.

**MR MACKINTOSH:** Burkholderia?

**DR MUMFORD:** Burkholderia is less unusual but doesn't have a background rate.

**MR MACKINTOSH:** How can it not have a background rate if it's less unusual?

**DR MUMFORD:** Because, you know, if you're seeing one or two a year, does that count as a background rate? That's the question.

**MR MACKINTOSH:** What sort of problems does that throw up?

**DR MUMFORD:** I think you would-- it would depend on your patient population as to whether or not you would see it at all. It would be unusual. You would always look for an environmental source. I think you-- If it had a background rate that was measurable and consistent-- but it doesn't.

**MR MACKINTOSH:** Right. Cedecea lapagei?

**DR MUMFORD:** That's very unusual, and I know that because I've-- until I read this document, I'd never heard

of it. I had to look it up.

**MR MACKINTOSH:** Right, and no background rate?

**DR MUMFORD:** No background rate. Chryseobacterium indologenes, unusual. Yes, it's unusual, and no, it doesn't have a background rate.

**MR MACKINTOSH:** The next one?

**DR MUMFORD:** And I assume, when we're talking about background rates, that we're talking about in humans?

**MR MACKINTOSH:** Yes. I mean, what I'm thinking about the context here is that we had evidence that during the September and October period in 2019, there was a view expressed I think by Professor Leanord, amongst others – maybe Professor Jones, I can't recollect – that infection rates in the Ward 6A had reached a background rate.

Now, to be fair to them, they weren't doing it at species level, but Dr Inkster, I think, wanted to make the point that there weren't background rates for these infections, and I think it's important that we find out if you disagree or disagree with her.

It seems easier just to walk through it rather than replaying evidence. So, in that context, does Comamonas testosteroni-- I think you're going to have to pronounce them. Is that unusual and does it have a background rate?

**DR MUMFORD:** It is unusual and it doesn't have a background rate.

**MR MACKINTOSH:** Do you want to just walk through them?

**DR MUMFORD:** Shall I tell you which ones are not unusual?

**MR MACKINTOSH:** Yes, that might be quicker.

**DR MUMFORD:** It might be helpful. So Enterobacter cloacae is not unusual and does have a background rate. Klebsiella pneumoniae, not unusual, does have a background rate. Morganella morganii, again, has a background rate, but it is less common, but it is recognised and you would expect to see it.

Now these-- the three Pseudomonases are unusual species of pseudomonas, so although we say Pseudomonas aeruginosa, common, yes, has background rate, these three species-- four species, sorry, are uncommon and wouldn't have a background rate. Serratia, again, as Linda said, Serratia as a genus, you would see it. It's not uncommon, and it does have a background rate, but fonticola as a species: unusual and doesn't have a background rate.

**MR MACKINTOSH:** So within the class, it's unusual?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** But you could have a background race for both the Serratia and, indeed, going back,

Pseudomonas?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** That's something you could say----

**DR MUMFORD:** At the genus level----

**MR MACKINTOSH:** -- at the genus level----

**DR MUMFORD:** -- but not at the species level.

**MR MACKINTOSH:** -- but not the species level. All right.

**DR MUMFORD:** And Stenotrophomonas maltophilia, not unusual and does have a background rate.

**MR MACKINTOSH:** Thank you. Now, if we look at this whole list-- Now, I'm conscious we've had evidence this list was written by Dr Inkster in the early part of 2018 and then used for Dr Kennedy from then on. To what extent does this list have the potential to be connected to the water or environmental or ventilation systems as a whole?

**DR MUMFORD:** As a whole, they are all organisms which can be associated with the environment.

**MR MACKINTOSH:** Then does it contain organisms that are generally unconnected to the environment?

**DR MUMFORD:** It has organisms in it which can cross from-- or are seen in both human sources and environmental sources, such as the Entrobacter, the Klebsiella, Morganella, as we've discussed, but it----

**MR MACKINTOSH:** Those would be gut translocation cases and----

**DR MUMFORD:** Well, not----

**MR MACKINTOSH:** Or not necessarily?

**DR MUMFORD:** Not necessarily, because they are contaminants of the environment as well because they're gut organisms. So you can have urinary tract infections, you can have line infections with them if you have poor hygiene or the staff aren't washing their hands or poor practice or whatever. So it's not as clear-cut as saying if they're not environmental then they're gut translocation.

**MR MACKINTOSH:** Okay, and to what extent would you expect an association or relationship of causation between this group and contamination in the water system?

**DR MUMFORD:** Association, yes.

**MR MACKINTOSH:** It's something you might expect?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Now, finally, I want to turn to CLABSI as a category. There's been lots of discussion – you can take this off the screen – but there hasn't ever been a list of which organisms are included in CLABSI rates. We've seen lots of charts of CLABSI rates. Various

people have made points in meetings or in evidence about how CLABSI rates were addressed and changed over time. What do you understand these discussions of CLABSI rates to be measuring? Maybe if I start with Ms Dempster.

**MS DEMPSTER:** It's a central line-associated bloodstream infection, so if there's a person, a child – well, it could be adults as well, they would look at, as well as children – who's got a central line in, so a line that's going right into a big vein in their body, and then when they've got a bloodstream infection-- so a blood culture's been taken, the patient's got a bloodstream infection, that's then thought to be related to the line.

**MR MACKINTOSH:** Is it actually as simple as you have a bloodstream infection and you have a line, therefore you have a CLABSI infection? Is it really that simple?

**MS DEMPSTER:** No, and that's, again, where it goes back to-- A bit like the other scenario: you have to look at the patient and assess the patient. It might be. I might have a blood culture taken. I've actually got a-- I have got a central line in, but I've got a rip-roaring wound infection, an infected hip or something else, so there's an actual identified source of the infection that's not thought to be line related.



**MR MACKINTOSH:** Is there a definition? There's a definition which we have. Sorry, I'm just trying-- a few moments confusing myself. If you just allow me for a moment just to find the right definition. If we go to Bundle 7. Go to page 218. Do we have the CLABSI definition here? Are you familiar with that definition, Ms Dempster?

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** Yes, so I read that is-- as you said, it has to be a bloodstream infection. They have to have a central line, there has to be a not another cause.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** You're nodding again. For the sake of the transcript----

**MS DEMPSTER:** Yes, sorry. Yes, yes.

**MR MACKINTOSH:** From your point of perspective, is the rate of CLABSI infections measuring particular types of species, or is it measuring this definition?

**MS DEMPSTER:** It's measuring this definition. This definition doesn't give a list of set organisms that they're going to measure. It will be the assessment of the blood culture and the patient to see whether that's line related.

**MR MACKINTOSH:** Dr Mumford, firstly, anything you want to add to that?

But secondly, does that have any consequences for the use that one can make of CLABSI rates to understand what's going on in terms of infections in a unit?

**DR MUMFORD:** I mean, I agree with Linda, absolutely, about the clinical aspect to this, and it has to be-- to label a patient as having a CLABSI, you have to have the full clinical picture. It's not just good enough to have a positive bloodstream infection or a positive blood culture.

If you have a group of patients who-- in a unit where you do not have any issues with the environmental infection risk, then what you see is-- CLABSIs tend to be much more due to Staphylococci and other gram-positives rather than the gram-negatives. The gram-negatives would be less common in the group of CLABSI infections.

**MR MACKINTOSH:** Why is that?

**DR MUMFORD:** I think it's-- if we go back to our friend, the biofilm-- because you can get biofilm developing in central lines in the catheter, and the gram-positive, (A) they're skin organisms, so they're right next to the opening in the central line, so if they're going to in there, that's where they will come from.

So that's a much more-- So just by the position of the central line, you have a higher risk of a gram-positive than a gram-negative infection. So, based on the sighting of them, you do have that-- that, I think, is why you have preponderance of gram-positive infections.

**MR MACKINTOSH:** So there's some connection between the gram-positive group and the CLABSI list?

**DR MUMFORD:** Yes, because you don't-- It depends if the infection is primarily in the line or primarily something else. Because you can see, if you have a translocation of organisms from the gut, it can go and settle inside the cannula, the central line, because it's a foreign body, and therefore it will attract organisms to settle on it because that's unfortunately what organisms do if you have a bacteraemia.

So it depends on your primary source, but if your primary source is in the central line, they will tend to be more gram-positive than gram-negative, but if the source is a translocation or a similar event or a urinary tract infection, then it can still colonise and infect the central line.

**MR MACKINTOSH:** So the type of species within your CLABSI data can tell you something about what the primary source is?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. I wonder if we can look at-- Within the

same Volume 7, this time we're looking at the earlier HPS report, Appendix 4. It's Figure 4, at page 211, which we had some evidence about. If we could zoom into the top half of the page. Now, this was discussed by Dr Imrie. Is this a presentation, Dr Mumford, that you've come across before this report?

**DR MUMFORD:** I've seen it before, yes.

**MR MACKINTOSH:** But have you come across this style of presenting data before?

**DR MUMFORD:** I've not commonly come across it, but I've come across it.

**MR MACKINTOSH:** Right. Now, what I wondered is what do you think is the story that we should take from this figure, which has passage of time from 2013 to late 2018 with the opening of the hospital at that line two-thirds-- a third of the way along?

**DR MUMFORD:** So I think it shows you that, in the old hospital, you had a small number of environmental-- infections with environmental organisms, but that that's increased when you-- when they moved to the RHC.

**MR MACKINTOSH:** Is there anything about the nature of the population of these bloodstream infections that is interesting?

**DR MUMFORD:** So there is a move to an increased number of the more unusual infections.

**MR MACKINTOSH:** So we can look down that list and remember what you said about what was unusual, and so the only things that are not unusual in there are the Cupriavidus, the Enterobacter, the Klebsiella----

**DR MUMFORD:** No, the Cupriavidus is unusual.

**MR MACKINTOSH:** It is unusual. Right, sorry. So the Enterobacter, the Klebsiella, the Pseudomonas and the Serratia?

**DR MUMFORD:** Yes, but, again you're looking at genus level rather than species level----

**MR MACKINTOSH:** Of course.

**DR MUMFORD:** -- so you may have unusual species within those.

**MR MACKINTOSH:** Within those. Ms Dempster, is there anything you want to add to that about looking at this figure and seeing what you see?

**MS DEMPSTER:** I don't think so.

**MR MACKINTOSH:** No? Okay. I wonder if we can look at a similar-- well, a very different presentation, but it's got colour and it has different species. This is a later report. It's page 233. It's the October report in draft, which we discussed, I think, with Dr Kennedy, amongst others.

Again, Dr Mumford, is there anything that you-- There seem to be

three years: Yorkhill, 2A/2B and then 6A/4B. What do you draw as conclusions or information from this Figure 9 by looking at the mix of species it records?

**DR MUMFORD:** So you can, again, see that the mix of organisms and the increased variation in the environmental organisms is very much seen in the 2A/2B----

**MR MACKINTOSH:** That's the middle column.

**DR MUMFORD:** Middle column, yes, and then, at 6A/4B, you are seeing more of the organisms that perhaps you might think of as having a background rate, but there are also some more unusual organisms creeping into that list as well.

**MR MACKINTOSH:** Those are the ones at the top of the of the table that aren't labelled?

**DR MUMFORD:** Yes, so there's an Achromobacter, there's a Chryseobacterium, there's an Elizabethkingia, for example.

**MR MACKINTOSH:** Those are things without background rates?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Now, what I'm proposing to do now is to move away from looking at the different sources of data and the different species and things to some of the other reports in your Chapter 8.

I want to discuss – if you can take that off the screen, please – and go back to your main report in Bundle 21, Volume 1, which is on page 129. Now, from paragraph 8.9 to 8.13, you seem-- beyond that, you seem to derive considerable information from Dr Walker's conclusions. Have I got that right, Dr Mumford?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Do you disagree?

**MS DEMPSTER:** No, same here.

**MR MACKINTOSH:** How do you respond – each of you separately, perhaps – to the suggestion that your conclusions are undermined or unsupported because of your heavy reliance on the opinions of Dr Walker and particularly what I think NHSGGC would describe as him setting a rather impossible standard for water contamination that might, therefore, render unreliable large parts of his conclusions? Dr Mumford, how would you respond to that, as a user of Dr Walker's report?

**DR MUMFORD:** I think Dr Walker is a renowned expert in the area of water and water systems. Part of our instruction from the Inquiry was to take into account, when we wrote our report, the other experts' reports because we're clearly not water experts to the same

extent that Dr Walker is. So that's what we did, but I think, in doing that, I don't feel that it undermines our report in any way because we took expert evidence and used it, as we did with all the other evidence that we reviewed and considered and put together within our report.

**MR MACKINTOSH:** Well, before I come back to Ms Dempster, it follows-- the follow-on question is, what additional evidence did you use and rely on about water and water contamination, water systems, that you had for you when you wrote your report, beyond Dr Walker?

**DR MUMFORD:** Well, we obviously had Dr Chaput's evidence, and we had the snippets of information that were in the IMT reports and in the other reports that we've read.

**MR MACKINTOSH:** Did you read the DMA Canyon reports of Mr Watson, the auditing engineers reports of Mr Kelly?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Is there anything you want to add to that, Ms Dempster?

**MS DEMPSTER:** No, I agree. Yes.

**MR MACKINTOSH:** What I want to do is turn to you, Ms Dempster, and ask you about water contamination, and I'll come back to Dr Mumford. You discuss this in a number of different places in your report and-- in the executive summary but perhaps most importantly here, when you're discussing Dr Walker's conclusion.

You have a rapportage that:

> "[His] report demonstrates the failing of the system, its maintenance and how the entire water supply to the hospital outlets became contaminated."

There are various documents that you've referred to in your footnotes, which we can go to if necessary. But you also say, if we jump quickly to page 149, at the top of the page, that:

> "Water testing results, as analysed by NHSGGC and HPS/HFS, demonstrate that the water system was significantly contaminated with multiple organisms throughout the site over a number of years."

Now, I don't think NHSGGC accept that, and I suppose that prompts the question of, what do you-- what's your sources for this? One of your sources is Dr Chaput's work, I understand that, and is the other source Mr Storrar and Ms Rankin's work?

**MS DEMPSTER:** Yes, we looked at the discussion in there, but, importantly, I think it was what we had seen also-- there was expert reports, but we had seen reports through IMTs, the Water Safety Group, that there was evidence of

microorganisms in the water and a potential connection to the children and their bloodstream infections.

**MR MACKINTOSH:** So that would have included the water technical meetings from March/April 2018?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** The wrap-up for the IMT and the water incident in May 2018?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Well, what standard did you apply to the concept of a water system being contaminated? What do you mean when you say that?

**MS DEMPSTER:** I'm not going to be able to quote the certain levels of what was available in each blood-- not blood sample, each water sample, but we were talking primarily about bacteria that was found.

**MR MACKINTOSH:** Yes, so I suppose, before I come back to Dr Mumford, is there a standard out there that was in existence at the time, in '15, '16, '17, against which you could measure NHSGGC? Or are you reaching or understanding in a different way?

**MS DEMPSTER:** Yes, I can't-- I don't know what the standard was. I couldn't tell you.

**MR MACKINTOSH:** Right, well, I'll turn to Dr Mumford.

**MS DEMPSTER:** Yes, no.

**MR MACKINTOSH:** Dr Mumford, when it comes to this statement that it's contaminated, are you reaching that because of the particular standards that GGC had to meet-- a failure to meet which requires it to be contaminated, or for some other reasoning process to get to the idea it's contaminated?

**DR MUMFORD:** So standards only exist for Legionella and Pseudomonas. There are no standards for other organisms, so I think, in judging whether or not something was significantly contaminated, it's knowing that there was a large extent of biofilm, knowing that there was a large number of different organisms isolated from different areas within the-- and different outlets and different parts of the water system over a long period of time, and then relating that back to environmental organisms being seen in children and other patients.

Because we know that water isn't sterile and we know that it doesn't need to be sterile, but what we do want is for the water to not pose a risk to patients. And if we start seeing infections with organisms that are similar to those which are in the water and-- then that becomes an issue.

**MR MACKINTOSH:** Would you agree with the statement that contamination is the presence of microorganisms in the water supply of

what is deemed acceptable by current guidance at the time of sampling? Do you agree with that definition?

**DR MUMFORD:** Well, that, again, only relates to the organisms covered by the current guidance, doesn't it?

**MR MACKINTOSH:** If we imagine-- take you back in time and give you the job of being the lead ICD at Greater Glasgow and Clyde. So imagine that you were in a room-- Remember Dr Inkster complaining that people hadn't told her of the DMA Canyon reports?

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** Well, I think she gave evidence that, in 2016, she was asking questions, and I think she pointed us to a minute of the Water Safety Group which describes some of the questions she was asking.

Imagine you were there in her stead and you asked enough questions to get some answers, and you got answers, and someone from Estates said, "Well, Dr Mumford, what does it mean to be contaminated?" What would you have told them then is the definition of a contaminated water system?

**DR MUMFORD:** I think I would have said that it is water which contains-- Because you have to be relatively vague about these things. Water that contains multiple bacteria to an extent that patients are at risk of infection.

I think the risk of infection was quite well recognised by everybody, but if you had to look at just an overall catch-all, I would say if you're consistently-- if you're seeing total viable counts, for example, of greater than 500 per 100 ml, then that would be a significant level of bacteria that you wouldn't necessarily want to see in a ward which is housing severely neutropenic patients. So that's just one kind of marker, but, as an example, as an overall statement, it would be that the water contains bacteria at levels which represent a risk to patients.

**MR MACKINTOSH:** How would you respond if someone then said, "But, Dr Mumford, there's no standard at the moment published by the Scottish Government" or "There's no standard in L8"? How would you respond to that?

**DR MUMFORD:** So then I think you have to go back to the data and you look at-- and you have to make it up as you go along, which we do quite a lot in infection control, in this kind of situation. So you look at all of your data, you look at where your infections are and you come to an understanding of what level do you feel is acceptable, and then you make an internal standard. That's the standard that you want to get to, and that's, in these areas, "This is too high." Because we know there isn't a standard because, you know, these things don't happen

every day and we-- so there is no reason to have one.

**MR MACKINTOSH:** But if it is a case of, as you say, making it up as you go along, isn't that imposing a hindsight-based standard on Greater Glasgow and Clyde in 2016?

**DR MUMFORD:** Possibly, to some extent, but the fact that the water is contaminated is in document after document after document. You know, all of the-- not just the IMTs, but the water review group says----

**MR MACKINTOSH:** But that's not until 2018.

**DR MUMFORD:** But they state in many places, in all of these reports, "The water is contaminated."

**MR MACKINTOSH:** If we go back to 2016. So, in 2016, we have the Legionella L8 report from 2015----

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** -- and we have some doubt about whether it's being implemented.

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** We have Dr Inkster asking questions in the Water Safety Group, and there's no Water Safety Group for the hospital, and I don't think that-- There's some doubt about whether there is an appointed authorised person. There's no Authorised Engineer, and you say, at that point, 500 total viable accounts, or whatever you just described.

How do you respond to the suggestion that you're setting up too high a standard for NHSGGC Estates people to meet at that point? It's just not fair; it's benefit of hindsight. How could they possibly know?

**DR MUMFORD:** So, it-- I mean, it's very easy for me to say with the benefit of hindsight because-- but you have to put the safety of the patient first. You have to consider that you are seeing unusual infections in patients with organisms which are environmental. When you have contamination in the-- Okay. You have organisms which are unusual, isolated from your water. You have to put the patient first.

You can't just say, "Well, there isn't a standard, so there's nothing we can do about it." You have to say, "But these patients are being put at risk. What we need to do is mitigate that risk." The way that we can mitigate the risk is by reducing the number of bacteria in the water. "So, Estates team, how are we going to do that?" Because they're your experts on the ground if you're not a water expert yourself.

You know, this is-- You know, "We need to get below where we are now, so let's set ourselves a target and head for that." And then we look again: "Have we made a difference to those patients?

Have we reduced the infection level?"

**MR MACKINTOSH:** Thank you. I'll turn to Ms Dempster.

**MS DEMPSTER:** Yes. Can I just say, and on the back of that as well, if what we read through-- the evidence we were given was that GGC did think the water was contaminated because the actions they took – point-of-use filters, then looked at dosing the system, looked at chlorine-- There was lots of interventions put in place.

**MR MACKINTOSH:** But that's in 2018.

**MS DEMPSTER:** But starting on the testing-- Yes, I see what you mean. Yes, I'm talking 2018. Yes.

**MR MACKINTOSH:** So what I'm wondering is, conscious that your earlier evidence that, of course, a lot of the people doing the do in infection control are infection control nurses-- We've heard a sort of microbiologist perspective on this.

I think, at this point, Pamela Joannidis might have been at Water Safety Group meetings. If you'd been in Water Safety Group meetings in 2016, what would you have been saying to the Estates people about how they should-- the standard to which they should run their water system in that hospital, given that there is no published standard beyond Legionella and Pseudomonas?



**MS DEMPSTER:** I would have then, as probably Sara alluded to-- we would defer to probably our Authorised Engineer. We would also get another water expert in.

**MR MACKINTOSH:** But there wasn't an Authorised Engineer.

**MS DEMPSTER:** No, but they-- I would have asked the water expert who-- Within an organisation, you've got your internal person who is responsible. Then you-- I've always worked with an external water expert as well, whether it be for the water in the ward or if you've got, I don't know, probably the commonest time would be when you're looking at endoscopy and you've got a problem with the levels of microorganisms in water there. So I've always-- we've always had water experts.

**MR MACKINTOSH:** And that independent person is the authorising engineer?

**MS DEMPSTER:** Yes, yes. Because you're-- Well, there's usually-- In my personal experience, there's always been somebody internal with those expertise as well.

**MR MACKINTOSH:** I suppose this is a relevant point before I go on to more questions about this-- is to pick up the way the Water Safety Group was running not in 2018 but in 2016.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** So we heard evidence of Mr Walsh and there was evidence, which you didn't hear, from Mr Gallagher, Mr Parry, Mr Purdon, I think Mr Brattey at one point, about the Water Safety Group, and we've got its minutes. What role should Infection Prevention and Control play in a Water Safety Group?

**MS DEMPSTER:** Well, I think they're there as-- I don't want to say the advocate for the patient-- They're there about patient safety because an engineering view might not appreciate the risks that the patients are at, so I would be there looking at the practicalities.

If they're talking about, I don't know, you know, turning up the heat and putting really hot water through the system, we'd be looking at the practicalities of that-- of the impact on the patient. But if we had concerns, if I had concerns, I would be escalating that up to my, in England, maybe my DIPC, or whoever the exec was to say that we've got concerns about this.

**MR MACKINTOSH:** Do you see any relevance to the questions that I asked of Mr Walsh about him not attending Water Safety Groups and arranging with Ms Kane to take the chair permanently? Is the requirement to have the infection control manager or a senior infection control person there important to the balance of the system?

**MS DEMPSTER:** Somebody needs to be there with the expertise in IPC. That might not be the nurse. It might be-- Classically, it's been microbiologists who I've worked with who are very interested in water, whether it's hydrotherapy pools or, as I said, decontamination. So there would be somebody there. It wouldn't necessarily need to be the nurse.

**MR MACKINTOSH:** Right. Now, I've got a question for both of you, so I'll start with you, Ms Dempster. If we look at your Direction 5 response, which is Bundle 21, Volume 6, Document 4, page 124. At question 11, you were asked a question about the surveillance established in May 2016 of the water system based on what was known at the time and the guidance in Appendix 13 of the NIPCM. You have provided a response that you think that:

> "... a proactive surveillance of environmental organisms may have acted as an early warning system and allowed correlation of different organisms which [would] have remained otherwise unconnected."

Now, can you provide an example of a health board or an NHS trust that has done something like this, what you're suggesting here on question 11?

**MS DEMPSTER:** I think all trusts,

well, certainly where I've worked, we would be collecting data broader than just a set of alert organisms. We would be looking at infections. If you're thinking of a neonatal intensive care unit, you wouldn't just be counting a tiny number. You would look at the whole of infections.

**MR MACKINTOSH:** So you think this standard that you've suggested is something that would be widely applied in England?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. Dr Mumford, do you have a view on that?

**DR MUMFORD:** Yes, I would agree. I mean, it's one thing to count things, it's another to actually look at what you're counting and use that data to make inferences about what might be happening. And I think that's what we try to do, so that we can join the dots and make sure that, if there are several of a certain infection, that we can actually join them up and say, "Actually, do we have a problem here?"

It's the same way that, you know, when we have a-- Say we had an MRSA bacteraemia. You don't just say, "Well, we've got an MRSA bacteraemia." You go back and look and see which other patients around do we know have MRSA colonisation, and you use the data that you have in order to be able to inform whether or not you've got an infection-- a cross-infection problem.

**MR MACKINTOSH:** But I think the concern that's been put by the Health Board is that you've set a standard here that is----

**DR MUMFORD:** I don't think it's an unusual ask.

**MR MACKINTOSH:** You don't think it's an unusual ask?

**DR MUMFORD:** No.

**MR MACKINTOSH:** No.

**DR MUMFORD:** No, I would take that to be the minimum standard. If you could do above and beyond, then you would.

**MR MACKINTOSH:** If you to question 16 on this document, so if we jump on to page 127, this is about water testing rates. I think you're saying something you've already discussed. Dr Mumford certainly has:

> "The level of testing during 2015/16 following handover would have been based on the local risk assessments of the water system to ensure compliance with the ... guidance at the time."

You listed what those are, and:

> "As a minimum, water should have been tested for total viable counts and Legionella. Outlets tested would be laid out in the water safety plan for the building. Routine

Pseudomonas testing was not recommended in Scotland at this time."

Now, what I want to do is-- you've seen a lot of Dr Chaput's reports, so although you're not Dr Walker, you know how much water testing was going on in '15/'16. To what extent was the amount of water testing that you saw in the Chaput data from '15/'16 comparable to-- how does it compare to the water testing rates you'd have expected to see in an English hospital in '15?

**DR MUMFORD:** I'm not sure we had rates of testing. We had rates of-- we had numbers of tests done, didn't we?

**MR MACKINTOSH:** Numbers of testing,

**DR MUMFORD:** I think, although some of those numbers looked big, you have to take into account that QEUH and RHC are very big with many, many outlets, potentially three outlets per room, which you see in an all single-roomed hospital.

And what we didn't see, I think, was the absolute risk-based testing. So when-- Some of the data showed that there was maybe two or three water samples taken on the whole of the Schiehallion unit, for example, which isn't going to necessarily be representative of what's going on.

**MR MACKINTOSH:** Might it have been represented in the old-style sort of Nightingale ward?

**DR MUMFORD:** Yes, because if you just take one patient's room, when you have the six-bedded bays or so on, then you take one and it's the environment that affects six patients, but in a single-roomed environment, you take one sample and it affects one room, so it doesn't give you a fully representative picture of actually what is going on.

And they had quite a number of high-risk areas that we might call augmented care areas – so the Schiehallion unit, the renal unit, the ITU, the PICU, the HDU, theatres and so on – where you might-- where you would want to do the testing. And I didn't feel that the numbers of tests that were done were representative of the large number of augmented care and risk units that they had in the hospitals.

**MR MACKINTOSH:** Ms Dempster, do you have anything to add to that or-- from your perspective? Thinking about hospitals you were in in England in 2015.

**MS DEMPSTER:** I've been into quite a few. There is this bit about it is dependent on the risk that you're facing as well. So I think if you think of-- It has been also upped. You would up your water testing if you did----

**MR MACKINTOSH:** When you say "the risk," are you thinking of the DMA

Canyon report as a sort of indicator?

**MS DEMPSTER:** Well, that wasn't-- Certainly, if we'd have seen that, probably, as an Infection Prevention and Control team, there would have been some kind of incident meeting, I'm sure, about decisions around water.

**MR MACKINTOSH:** So do you feel there should have been an IPC reaction to the DMA Canyon report?

**MS DEMPSTER:** I would have thought a broader reaction to that 2015 report for an occupation of the site.

**MR MACKINTOSH:** So we know what didn't happen, but what do you think, before lunch, should have happened when the 2015 DMA Canyon report was handed over by Mr Watson's colleague in 2015, in terms of IPC?

**MS DEMPSTER:** I would have expected there to be a meet – whatever you like to call it; our language might be different – but an incident management-- an extraordinary meeting to actually look at the report with not just Infection Prevention but obviously Estates colleagues and water experts----

**MR MACKINTOSH:** But that sort of requires them to draw it to IPC's attention.

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** Anything you would you like to add to that, Dr Mumford?



**DR MUMFORD:** No, I don't think so. I think, you know, that communication of the-- of that report is the thing that was missing, as we all know.

**MR MACKINTOSH:** All right. My Lord, this might be a good time to break for lunch.

**THE CHAIR:** We'll take an hour for lunch, and if I could ask you to be back for two o'clock. Thank you.

**MS DEMPSTER:** Okay, thank you.

**(<u>Adjourned for a short time</u>)**

**THE CHAIR:** Good afternoon, Ms Dempster, and good afternoon, Dr Mumford. Mr Mackintosh.

**MR MACKINTOSH:** Thank you, my Lord. What I want to do is return to water, and I think probably what I'll do is I'll direct these two questions to Dr Mumford and then see if Ms Dempster has any comments.

So, Dr Mumford, to what extent do you think there needs to be an exceedance of a standard or guidance threshold before it's possible to decide whether a water system in a hospital is contaminated or whether that contamination is widespread or systemic?

**DR MUMFORD:** I think if there were really comprehensive standards, then that would be a reasonable thing to

say, but because there aren't comprehensive standards, only for Pseudomonas and Legionella, that makes it really difficult to make that as a broad statement.

**MR MACKINTOSH:** In a circumstance where, as there were in 2015, no national standards beyond Pseudomonas and Legionella, how should a hospital trust or a health board notice that there is a risk of its water system becoming contaminated or has actually become contaminated?

**DR MUMFORD:** So I think that's about having good reporting systems and good governance systems, and ensuring that the water safety plan is in place and is followed, and that reporting to the Water Safety Group and beyond is as it should be, with the right membership of that Water Safety Group to include people who will be able to identify risk and whether that's actual risk related to the water itself or risk that is becoming evident within the patient population, and ensuring that there is appropriate escalation processes in place.

**MR MACKINTOSH:** If there were appropriate escalation processes in place, would one see the evidence of those within the minutes of the Water Safety Group?

**DR MUMFORD:** I would hope so.

**MR MACKINTOSH:** Right. Ms Dempster, do you have anything you want to add to either of those two answers from Dr Mumford?

**MS DEMPSTER:** I just think it's not just about the testing, is it? You alluded to the water safety plan, but the compliance with, like, the L8 legislation is there, isn't it?

**MR MACKINTOSH:** So what would you----

**MS DEMPSTER:** -- safe water system regarding L8.

**MR MACKINTOSH:** What would you expect to see in minutes of a Water Safety Group if a hospital has carried out an L8 risk assessment?

**MS DEMPSTER:** I'd expect to see that as-- I don't mean a standing agenda, but that would be sort of crucial to your water safety-- is your compliance with L8 and then any actions that you need to take or may take.

**MR MACKINTOSH:** What I want to do now is to move on to ventilation, because am I right in thinking that you relied on reports of Mr Bennett and Mr Poplett? I'll direct the question initially to Ms Dempster.

**MS DEMPSTER:** Correct, yes.

**MR MACKINTOSH:** What I want to ask you is a series of questions that-- imagine that each of you were standing in the shoes of your equivalent number, so that you, Ms Dempster, were the lead

ICN of the Health Board or the lead ICN in a part of the hospital at the time, and you, Dr Mumford, were the lead ICD or a sector ICD at the time.

So the first scenario – and I'll start with Ms Dempster – is, in 2015, it became clear that isolation rooms in both the adult and children's BMT wards were not fitted out as some IPC clinicians and treating clinicians expected them to be. We heard – you've seen the material – how the adult BMT service returned to the Beatson, but the paediatric one proceeds with bone marrow transplant happening.

Do you have any issues, Ms Dempster, as if you were standing in the shoes – what they knew then, so without the benefit of hindsight – with the decisions that were made by infection control nurses at any level in that summer of 2015, when those two decisions were made?

**MS DEMPSTER:** The decision to proceed with----

**MR MACKINTOSH:** Proceed in the children's and to return at the Beatson.

**MS DEMPSTER:** No, I don't have any problems with that because I'm-- again, would have assumed – you can never assume – that somebody would have made those-- if you're thinking of a child needing a bone marrow transplant, for example, that their clinical decision would have been made in the best interests of that child and the risks that they faced by probably not having the bone marrow transplant.

And I'm sure that the clinicians would have been involved. When I say "the clinicians," I mean the child's, you know, haematology oncologist. They would have been involved in that process. They wouldn't-- If the risks were known, they would have been discussed and a decision made.

**MR MACKINTOSH:** I think there's an email. Sandra Devine visits. She notices there's no HEPA filters. She reports this back. So if we make the assumption that the infection control nurses, both in the children's hospital and for the whole Health Board, realised there weren't HEPA filters, there were holes in walls, there weren't sealed ceiling lights, they seem to have been concerned. Were they right to be concerned?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Dr Mumford, if you've put yourself in the shoes of either Dr Peters in respect of 2A or Dr Inkster in respect of 4B or Professor Williams as a lead ICT, what should have been the correct steps to take once it became clear in 2015 that these two specialist facilities were not specified as clinicians expected, ignoring for a moment any contractual issues?

**DR MUMFORD:** So, I mean, the first thing to look at, really, is the patient risk, and you would want to do a full, multidisciplinary team approach to doing a full risk assessment for those patients and a risk-benefit analysis of whether they should stay where they are or move, or, in the case of a child, whether the transplant should be done in Glasgow or somewhere else. And that would have to involve, as I said, the multidisciplinary team – so microbiologists, the infection control team, the clinicians on the ground, the Estates – to talk about what the possible mitigation could be in the short term and what the possible mitigation would be in the long term.

And once you had made those decisions about the patients, you would then go on and look at the Estates issues and how you would-- what was, again, the art of the possible in how far can you mitigate the issues that you have, whether that was lack of HEPA filtration or unsealed ceilings or, you know, lack of positive air pressure, to get the best possible outcome going forwards and what that work would look like.

And that would be-- it wouldn't be like half an hour sitting down around a table. That would be something that would take several weeks, if not a few months, to get in the granular detail that you would need it to be able to inform



those future decisions.

**MR MACKINTOSH:** To what extent would you accept that that's quite a high standard in terms of detail for a hospital reacting just after it's opened? It's a busy time. Is it reasonable to expect such a big and detailed exercise to be carried out?

**DR MUMFORD:** Well, the risk assessment for the patients, absolutely, because the patients come first and you have to make sure that they're safe, so absolutely, you should do that risk assessment and the benefit-risk analysis to decide the placement of the patients and how you proceed.

From the Estates point of view, and what work is possible in the short term and longer term, it strikes me that not having attention to some of those details is what got-- the situation arose in the first place. So absolutely, it shouldn't have been the case, but having the position of where they were, they had to get it right to follow it up.

**MR MACKINTOSH:** If we go back to the question I asked Ms Dempster-- is that, if we think about the decision to go ahead with bone marrow transplants that summer, is that decision-- I mean, obviously, you're looking at it from a distance of time, but knowing what they knew at the time, do you have a difficulty with that decision?

**DR MUMFORD:** I don't, because there is-- although I haven't seen the risk assessment itself, we've seen documentation saying a risk assessment was done and those conversations, that multidisciplinary team conversation, went ahead. If that's the decision that's been taken in the best interest of the child, then I don't have a problem with that.

**MR MACKINTOSH:** What about the decision to return the adult service to the Beatson, do you have any issue with that as a decision?

**DR MUMFORD:** Well, again, it's a risk-benefit discussion, isn't it? And, you know, we weren't there. It's very hard to put yourself into that conversation, but I would imagine that, if the facility wasn't what it should have been and actually presented a greater risk to the patient than moving back presented, despite the lack of an ITU facility, then absolutely, moving back is the right thing to do.

**MR MACKINTOSH:** You'll have heard there was some evidence from Dr Inkster about-- I think it was November/December 2015, when she was asked to sign off a return of Ward 4B from the Beatson and she didn't do so, and it didn't actually return for a couple of years.

Knowing what you know – and I appreciate you've only heard her evidence, Professor Williams, Sandra Devine, Dr Armstrong, you may not have heard everybody – do you have any difficulty with her approach to risk at that point?

**DR MUMFORD:** I think she was put in a really difficult position because she wasn't given the information that would enable her to be confident about making that decision and taking the responsibility on behalf of the Board for making that decision. And I think it's a lot to ask of an infection control doctor to make that kind of decision.

**MR MACKINTOSH:** Because, at that point, she had a couple of sessions of ICD.

**DR MUMFORD:** Yes, when you're not provided with all the information-- I mean, for me, the position of the ICD is to advise somebody higher up, an executive, of, "This is the evidence. I've analysed it. This is my report on it. These are my recommendations. Would you like to make a decision?" It shouldn't be a decision that is made at ICD level.

**MR MACKINTOSH:** Right. I want to move on to another group of decisions that are happening in '15. They're not even decisions; they're more sort of commentary. We've heard repeated evidence, and we've read computer communication, that there's no guidance for the specification of a bone marrow treatment award for its ventilation system

in SHTM 03-01.

I do respect the fact that you're not ventilation experts and so I'm asking you to come this from the perspective of an infection control nurse and an infection control doctor rather than a specialist ventilation expert.

I wonder if we can look at SHTM 03-01, Table 1, which is in Bundle 16, Document 5, page 483. The reason I've shown this-- I've shown this to a number of witnesses, and I absolutely appreciate there's lots of technical material in here, but there is a phrase which I'd like to get your perspective on from your two professional backgrounds, and that is "neutropenic patient ward."

So starting, I suppose, with Ms Dempster, what would you understand to be, from your perspective of an infection control nurse of some experience, to be a neutropenic patient ward?

**MS DEMPSTER:** A ward where patients are nursed to a neutropenic.

**MR MACKINTOSH:** Would they have to always be neutropenic?

**MS DEMPSTER:** No, I should have probably caveated that, because there will be groups of patients who we would know the risk: the haematology oncology patient group, transplant groups. Whilst nearly all of those are going to be immunocompromised or neutropenic for most of their stay, you might be



neutropenic and end up in a different part of the hospital because of a different clinician, for example, so it's not going to be----

**MR MACKINTOSH:** So you might be neutropenic and end up in ITU?

**MS DEMPSTER:** Yes, yes. Or I might-- I don't know, I might fall over and break my leg and I need to be in-- Probably not a very good example. You know, you need to be in a different part of the hospital for their specialty, but there will be cohorts of patients who would meet the criteria, if you like, of being a neutropenic patient in a patient ward.

**MR MACKINTOSH:** Now, I'll just ask Dr Mumford the same question and I'll come back to you. Dr Mumford, what would you understand to be a neutropenic patient ward from the perspective of an ICD?

**DR MUMFORD:** I would expect it to be a ward where the majority of the patients were neutropenic for the majority of the time.

**MS DEMPSTER:** Mm.

**MR MACKINTOSH:** Right. Ms Dempster, I want to ask you-- I've got three questions for each of you and I'll start-- perhaps I'll alternate and see what happens. Knowing what you know, Ms Dempster, about the mix of patients in the Schiehallion unit through all the work you've been involved in, what is your

view about whether the whole of 2A, not just its isolation rooms, would, to your understanding, be a neutropenic ward?

**MS DEMPSTER:** Yes, I believe it would be.

**MR MACKINTOSH:** Why is that?

**MS DEMPSTER:** Well, the children and young people on that ward would probably come out of their rooms as well and mix in different areas, go up to the-- There was a room we saw on there where the teenagers would go, so there were other areas apart from your room.

**MR MACKINTOSH:** Can you think of a reason why Ward 2A would not be a neutropenic patient ward?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** Dr Mumford, do you have anything to comment on that particular question?

**DR MUMFORD:** No, I agree.

**MR MACKINTOSH:** Dr Mumford, knowing what you know about the nature of the adult bone marrow treatment patient cohort, the ones who returned to the Beatson and, therefore, in Ward 4B, what's your view about whether Ward 4B as a whole, and not just its isolation rooms, would be a neutropenic ward?

**DR MUMFORD:** I think the same thing applies. A neutropenic ward is a ward. It's not just patient rooms, and it includes the other areas because, inevitably, patients will come out of their rooms, whether that's to go into a clinical room or to have a procedure on the ward or whatever, but----

**MR MACKINTOSH:** Or just even to walk up and down the corridor?

**DR MUMFORD:** Yes, or just walking down the corridor. I mean, they will-- It should all be treated as one unit.

**MR MACKINTOSH:** I wonder if we can look at the document, Dr Mumford. Well, first, I'll ask Ms Dempster, do you have anything you want to add to that question about 4B?

**MS DEMPSTER:** No, nothing to add.

**MR MACKINTOSH:** We'll look at the document at Bundle 27, Volume 7, Document 19, page 375, which is an email from Dr Hart, Dr Inkster, on 6 December 2018 about Ward 4C. 27, Volume 7, Document 19, page 375. (After a pause) Yes, and so if we would go on to the next page, we would see the question that Dr Hart has asked, and so Dr Inkster asks on 5 December:

> "Hi Alastair,
>
> When we decanted the paediatric haem-onc ward, we took the opportunity to review the ventilation as there were some concerns. A number of issues have been identified which have implications for other wards on the site, one of which is 4C.
>
> I have been asked a question

from Estates highlighted in the email below. I need to give this some thought. Can I check, first of all, if you have patients with the following risk factors in Ward 4C?"

The first one is, "Recent history of neutropenia," and then, if we go to page 375, we get the answer, "Yes, we do constantly (AML and all patients)." Now, conscious, Dr Mumford, that you're not a clinician who treats bone marrow patients, have you ever had adult haemato-oncology patients in your hospitals?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** What's your view on whether, given what Dr Hart is saying, albeit in 2018, Ward 4C is a neutropenic ward within the definition that we've seen?

**DR MUMFORD:** This is a very high bar that they are suggesting, I think. Neutropenic patients go home----

**MR MACKINTOSH:** Right.

**DR MUMFORD:** -- quite often, so they don't stay in hospital. I mean, clearly, there are added risks of just being in a hospital, but in that kind of scenario, you might want a few rooms for your more profoundly immunosuppressed patients, but I wouldn't say that that constituted----

**MR MACKINTOSH:** A neutropenic ward?



**DR MUMFORD:** -- a neutropenic ward. And that "AML and all patients" is actually, according to the "PS" at the bottom, it's all acute lymphocytic leukaemia.

**MR MACKINTOSH:** So it's not all the patients?

**MS DEMPSTER:** No.

**DR MUMFORD:** It doesn't say all, it says "acute lymphocytic leukaemia."

**MR MACKINTOSH:** Oh, I suppose I should learn that. Right. Ms Dempster, anything to add to that?

**MS DEMPSTER:** No, I agree with----

**MR MACKINTOSH:** Right. We've heard evidence – so this is going back to the roleplay of being the lead ICD and the lead ICN – that, in May 2016, Dr Inkster learned that the whole of the hospital, outside specialist ventilation rooms, was running at 3 air changes an hour rather than 6, as required by SHTM 03-01, and she received an email from Mr Powrie about that, which I think you've seen. She produced an SBAR, and that SBAR is of June '16. It's Bundle 4, Document 11, page 52. It's a single page. Can I just check that you both read this before today?

**MS DEMPSTER:** Yes.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Yes. Now, we've heard from a number of witnesses

that there's no other risk assessment beyond this SBAR of the 3 air changes an hour rate. Professor Steele was the clearest. Starting, I think, with Ms Dempster, to what extent are you comfortable with this being a sufficient first-stage response to this discovery that there's only 3 air changes an hour?

**MS DEMPSTER:** I don't think it does provide a response to that across the whole of the site.

**MR MACKINTOSH:** I.e. what's wrong with it and what would you be expecting?

**MS DEMPSTER:** It's not looking at the risks of any of the patients who might be at risk. The way I'm reading this, it's patients who are coming in who might have an infection themselves that-- they're looking at how they prevent that transmitting to other patients.

**MR MACKINTOSH:** That's what we see in the first paragraph of assessment.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** You're nodding again.

**MS DEMPSTER:** Yes, sorry. I'm sorry, yes.

**MR MACKINTOSH:** So this doesn't address patients who don't yet have an infection?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** What would you require to do-- I mean, I'm conscious that people like Mr Hoffman and Mr Poplett and Mr Bennett have all got opinions on this, but just in terms of process, what would be the necessary process that you would see it required to be done to react to this news?

**MS DEMPSTER:** I would have thought-- Well, if I'm playing that scenario, I would've looked at all of the wards that we have in the hospital and the patients in them, and looked at the categories to see whether they met the 6 air exchanges or the 10 that would be recommended.

**MR MACKINTOSH:** So a patient placement?

**MS DEMPSTER:** Like a picture of the whole-- not a picture, like a-- what was happening everywhere and what we would expect to see.

**MR MACKINTOSH:** Because you would expect some wards for it to be less of an issue than other wards?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** And some wards where it's even more of an issue?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. I'll come back to you with a specific question, and I turn to Dr Mumford. What's your view of this as a sort of first response by the lead ICD to this discovery?

**DR MUMFORD:** I think it's

incomplete. I mean, I agree with Linda. This just addresses those patients, as she says, with airborne infections in these rooms, so it's all about airborne infections and it's about patients who've come into the building with an airborne infection.

I think, from that point of view, it's incomplete and it should be a broader document, or at least a comment on it, to say, "I'm only including these in this. There must be supplementary work on vulnerable patients and the implications of that."

**MR MACKINTOSH:** How would the sort of work that you were envisaging here compare to the sort of work that you talked about when we discussed 2A and 4B in 2015?

**DR MUMFORD:** Well, you know, as Linda said, you need a risk assessment of every area: what the ventilation looks like, what it should look like and, you know, the potential mitigation of that and what more you could do.

**MS DEMPSTER:** I----

**MR MACKINTOSH:** Now-- Sorry, Ms Dempster.

**MS DEMPSTER:** Sorry, can I just-- I think it's very hard from just one page of A4 to know where was this going, who it was for and what was the reason.

**MR MACKINTOSH:** Because this is a point you generally have about SBARs as a whole?



**MS DEMPSTER:** Yes, so this one is discussing a very specific case about-- you know, there's an investigation going on and we're looking at this group of people with cystic fibrosis. So this seems to be a small-- I don't mean a small. It's a quite focused SBAR, which then would've, presumably-- If you've only just found out there's only 3 air exchanges across the site, there would be a whole load of work that would follow on from that.

**MR MACKINTOSH:** Well, Dr Inkster gave evidence that, in her recommendations, certainly 2 to 7 would probably find their way into SOPs, standard operating procedures.

**MS DEMPSTER:** Mm-hmm.

**MR MACKINTOSH:** My question for you is, how would it be possible to operate a door-closed policy in a hospital this size? How would you do it?

**MS DEMPSTER:** Well, it's even more challenging when you've got 100 per cent single rooms, isn't it? So it's challenging enough sometimes if you've got a 20-bedded ward with six side rooms to try and make sure that doors are kept closed, so it would be difficult.

And there are times when you do need the door open. You do need to observe somebody in the room, or somebody's frightened in the room or claustrophobic in the room. Perhaps

they're at risk of falls, so you couldn't, I don't believe, apply a blanket policy to say every door will be shut without thinking of the person, the patient in the room.

**MR MACKINTOSH:** So as an infection control nurse, how do you go about convincing members of the hospital staff to do things that are, in terms of time, inconvenient that you require them to do? Like, you couldn't convince them to wash their hands, but presumably you had to tell them about the risk?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** So how do you tell them to shut the doors?

**MS DEMPSTER:** Well, I think it's them understanding the need to shut the doors, but this door shutting is relating to the people in the room who've got an infection.

**MR MACKINTOSH:** So you could explain that quite easily to them?

**MS DEMPSTER:** Yes, you could, and you could easily say that there are times when the doors need to be open, and we all would have seen many times that patients could not have the door shut.

Then you would do some kind of assessment to say, is the patient a risk of infection to everybody else? Have they got TB, for example, and the door definitely must be shut, or can we leave the door open? Or is it so important the door's got to be shut, and the patient perhaps is confused or disorientated, that they actually need somebody to stay in the room with them to make sure they're kept safe? So it's a challenge.

**MR MACKINTOSH:** Is there anything you want to add to that, Dr Mumford?

**DR MUMFORD:** Well, one of my hospitals is 100 per cent single-roomed, so we've come up against this issue. We have a risk assessment because when you tell nursing staff on the ward that all the rooms have got to stay closed – say you had a norovirus outbreak, then sometimes you might say, "Shut all the doors, keep them all shut" – the first thing they do is go, "Oh, I don't think we can do that," and they are instantly worried and concerned.

So a risk assessment enables them, as Linda was saying, in certain circumstances to leave the door open safely, so they work their way through the risk assessment for those patients that they're concerned about and determine whether or not they can close the door or leave it open.

There's all sorts of nuances around it, like, you know, you can open the door during times of low traffic in the ward. So overnight, maybe you can leave the door open because there's not very much

movement, so there won't be as much air movement. But it is a really challenging problem in that multi-roomed environment.

**MR MACKINTOSH:** What I want to do now is think about the positive pressure-ventilated lobby rooms and the air change rate across the general wards in terms of management of patients. So we had a hospital that appears to have been designed with 30-something positive pressure ventilation lobby rooms, and the rest of the rooms, all 3 air changes an hour, single rooms.

Are there any issues that arise in terms of simply managing that hospital, in terms of dealing with potentially unusual events or unexpected infections that arise because you've got a balance between 3-air-changes-an-hour single rooms, and 10-air-changes-an-hour, potentially, PPVL rooms? Dr Mumford.

**DR MUMFORD:** 'Yes' is the short answer. The longer answer is that you have to have some sort of method of prioritising your patients so that those with the greatest need end up in the better or the correctly ventilated rooms for their need. It's really complex and you have to have a really good method of managing your beds in order to do it.

**MR MACKINTOSH:** I mean, you presumably saw emails and you've heard evidence of witnesses of what was going on in terms of working out what the rooms were in 2015. How does that compare to the ideal you're discussing?

**DR MUMFORD:** It makes life really, really challenging. You know, every hospital goes through this, to some extent, because most hospitals would have a very limited number of side rooms, so, therefore, you prioritise the patients that you put in them.

There's always a lot of work involved in that, usually from an infection control team, in identifying who's in which room and identifying their need to be in that room, and also identifying the point at which they can come out of that room if somebody of greater need is admitted to the hospital. So it's a complex thing, and I imagine, somewhere the size of the QEUH, it is much more complex.

**MR MACKINTOSH:** In terms of managing the fact that you've got most of the rooms sitting at 3 air changes an hour and very small numbers of rooms above that, are there any sort of events that hit a hospital where that becomes a problem, where you can't-- there aren't lots of 6-air-change-an-hour rooms available, that you can think of from your experience?

**DR MUMFORD:** Well, I mean, there was COVID, but COVID rapidly developed into a-- you know, it doesn't really matter because "everybody's got COVID" scenario.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** But you could have a community-based outbreak or you could have a hospital-based outbreak where you wanted to protect certain patients.

**MR MACKINTOSH:** So if it was a hospital outbreak, what sort of infection will we be talking about where air change rates becomes an issue?

**DR MUMFORD:** So something like norovirus, rotavirus, any of those airborne diseases, that would become very important for the most vulnerable patients who you wanted to protect from----

**MR MACKINTOSH:** And they'd be in 3-air-change-an-hour rooms?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Ms Dempster, is there anything you would like to add to that before we move on?

**MS DEMPSTER:** No, I don't think so, thank you.

**MR MACKINTOSH:** Right. I'm going to deal with Mr Bennett and Cryptococcus tomorrow, so I'm not forgetting it, but just for a reason of housekeeping I'm going to do it tomorrow. What I want do now is move on to infection patterns, your second source in your report.

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** Now, you've discussed it in some length in your report. There's been some additional material that's come out in evidence. What I wanted to do was to ask a few questions about the general methodology of Mr Mookerjee's report and your involvement – we've done the choice of infections, but just general methodology – and then see if there's anything that you can help us understand in other bits of the work and his work.

I'm working on the basis – please tell me I've got this wrong – that, as infection control professionals, you can understand the work of epidemiologists. Are you both happy with that idea that, if an epidemiologist starts putting slides up, you will understand what they're talking about most of the time?

**MS DEMPSTER:** Most of the time. If I didn't, I would ask them.

**MR MACKINTOSH:** So in terms of Mr Mookerjee's work, he chose a particular methodology. Did you both have involvement in developing that? I don't know who wants to answer that question.

**DR MUMFORD:** We discussed it. We relied on him to come up with the epidemiological analysis and the methods by which he would want to do that, but we then discussed it with him so that we were clear that what he was doing would get to the point that it would produce something useful.

**MR MACKINTOSH:** What I'm keen to find out from both of you is why you think it was appropriate or important to compare the Schiehallion cohort with other paediatric haemato-oncology units elsewhere in the UK. Ms Dempster, is there a particular reason you felt that was the right comparison to make?

**MS DEMPSTER:** Well, because it was right to compare them with other-- Sorry----

**MR MACKINTOSH:** To compare it with other----

**MS DEMPSTER:** We wouldn't have compared them adults or something. Is that what you meant, or just----

**MR MACKINTOSH:** Yes, exactly.

**MS DEMPSTER:** Yes, yes, I think----

**MR MACKINTOSH:** I mean, why pick that comparison?

**MS DEMPSTER:** A similar population. We couldn't say they were definitely the same type of population, but we selected from the list of NHS trusts in England and Wales those units that had bone marrow transplant units in them.

**MR MACKINTOSH:** Would there have been any advantage in comparing the Schiehallion unit's cohort with, say, a large teaching hospital with an accident and emergency department?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** Or a regional cancer centre for adult patients?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** Or a district general hospital?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** No. You didn't think about comparing the Schiehallion unit with other hospitals in Glasgow, for example?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** No. Is there any particular reason?

**MS DEMPSTER:** Because it would be a very, very different patient cohort. It was trying to find a similar cohort of patients with similar risk factors and treatments.

**MR MACKINTOSH:** Anything you want to add to that?

**DR MUMFORD:** No, I think that's----

**MR MACKINTOSH:** I think you've already answered that question and that one, too. Do either of you have any view on the debate which seems to have broken out about whether the correct denominator should be admissions or occupied bed days, having heard evidence from a number of witnesses? Dr Mumford, do you have any view about the utility of either as the denominator?

**DR MUMFORD:** I think that there's probably arguments in both ways. I can understand why Mr Mookerjee felt that

admissions was the right one because it gave-- it used the turnover of patients and the number of patients who were going through the unit and, therefore, the risk to individual patients. But also, occupied bed days also gives you a kind of quantum of risk because the whole patient admission is counted in the denominator, so I think there's pros and cons to both methods.

**MR MACKINTOSH:** Do you have any comment on his evidence about the difficulty of getting occupied bed days from other hospitals?

**DR MUMFORD:** I'm less sure of that because I haven't got experience of a large number of hospitals and how they calculate their occupied bed days, but, you know, if you asked me to do it in my hospital, I would just be able to make one phone call and get it because we have an electronic bed management system, which I think is not uncommon. So we have that patient admin electronic system, which allows you to calculate that relatively easily.

**MR MACKINTOSH:** Right, okay. You state in your report on 33.-- You almost certainly don't say that at 33.2. (After a pause) I'm just going to have to find out where you've done that because that's definitely a wrong reference. You don't have a paragraph 33.2 in your report, so I'll have to come back to that later when I've checked this. If we can look----

**DR MUMFORD:** I think it's in the Direction 5.

**MR MACKINTOSH:** Yes, it is Direction 5. Thank you, sorry. If we look at your Direction 5 document – that's 24, Volume 6, and it's 33.2 – you describe in the second half of that paragraph:

> "Mr Mookerjee has demonstrated a significant difference in the infection rates per 1,000 emissions from the Schiehallion unit and the four English comparative units."

I wonder if we can just show you the document that was put up for the first time on Mr Mookerjee's-- single page, which has his final figure with an additional line added, and we can talk about this. (After a pause) So is that reference, at 33.2 in your Direction 5 response, a reference to the green line in his report, or the dotted, purple line? What line is it a reference to?

**DR MUMFORD:** It's the dotted, purple line.

**MR MACKINTOSH:** Dotted, purple line. Do you understand that that only includes overnight cases in 2A and overnight cases in 6A, and not day cases?

**DR MUMFORD:** Yes, yes.

**MR MACKINTOSH:** So is that sentence entirely correct? Because it's not covering-- the dotted, purple line doesn't include the day admissions?

**DR MUMFORD:** So I don't think I've appreciated that the comparator unit included both day and inpatient admissions.

**MR MACKINTOSH:** So Mr Mookerjee recalculated and produced what is now the magenta line at the bottom of the figure, which shows the overall Schiehallion rate per 1,000 admissions, including day and night admissions. How would you describe that result in comparison to the comparative units? Would you continue to describe it as significant, or would you give it a different description?

**DR MUMFORD:** Well, it still more than doubles the-- it multiplies the risk by 2.5 at the peak, so I would say that was still-- and doubles it in 2018. I think that was probably still significant when you're talking about the high-risk population.

**MR MACKINTOSH:** Ms Dempster, do you have anything to add about that?

**MS DEMPSTER:** No, I agree.

**MR MACKINTOSH:** No. Now that you've heard Mr Mookerjee's evidence, are you sticking by what's in 33.2 or would you change it at all? Because obviously you refer to, at its peak in 2017, the Ward 2A rate, which was more than 16 times the average rate for the comparative units, albeit that includes day cases.

**DR MUMFORD:** Well, clearly, perhaps the numbers need to be amended, but I think the other question to ask, before you come to that conclusion, or any conclusion, is around the proportion of day case to inpatients in both units, and I think that would probably give you more granularity. I know we haven't necessarily got the data, but I'd want to ask more questions, I think.

**MR MACKINTOSH:** But you can't because we haven't got the data?

**DR MUMFORD:** We can't.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** So yes. So there still is, in my mind, a significant increase, but it's not of the order of magnitude that we've previously stated.

**MR MACKINTOSH:** Right. In Mr Mookerjee's evidence, he talked about why he chose annual totals, rather than monthly totals, in this figure. My recollection is he felt that the human mind finds it hard to see a chart where you show monthly totals because it will bounce up and down a lot.

With that in mind, I was proposing to show you a lot of monthly charts and ask you if you had any thoughts arising from them. I wonder if we could compare this – so if we can keep this around and not

get rid it – and look at Bundle 7, Document 6, at page 214, which is the October 2019 HBS report, and go to page 230. Hopefully, we have Figure 6. Not Figure 6. Sorry, the figure's at the top of the page, which is:

> "SPC chart using the environmental including enteric group case definition for HPS data from July 2013 to September 2019."

So that's the blue-green line at the bottom of that chart. Do you see anything, conscious that there's this monthly variation, of difference or similarity between the changes that are happening over time in that figure and the one in the previous figure, which perhaps we can flip back just to help you reach a conclusion? So this one doesn't show pre-'15, the other one does. If we go back again, is there anything going on that might be a similarity or difference?

**DR MUMFORD:** So if you lean back and have a look at the-- squint a bit, you can see that there is a step change in the rates of infection in 2017 and 2018, and there are still some very high months in 2019, and you've got some data exceedances as well. So yes, there is a definite increase, although it's difficult to see because you do have that bouncing around of the data.

**MR MACKINTOSH:** The way this is presented, presumably-- we've had evidence that the centre line is only found in the data in the chart itself. It's not from any external baseline.

**DR MUMFORD:** Sorry, I missed----

**MR MACKINTOSH:** The centre line is-- it's not based on an external baseline. It comes from-- it's the average of all the positions in this chart ----

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** If we could just look at the earlier HPS chart for environmental group, which is Bundle 7, Document 5, page 194 at page 210. So this is the environmental group. Now, remember this was a group that was slightly smaller than your group when we looked at it this morning, and it has drawn out the two areas in circles, but is there anything that seems to be similar or different to the conclusions from Mr Mookerjee's report about infection rates?

**DR MUMFORD:** I think you see the same pattern again of low levels in 2015, going into 2016, and then it's starting to rise, with higher levels in 2017 to 2018.

**MR MACKINTOSH:** Now, Ms Dempster, anything you want to add to that?

**MS DEMPSTER:** No, I agree with that, yes.

**MR MACKINTOSH:** This is a question which I should have asked Mr Mookerjee about, so it may be that

neither of you want to comment on this because it might be outwith your area of expertise.

The second chart, which was produced in this report, deals with the whole children's hospital, and there are three moments when the data for this group goes above the upper line. They're the red diamonds at the bottom of the chart. Can we draw any conclusions, Dr Mumford, from seeing changes in the rate of these environmental actions across the whole children's hospital?

**DR MUMFORD:** Well, without knowing what those infections actually are-- but you could put forward a theory that they could be patients who are on the PICU or other high-risk patients elsewhere in the hospital.

**MR MACKINTOSH:** But you'd have to look and drill down?

**DR MUMFORD:** Yes, but there's definitely-- in order to determine whether they are just kind of general, if you like, patients rather than the high-risk patients, you would have to know if they are.

**MR MACKINTOSH:** What I want to do now is to look at the presentation by Dr Kennedy and Ms Rogers to the IMT in September. So if we just go back to the document that Mr Mookerjee produced that we're keeping to one side, hold that thought, and then we look at Mr Mookerjee's addendum report, which is



Bundle 21, Volume 1, page 771. So this is his rate of infection in 2A only for 1,000 occupied bed days. Now, he described this as a roughly tripling of infection rates.

So we've got those two bits of information. Let's look at Dr Kennedy and Ms Rogers, so that is Bundle 27, Volume 13 at Document 13, page 77, at page 85. Now, we obviously look at the top of that and we see-- Should we worry that this is all gram-negative blood cultures, Dr Mumford?

**DR MUMFORD:** I don't think you can draw any-- I mean, you can see that the rates go up----

**MR MACKINTOSH:** Yes.

**DR MUMFORD:** -- but whether or not you need to worry, I think is a----

**MR MACKINTOSH:** Because the reason I'm interested, and please shoot me down if it's necessary, is-- what I noticed is that the left-hand column of this chart is a rate per 1,000 occupied bed days. It shows, as I think Mr Mookerjee had interpreted, the numbers, if not the significance of it, are quite a low rate until late '16, then it steps up and starts bouncing around, to my eye, 6 and then drops away a bit.

Given that he's identified a rate for just 2A of 6 per 1,000 bed days, I did ask, is there something going on here that we can draw a comparison? Do you have any views about whether this is useful?

**DR MUMFORD:** Well, again, you're back to monthly rates, so the troughs are as important as the peaks when you're comparing the annual rates with the monthly rates.

**MR MACKINTOSH:** I see, so we shouldn't worry about this chart too much, or should we-- What can we draw from this chart?

**DR MUMFORD:** You can draw that there has obviously been an increase in bloodstream infections, but I don't think you can say more that.

**MR MACKINTOSH:** Okay.

**THE CHAIR:** Sorry, can I just get that from you again, Dr Mumford? "You can say that there is----?"

**DR MUMFORD:** An increase in infections, but you can't-- Sorry, I've forgotten what I said myself now. Sorry. You can see that there has been an overall increase in the number of positive blood cultures, but you can't say any more than that.

**THE CHAIR:** Right.

**MR MACKINTOSH:** Ms Dempster, do you have anything you want to add about this?

**MS DEMPSTER:** No.

**MR MACKINTOSH:** No. I wonder if we could look at page 122 of your original report. That's Bundle 21, Volume 1, page 122. So you, at 5.2, suggested that the Schiehallion unit is, in effect, used as a proxy for the hospital and as a whole to identify the overall risk.

Now, I think you've thought about this because I asked you that question at a consultation last year, but I wonder if you can expand on your-- 5.12-- expand on your meaning of "as a proxy." What do you mean by "as a proxy"?

**DR MUMFORD:** So I think if you-- So your Schiehallion Unit patients are your most vulnerable patients out of your whole patient cohort in the RHC and-- because they're vulnerable for a long time and they can be exceptionally unwell. So you can use that group because you can identify the risk in there and then you can be reasonably confident that the risk elsewhere is not going to be higher than that, so that gives you a kind of ceiling for your level of risk because these are your most vulnerable group of patients.

**MR MACKINTOSH:** So is "proxy" quite the right word?

**DR MUMFORD:** Possibly badly worded, yes.

**MR MACKINTOSH:** What would you think might be a better word to use there?

**DR MUMFORD:** I don't think there is a word. I think I probably would have phrased it as I've just stated it.

**MR MACKINTOSH:** Right. Can you help us, Ms Dempster, about how

you see the Schiehallion unit being in relation to the whole children's hospital?

**MS DEMPSTER:** I think it's, as Sara said, and I'm not a very good wordsmith, so I'm sure I'm not going to come up with the best sentence to say that. But the decision was made with that sentiment in mind. That's why we chose it----

**MR MACKINTOSH:** Does it sort of amount to the idea that, if there is a problem with the water supply, it will exhibit itself first in this cohort?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Now, I want to now move on to the views of others, and this section is a little eclectic, as I think it was in your report a little eclectic. I want to cover whole genome sequencing and its utility, laboratory practices, selection pressure by meropenem, Ms Devine's appendix, the GGC positioning paper, and Mr Bennett's report on Cryptococcus. I don't imagine we'll get to the end of this by the end of the day.

I wonder if we can turn to whole genome sequencing, which you cover in your report from paragraph 9.130 in page 161 through to 9.149 at page 163. Now, you seem to be saying in this report that the utility of whole genome sequencing, in your eyes, determines, to some degree, on the reliability or extensiveness of environmental sampling. Have I got that right?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** I want to check a couple of things that's been suggested I should put to you, that NHSGGC have carried out more water testing, commonly picking whole genome sequencing-- Well, I'll put it a different way. Are you saying that GGC should have done even more of this stuff at the time: more water testing, more colony picking and more whole genome sequencing?

**DR MUMFORD:** Well, the whole genome sequencing, as I understand it, that was done by Professor Leanord and Dr Evans, they used the same source material for both papers, so there was an awful lot of water testing done subsequently.

**MR MACKINTOSH:** So when you say "subsequently," after what time?

**DR MUMFORD:** Well, after the samples that they used, and even before, where the organisms were not saved and the whole genome sequencing wasn't done.

**MR MACKINTOSH:** At the time?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** But, to be fair, it probably couldn't be done at----

**DR MUMFORD:** Or even subsequently, so there weren't-- In order to say that I've tested the whole water

system and I've done whole genome sequencing, you need to test everything. You can't pick and choose what you----

**MR MACKINTOSH:** So what's your basis for that observation, that you test everything?

**DR MUMFORD:** Because if you have a multi-organism contamination, for want of a better word, of your water system, when you do the culture of that, you will have multiple strains of the same organism, and lots of different organisms.

**MR MACKINTOSH:** Is there research to support that assertion?

**DR MUMFORD:** I don't-- Well, that was the reality of the situation, wasn't it? It's not a matter of research. When they cultured the water, there were multiple different organisms in water samples, and we know from research, certainly, that multiple different strains exist within water systems. It's not a static population. You get variation.

So unless you can-- in order to say there's no link, you need to identify all of those different strains and all of the different organisms and all the strains of those organisms, and then test them all. Because they were doing a lot of retrospective work, so they were taking samples from stored organisms----

**MR MACKINTOSH:** These are the samples taken in '15, '16, '17?

**DR MUMFORD:** Yes. They were looking at stored organisms and without clarity about how those organisms had been chosen to be the ones that were stored. Professor Leanord's paper in particular mentioned that some of the organisms that he cultured up were different from what was on the label on the tube.

So there was some discrepancy also in whether or not the labelling was accurate, and so because you didn't have that almost chain of clarity around how the tests had been-- or we know what the water process was, but how those organisms, on an individual basis, had been chosen, how many of them-- Was it just one of each morphological type, or was it more?

Then storing them, and then it was kind of, as Professor Leanord described, the luck of the draw which ones they managed to find in the archive of organisms. So to make a deduction when you do the whole genome sequencing is very difficult because he didn't do thousands of organisms.

**MR MACKINTOSH:** Because, at the moment, they seem to be doing quite a lot now. Would you accept that?

**DR MUMFORD:** I haven't seen it. I don't know that.

**MR MACKINTOSH:** So can I just ask you to look at the document which I don't know whether you saw. Dr Walker

saw it. It's in Bundle 18, Volume 2, Document 105, but it's particularly at page 459 and it's the standard operating procedure, page 459. It's in the water--

(After a pause) So this appears to set out, if we look at the bottom of the page, what was being done in June '22, and it lists all samples that had to be taken. If we slowly plod through the next few pages-- That's too far. So if we plod through until we get to page 465, and then we look at the flow chart that follows in-- That's the governance water-- Have you had an opportunity to look at these sort of documents in the bundles, if we go back to, say, page 459 itself?

So they're obviously doing some measure of monthly, weekly tests for various different things, and they have rules about where they're to be taken from. Would you accept that they're doing testing now at a higher frequency than before and over a wider range of organisms and TVCs than before?

**DR MUMFORD:** Absolutely.

**MR MACKINTOSH:** Are you aware of any health board or trust in the UK that's testing with this sort of frequency?

**DR MUMFORD:** I don't, no.

**MR MACKINTOSH:** Does your hospital in Kent test with this sort of frequency?

**DR MUMFORD:** No, because we do follow a standard protocol and then, if we find anything of concern, we will-- so we do our augmented areas mostly and then, if we find anything of concern, then we increase our testing.

**MR MACKINTOSH:** So you wait-- you would increase----

**DR MUMFORD:** So it's not this kind of testing.

**MR MACKINTOSH:** In the sense it's not as much or it's more or----?

**DR MUMFORD:** It's not as much and it's not as prescribed.

**MR MACKINTOSH:** So if they're doing more and in a prescribed way than your hospital, how is it reasonable to critique what they did-- their sampling strategy in the question of whole genome sequencing?

**DR MUMFORD:** Because this isn't what they were doing then.

**MR MACKINTOSH:** This is what they're doing now?

**DR MUMFORD:** Mm.

**MR MACKINTOSH:** How would you respond to the view that, since Dr Kelly was appointed authorising engineer and Mr Clarkson became the authorising person, that GG has learned a lot and implemented new ways at a higher level of intensity to adequately sample and test water? Would that be something you'd accept?

**DR MUMFORD:** Well, I mean, looking at this SOP, you would have to

accept that, yes.

**MR MACKINTOSH:** Yes. Ms Dempster, would you be able to help us whether hospitals, before you retired, that you were involved in were testing water at this level of intensity in England?

**MS DEMPSTER:** I couldn't say. I----

**MR MACKINTOSH:** What connection do you see, Dr Mumford, between the amount of water testing being done at GGC and the history of the water system? Are these two things related, in your mind?

**DR MUMFORD:** You would assume so.

**MR MACKINTOSH:** Why?

**DR MUMFORD:** Because if you've had huge problems with your water system, it would make sense to increase the amount of testing you were doing until you were confident that those issues were resolved.

**MR MACKINTOSH:** What I want to do now – thank you – is to turn to your addendum report, which is at Bundle 21, Volume 1, page 773, and to the topic of picks used in laboratory methods. I'm assuming, Ms Dempster, this isn't your thing.

**MS DEMPSTER:** No, I'd like to say it's Dr Mumford's thing.

**MR MACKINTOSH:** I wonder if you can take us through the approach you've taken on page 776, because I think we could do with a little seminar on picks. Because we've had a lot of evidence from Professor Leanord, Dr Redding, a little bit from Ms Lee-- Dr Lee, but subsequently, we've had statements, following Professor Leanord's evidence, from Dr Inkster, Dr Peters, I think a couple of other people. Obviously, we've got to read those statements and understand them.

So when you're taking a water sample simply to identify things for the purposes of treating the patient, what are the-- what's your objective in terms of how many picks you take or how many samples you take?

**DR MUMFORD:** So I'm going to challenge you slightly because you would never take a water sample in towards-- in order to come----

**MR MACKINTOSH:** Okay, well, I'll rewind it, then.

**DR MUMFORD:** -- to lead you to how you were going to treat the patient.

**MR MACKINTOSH:** So if we go back to a patient sample.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** So imagine you've got a patient sample. You're treating the patient. You have a suspicion they have microorganism X.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Then, in

comparison with that, you're taking a patient sample and you want-- do whole genome sequencing. Is there any difference in the objectives, the methodology, the approach to how many colonies you pick between the two?

**DR MUMFORD:** So in a blood culture, usually you would only have one organism. It would be a single organism which was causing the infection. Sometimes you get them mixed, but most of the time there is a single organism. And under those circumstances, you can just pick one colony to save and send for whole genome sequencing.

**MR MACKINTOSH:** So let's imagine you're now-- you've got your infection in your ward, you're worried about a couple of cases, so you start doing environmental samples. How many picks or samples would you grow of water samples to, say, find some Stenotrophomonas that you suspected might be there because it's in the patients? How would you do that?

**DR MUMFORD:** So the way you culture, if you're looking for a particular organism, is to use selective plates or so on so that you can identify which colony is the Stenotrophomonas or which colonies are the Stenotrophomonas.

Now, because we know that, in water, you can get multiple strains of the same organism – and that's partly due to biofilms and the diversity that develops within them – you couldn't just pick one colony of your presumed Stenotrophomonas. You would have to pick more, and that's partly to assure yourself that they're all the same, but it's also partly to say, "Well, actually, we have got some different strains here and so we need to be comprehensive in how we take them."

So if you've got a few colonies, you should take all of them. If you've got many-- you know, 100 colonies, that would be too many and you should take a representative sample. And I think the literature that I've seen, which is very limited on the subject, really, is probably somewhere around 30 colonies.

**MR MACKINTOSH:** You discuss this, actually, over the page on 3.9-- on 3.8.

**DR MUMFORD:** Yes, so you would pick more to be sure that you had got samples of each strain or to assure yourself that it was a single strain.

**MR MACKINTOSH:** I suppose the final question is that, if you're trying to prove a negative-- and I want to make sure that we, as lawyers, don't make a mistake because we think something is similar to something we're used to and read across when it's the wrong approach.

So, as lawyers, we might, for

example, imagine there's a crime scene and there is various pieces of evidence that suggest that someone's been there, perhaps an eyewitness. Some mobile phone cell tower data, I don't know. An item has been found in that person's house. There might be a trial, but there's no fingerprints. No fingerprints have been recovered. No DNA sample has been recovered.

As lawyers, I suspect we would be surprised if someone argued, "My fingerprints aren't there. My DNA is not there. That's conclusive proof that I didn't steal the valuable gold vase that you found under my bed," for example.

That's a legal way of thinking about it in a different scenario. I might suggest it's something to do with the proof of the negative is harder, intellectually, for us. The absence of evidence is not evidence of absence, as we would call it.

Is this the same sort of method of thinking that's appropriate to the discussion of you using whole genome sequencing to prove the absence of connection, or have we misunderstood?

**DR MUMFORD:** I think that there are different circumstances. So if you had two patients who had the same-- say they both had a Pseudomonas in their blood culture. It was the same species, it was-- both of them were a Pseudomonas aeruginosa, both of them have the same antimicrobial sensitivity pattern, and you thought, "Well, maybe they're connected." Maybe they've either got it from the same place or one of them's given it to the other.

If you do whole genome sequencing on their organisms, you can absolutely say, "Yes, they're the same," or "Yes, they're not the same." And if they're not the same, then these two cases are not connected with each other.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** With water and the environment, because it's so diverse and because it's very easy to miss something – and it may be that a biofilm was broken down and sent a shower of Pseudomonas down the pipe and then it stops again – you can't be sure. You can't prove a negative.

You can prove a connection. "This patient has got this whole genome sequence." "This bug found in the water has got the same sequence. Therefore, there's a connection." But what you can't do is say, "I've done a couple of water tests. I picked everything. It's not there. Therefore, there's no chance that this water has caused this infection."

**MR MACKINTOSH:** Going back to the two patients, if you have two patients – or I think there may be an example where there are four patients – in the same room or in similar rooms over a

short period of time, and they seem to be the same strain and they seem to have the same resistance patterns, and there's some suggestions they've used the same shower, and that's all been developed by infection control staff-- But you carry out a whole genome sequencing and you discover they're not closely connected in that snips basis that we've had discussed with Professor Leanord and Professor Wilcox. Does the idea that the fact they're not closely related and, therefore, there's no link-- isn't that reliant with the idea that there is only one infection source? Because could it not have been the case that all four received a different Stenotrophomonas strain from the shower as that biofilm broke down?

**DR MUMFORD:** Yes. They could all have caught-- they could all have acquired their infection from the water, but what they didn't do was acquire the same strain from the water or acquire it from each other.

**MR MACKINTOSH:** What level of rigor would you need to apply to your sampling to take four unconnected whole genome sequencing-level cases and say they are not connected to the water at all?

**DR MUMFORD:** You couldn't.

**MR MACKINTOSH:** Why?

**DR MUMFORD:** For the same reason that you can't exclude a



connection by testing the water. So if you know that you have got a Pseudomonas in the water and you know that you've got four patients with a Pseudomonas, even if they're all different, you can't say that none of them have acquired it from the water.

**MR MACKINTOSH:** And this is because of the diversity of organisms in the water?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. What I want to do now is to move on to laboratory practices. This is back to your Direction 5 response, Bundle 21, Volume 4. Now it's page 22. So it's page-- No, I think I've done that wrong. Give me a second. Volume 21 (sic), Volume 5, at page 131. No, this is not right. Sorry, I misunderstood. If we go back to Bundle 21, Volume 4, Document 5 at page 22, this is the GGC response to you, and you answered a question that arose from this.

So do you see that there's a heading that they've inserted, "Implied failures in ... Infection Prevention and Control/laboratory management"? There are three paragraphs that follow, and they make a specifically strong response to your report. They also provided us with a large number of SOPs and policies. Now, these are – I'm not going to go to them unless you want to – Bundle 27, Volume 17, Documents 12 to 28.

Then in your response, if we go back to-- I don't think you've responded directly to their criticism because you didn't have the SOPs at this point in your Direction 5 response, and I wonder if you've had the opportunity of looking at their other SOPs that they've supplied?

**DR MUMFORD:** I have.

**MR MACKINTOSH:** Do they change your views about laboratory control and management that you expressed in your original report at paragraph 9.133?

**DR MUMFORD:** So----

**MR MACKINTOSH:** Which is on page 161 of Volume 21 (sic), Volume 1.

**DR MUMFORD:** The comment I made specifically says, "In this paper..." which referred directly to Professor Leanord's paper. It was not a global criticism of laboratory practices at GGC. It said:

> "In this paper there has been no standardised methodology recorded…"

And that was the case.

**MR MACKINTOSH:** Yes, so this is not a criticism of the way that GGC run their labs. This is criticism, in essence, of Professor Leanord's paper?

**DR MUMFORD:** Yes.

**THE CHAIR:** Right, could you just take me back over that (inaudible)----

**MR MACKINTOSH:** Yes, I managed to make a complete Horlicks of that, my Lord.

**THE CHAIR:** So a remarkable facility----

**MR MACKINTOSH:** So, if we just stay where we are----

**THE CHAIR:** -- with three documents, which (inaudible).

**MR MACKINTOSH:** If we stay where we are, my Lord. We're on Bundle 21, Volume 1, page 161, paragraph 9.132:

> "The paper by Professor Leanord and Dr Brown recognises the limitations..."

**THE CHAIR:** Yes.

**MR MACKINTOSH:** The next paragraph says:

> "In this paper there's been no standardised methodology recorded for either taking samples, labelling or culturing organisms from the water and drainage samples. The samples were taken over several years and by an unknown number of people. This brings variation to the process of collection of samples [and so on]."

If we then go to Bundle 21, Volume 4, Document 5, which is the GGC Direction 5 response, paragraph----

**THE CHAIR:** Right, let's just-- Just take it slowly because the-- Right, so it's paragraph 28?

**MR MACKINTOSH:** Well, 26 to 28, of their GGC response.

**THE CHAIR:** I mean, the word that sticks out there, at 27, is the word "egregious." I want to ascertain whether we have dealt with that.

**MR MACKINTOSH:** So they make their criticism, and no doubt they can deal with this in submissions, and I want to just deal with in evidence-- is that this paragraph deals with paragraph 9.133.

So there are earlier criticisms about the failure of GGC in paragraphs 26 and 27, which you've dealt with in our Direction 5 response and I don't need to revisit. Then paragraph 28 is targeted at the paragraph that we've just looked at, my Lord, in the original report, 9.133. So we've jumped back. The response here is that:

> "NHSGGC laboratories are UKAS accredited and operate according to strict SOPs with all patient and environmental data being obtained to manage the accuracy and integrity…"

What Dr Mumford, I think, was saying was that the criticism at 9.133 is not targeted at the laboratories as a whole. It's merely what is described in Professor Leanord's paper. I mean, to be fair, Dr Mumford, could it be that you are slightly criticising laboratories because Professor Leanord was only able to use the material laboratories retained and marked and labelled?

**DR MUMFORD:** Well, yes, but it's a limitation of his paper, and I think he acknowledges that it's a limitation of his paper. So I was criticising the fact that he did not include any methodology or even refer to the fact that there were SOPs in place.

If he'd said, "Specimens were collected in line with the SOP," whatever it was, then I couldn't have criticised, but he didn't. He just said, "We went back to the archive and we pulled these organisms out" and didn't have, then, anything which you would expect in a scientific paper to see.

**MR MACKINTOSH:** Right, and you've obviously seen the SOPs that are in place----

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** -- now. You've reviewed them. Are you able to provide any commentary about what your view is – you can take this off the screen – about the current SOPs that are in place in the (inaudible)?

**DR MUMFORD:** So, since several SOPs, which change over time, so several versions of similar SOPs, and-- The laboratory is a UKAS-accredited laboratory, and that accreditation means that they have to have those SOPs in

place which are in line with UKAS standards. That has been the case over another number of iterations that we were sent of those policies, so I have absolutely no problem with their SOPs.

**MR MACKINTOSH:** Could it be that the problem isn't actually the lab or Professor Leanord? It's that the samples that he was using were taken for a different purpose?

**DR MUMFORD:** Mm, probably.

**MR MACKINTOSH:** And the water samples-- Well, we've heard David Watson from DMA Canyon – he was our first witness – and others talk about the change-- that water sampling techniques change over time. So the water samples were taken for a different purpose----

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** -- were sampled by the laboratory for a different purpose, and whatever the reason they retained what they retained, they retained it for a different purpose?

**DR MUMFORD:** I'm sure that's true, yes.

**MR MACKINTOSH:** For the patient samples, that maybe is less of an issue because you can get away with retaining one.

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** But they actually didn't retain all the samples, as, I think, Professor Wilcox took us through



last week.

**DR MUMFORD:** Of the patients?

**MR MACKINTOSH:** Of the patients.

**DR MUMFORD:** Yes, so that's what I think Professor Wilcox found, but I would have expected that they would have. If you have a positive-- I'd certainly-- the laboratory that I've worked in, if there's been a positive blood culture, then you retain a sample.

**MR MACKINTOSH:** But in any event, some of them weren't used.

**DR MUMFORD:** No. Mm.

**MR MACKINTOSH:** So, I mean, I'm putting words in your mouth, but I wonder whether you think it makes sense-- is that Professor Leanord is effectively working with the material he's got, created at a point in the past, and he has to do the best he can?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** You then come along and say, "Well, that's not good enough," but, to a certain extent, he can't do better?

**DR MUMFORD:** Well, yes, and it was recognising that he-- that was the situation, but it-- and so it was a comment on what had been done.

**MR MACKINTOSH:** Right, okay. What I want to move on now is to the topic of selection pressure-- No, before that, sorry, I've got another question,

which I-- I've been neglecting Ms Dempster, and I feel she should be asked some questions.

We were provided with the current IPC process framework by the Board, which is effective from December '23, which is Bundle 27, Volume 17, Document 28, page 315. There's been some discussion about whether this is similar to or different from the National Infection Prevention Control Manual Part 3.

I'm conscious that you're an expert in the processes of a different jurisdiction, but just from your perspective, having read this document, is this different from the National Infection Prevention and Control Manual Part 3 in Scotland?

**MS DEMPSTER:** I looked at this alongside the published manual. They're very similar, but you couldn't, as a health board alone, just use the National Infection Control Manual. You do need some local information and detail to adapt your processes locally, so----

**MR MACKINTOSH:** Yes, because you need your own----

**MS DEMPSTER:** This is like a template. This is what the ideal is. Then you're going to say, "Actually, you know, ours isn't done that way. We report it to the governance committee." There's variations, so even if you're using the manual, you use the manual as your framework, I believe, then-- to then operate locally.

**MR MACKINTOSH:** So if we look at this page, for example:

> "A different health board will have a different outbreak plan."

**MS DEMPSTER:** Yes, that's-- they refer to the NHS XYZ (inaudible).

**MR MACKINTOSH:** They might have a different lead manager. They might have to-- they call it a different thing.

**MS DEMPSTER:** Yes, yes.

**MR MACKINTOSH:** If we go to the next page, so this is-- do you see this as, effectively, a localisation of the National Manual, from your perspective?

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** Right. If we go on to page 317, I mean, one of the problems I've certainly found personally with reading the manual is it's very loosely phrased, but then I'm a lawyer and it's written by infection control professionals, and perhaps that's a different standard.

But on this page, there doesn't appear to be a requirement to record a decision not to hold a PAG or an IMT. Now, it may be that that's actually done in medical records, I don't know, but is there anything that's significant about the fact that there's no requirement to formally record a decision not to hold a PAG or an

IMT?

**MS DEMPSTER:** I think, if you go to the next section----

**MR MACKINTOSH:** Next page?

**MS DEMPSTER:** -- it talks about you're either filling in-- "in some concerns" (reads from document *sotto voce*). It says:

"All assessments, regardless of outcome, must be recorded."

**MR MACKINTOSH:** So you read that as----

**MS DEMPSTER:** As you would record them.

**MR MACKINTOSH:** -- you would record them? Okay, that----

**MS DEMPSTER:** But you didn't escalate to a PAG.

**MR MACKINTOSH:** So that's a misunderstanding on my part.

**MS DEMPSTER:** Yes.

**MR MACKINTOSH:** That's helpful.

**MS DEMPSTER:** But then that's-- I'm looking at that with that redacted, so I don't quite know what that line is.

**MR MACKINTOSH:** If we go to page-- section 2.5, which is the next page over, I wonder, Dr Mumford, is there anything of interest in section 2.5 about environmental sampling, given our conversation previously about – and also various other people's evidence about – data around environmental samples?

**DR MUMFORD:** Personally, I don't think it needs an ICD to make the decision whether or not an environmental sample needs to be taken, because that could be anything. That could be a surface swab of a table. It doesn't have to be----

**THE CHAIR:** Dr Mumford, I----

**MR MACKINTOSH:** I think you're a little bit too quiet.

**DR MUMFORD:** Sorry, sorry.

**THE CHAIR:** I'm having difficulty hearing you.

**DR MUMFORD:** Sorry. I was saying that I don't think it necessarily needs an infection control doctor to make a decision to do environmental sampling, and-- because it could be something as simple as a surface swab. It doesn't have to be air or water, which is more complicated, and so I think, yes, again, that's kind of maybe lacking in detail ----

**MR MACKINTOSH:** Who else would you imagine making such a decision?

**DR MUMFORD:** Well, an infection control nurse.

**MR MACKINTOSH:** What about a microbiologist?

**DR MUMFORD:** Or a microbiologist, but an ICD, in this context, is a microbiologist, aren't they, but----

**MR MACKINTOSH:** I suppose we're conscious there's evidence in Greater Glasgow of there being

microbiologists who aren't ICDs.

**DR MUMFORD:** Yes, but, you know, if it was a Saturday morning of a Bank Holiday weekend and you wanted to do a sample, then you would want to take that decision, wouldn't you?

**MR MACKINTOSH:** Right.

**MS DEMPSTER:** I think it is important to help with the issues around identification of some-- the lack of identification of where samples have come from, so it makes it very clear we need to know what room you're in, and they've all got some kind of unique identifier. Was it the wash hand basin? Was it the basin in-- So I think it helps to describe far better that you need all this detail to then track back to say the sample was taken in, you know, side room number X from wash hand basin.

**MR MACKINTOSH:** Thank you. I wonder if we can go on to section 3, Reporting and Governance. Now, I think both of you have heard or watched evidence from Dr Inkster about her decisions along the way around decants, around water changes, and the interaction with the executive group. You, I think, will be aware of her evidence that, early in the water incident, she raises with Dr Armstrong, she says, the idea there should be an executive control group to somehow-- for her to report to.

With that in mind, I wonder if we can look at part 3, and particularly a weekly report requirement to the GGC senior management team and, over the page, the reporting of escalated red/amber assessments, then summaries of instances to the acute clinical governance committee, and then further summaries to the clinical care governance group for assurance, and if we go to the next page, that's the summary.

Now, does this policy, in your views, properly position the infection control doctor or an IMT chair in the structure so that when he or she makes a decision, it's clear what their remit is, what the decision can be and who is responsible for making decisions as to risk? Does this provide enough detail?

**DR MUMFORD:** I don't think it does. I mean, there's clearly lots of reporting in lots of different directions, but I think that the ICD doesn't have that direct access to the most senior subject matter expert always, and, you know, reporting through the infection control manager, who may or may not know anything about infection control, is a very difficult reporting line, for me. I would find that very, very difficult, and it wouldn't be ideal because you lose your expertise along the way of that.

So if you have your expert who is-- and, you know, we know that the infection control nursing team don't feel that they

are expert in water and ventilation, but then you have your infection control doctor, who has some expertise in those areas as they pertain to infection control, and yet the reporting line takes away that direct expertise.

**MR MACKINTOSH:** Do you mean that someone with expertise is reporting to someone without the expertise----

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** -- who then reports to someone with no expertise?

**DR MUMFORD:** Yes, so you end up with-- you could end up with a situation where you've got slight Chinese whispers, but you also lose that ability for the executive level to directly question the person with the knowledge. So you-- it's not as rich a conversation as it could be in your escalation. So you escalate a problem, but it doesn't necessarily mean that the person at the top of that escalation understands what the problem is.

**MR MACKINTOSH:** Is that entirely fair? Because we've seen a lot of email exchange between-- in the period when she was lead ICD, between Dr Inkster and Dr Armstrong about particular moments of importance where ideas seem-- information seems to be flowing between the two of them. I mean, it's not doing it through a formal structure, but it is flowing.



**DR MUMFORD:** But that's the point, isn't it? It's not through the formal structure, and that informal route hasn't been the most effective route. It's there because you need to get that message through, because Dr Armstrong is there as the executive lead for HAI and you've got your infection control doctor who needs to get to her, but actually, the governance reporting route is not that.

**MR MACKINTOSH:** Well, shouldn't we have been seeing that level of detail in the reports to the AICC and the BICC and those sort of committees? Is that what you're saying?

**DR MUMFORD:** Well, the few minutes I've seen from those committees have been very, very brief – you know, one/two liners – on something which could be described as quite a significant event, and those committees are at such a frequency that they don't lend themselves for urgent action.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** So they're a governance assurance route or reassurance----

**MR MACKINTOSH:** They're for these reports that Mr Walsh has talked about, about reporting on national targets.

**DR MUMFORD:** Yes, so-- and I know that if we go on to a little bit further down, we have a rapid escalation, big red

arrow, but it doesn't describe what that rapid escalation actually looks like or how that works, but-- and I think it would do well to define that more clearly so that that-- if that is the lead ICD to the executive with overall responsibility for HAI, that it says that.

**MR MACKINTOSH:** Yes.

**DR MUMFORD:** So that it sets it in a policy or an SOP, that that is an accepted route of escalation.

**MR MACKINTOSH:** Yes, and this might be an appropriate time to talk about something I was going to do tomorrow, but I think I'll do it now to save some time. Returning to this executive control group idea that Dr Inkster had-- Perhaps I should just set it up for completeness. We had evidence of an executive group dealing with the decant. You were reading the minutes of a meeting.

**DR MUMFORD:** Mm-hmm.

**MR MACKINTOSH:** You're nodding.

**DR MUMFORD:** Yes. Sorry, yes, I did.

**MR MACKINTOSH:** We had evidence of the decision for the small-scale decant to the CDU from Ward 6A in early 2019 being discussed at the morning stand-up in the ward with-- or near the ward with the chief executive.

Do you have any comments, either of you, about the way that NHSGGC and these events around the Schiehallion unit dealt with the connection between the infection control doctor as the primary investigator and the people who made decisions about how the hospital should be run in the form of the executive group? Is there any balance of power issues, balance of information issues that you want to draw to our attention?

**DR MUMFORD:** I think there was a very high expectation placed on the chair of the IMT without the associated authority to take action. And I'm not saying that the authority should sit there, but there was a very high expectation placed on the chair of the IMT, and I think that--

Maybe this, you know, process/framework will solve the problem. I think, you know, it remains to be seen, but there needed to be a better escalation route then, which would have allowed the chair of the IMT to escalate in a much more formal way.

Sending an email is fine as far as it goes, but it's not a formal route of escalation, and the ability for the-- For instance, the review group that decided that they would do the decant from 2A/2B into 6A, there was nobody from infection control at that meeting.

Now, if-- That's a really big decision, and if you're going to make a really big decision, you kind of need your

subject matter expert to come along, brief that meeting and make some recommendations in person so that they can be questioned, whereas what you didn't have was any sort of subject matter expert as to whether or not this was (A), going to work--

And you know, maybe you should have had a clinician there as well who could have explained the risks to the patients and what the necessity was----

**MR MACKINTOSH:** Yes, because there was Mr Redfern's paper, which looked at all the options.

**DR MUMFORD:** But he's a manager. He's not a clinician.

**MR MACKINTOSH:** Well, what I mean is, are you saying that it would have helped to have someone like Professor Gibson----

**DR MUMFORD:** Gibson, yes.

**MR MACKINTOSH:** -- and Dr Inkster in the room?

**DR MUMFORD:** Yes, so that they can explain the issues, they can explain their proposed solution and they can be questioned so that the executive team making the decision can have assurance that they understand what the issues are.

Sometimes, it's very difficult to cover everything in a paper. So you might have a paper, but if you don't-- if you cannot interrogate that paper by having the person-- the subject matter experts in the room, it makes that really difficult. And it was a really big decision, and it turned out to be an even bigger decision than they thought it was going to be.

**MR MACKINTOSH:** Because it was longer?

**DR MUMFORD:** Because it went on for so long.

**MR MACKINTOSH:** I mean, I've already asked you, and I think I'll come back to Ms Dempster in a moment, but just-- I'll follow up. I asked you about the decisions in 2015 as if the two of you had been sitting in the shoes of people who were doing that event. So if I can ask you, Dr Mumford, if you put yourself in the shoes of Dr Inkster at the time of decant.

Now she's explained, if I recollect, that she was content with the solution because she thought it would be a short-term solution. Are you comfortable with the conclusion she reached, or do you feel there's anything that needs to be said about whether it was----

**DR MUMFORD:** I think--

**MR MACKINTOSH:** -- problematic?

**DR MUMFORD:** I mean, I didn't see-- I haven't seen the risk assessments that were done at the time. You know, we know there were some delays because they had to do some work in the bathrooms and so on, so it's difficult to say, but if you just take the concept of,

"Should we decant this ward so that we can really get a grip of what is going on?" then, yes, that's an absolutely understandable decision.

Where the best place to decant to, I don't know all the ins and outs of it, obviously, but it seemed to be, "Well, that's the easiest ward to empty," rather than, "This is the best environment" or so on.

**MR MACKINTOSH:** There's a view expressed that 6A is the easiest ward to decant. It's the easiest ward. It's nearby. It's in the building. It beats the alternatives because it's quicker than building a new ward in the car park. It beats going elsewhere because there's no access to IT and all these things.

I'm wondering whether you can help us on whether-- how much that decision to go to Ward 6A seems to be grounded in the idea that it's going to be quick or not very long as a decant.

**DR MUMFORD:** I think that would have made the decision easier to make. To think it was only for a few weeks would have made a decision like that much easier, because if you're thinking of a longer-term decant, you would-- I think you would think harder about it and maybe be-- It would change your risk profile.

**MR MACKINTOSH:** Ms Dempster, if I put you in the shoes of Ms Devine at that point in 2018, do you have any views about the decisions she was involved in making around the decant and her support for it as an infection control nurse?

**MS DEMPSTER:** No, I think you would have been part of the process, that decision-making process, and then you, as the IPC team, would have been involved in assessing 6A, going to it, looking at it, what needed to be done, the standards.

Things couldn't be changed like the ventilation, etc., but I think it would be you would be there supporting once the decision has been made on how can you make this happen and how can you support the clinical team to move over as well.

**MR MACKINTOSH:** So if we return back to the comment that Dr Mumford was making about the informality of the management of Dr Inkster through emails and those sort of reporting mechanisms, for both of you, is it reasonable for the executive side of the Board to be the ultimate decision maker on whether you decant, whether you close the ward to omissions?

Are these decisions something that it is perfectly proper for an executive board to make, or is it something that should be made by clinicians and infection control doctors? I wonder if you

have any view, Ms Dempster.

**MS DEMPSTER:** I think that the executive team would make those decisions based on the information from the others. You know, I don't think any board would just say, "Oh, we're going to move across to Ward 6A tomorrow." They would have the information about that move from the IPC team, the infection control doctor, the clinicians caring for the children, and they would be making their decision based upon the information they'd received and assessed.

**MR MACKINTOSH:** So there's nothing wrong, Dr Mumford, about that decision being made by a medical director and the chief executive and the head of service and these people?

**DR MUMFORD:** No, because it was a very big decision, and my feeling is that that absolutely should not have been left to the chair of an IMT. You know, it had to be made at a higher level and it had to be made at a level which would make everyone feel comfortable, so the executive seems to be the correct place, with the executive who has the HAI responsibility present for that decision.

**MR MACKINTOSH:** Well, what I'll do is I'll return to this topic when we get to 2019, which we'll do tomorrow. It's now twenty to four. I want to just deal with selection pressure and meropenem, the last topic before four o'clock.

Now, you provided in your addendum report, which is Bundle 21, Volume 1, Document 11, at 773-- The next page, please. This section here about meropenem, which of you is the principal author of this section?

**MS DEMPSTER:** Dr Mumford.

**MR MACKINTOSH:** Dr Mumford. So you watched Professor Leanord's report-- evidence on this?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** He has produced to the Inquiry a paper by Aitken et al., which is published in the-- which is yet to reach it into a bundle. I think it'll make the 19th volume of Bundle 27, but I know core participants have it. It's entitled:

> "Alterations of the Oral Microbiome and Cumulative Carbapenem Exposure Associated with Stenotrophomonas maltophilia Infection in Patients with Acute Myeloid Leukaemia Receiving Chemotherapy."

You provided us with a paper, which is in a bundle, by Masit(?) et al., which is in Bundle 27, Volume 17, Document 29-- Oh, Aitken was there. Well, we've got Aitken on the screen, just so we can see it and prove it exists, but if we can go to Bundle 27, Volume 17, Document 29, page 336.

Now, your report, your

supplementary report, if we go back to that-- So that is 21, Volume 1, page 774. I wonder if you can help us here, because I think, for us who are lawyers, it gets very confusing. What is it that would have been seen at the time and would have been noticed at the time, or should have been noticed at the time, that would have been indicative of infections caused by meropenem resistance?

**DR MUMFORD:** So I think everybody agrees that meropenem overuse produces a risk that you will start to select out meropenem-resistant organisms. I don't think that is disputed by anybody, but what you tend to see, if you start increasing the amount you use, is that, over time – and there is always a lag period – that you then start seeing your meropenem resistance creeping up.

Then you reduce the amount of meropenem you're using because it can't be used as much because you've got a higher percentage of resistance, and then, again, after that period of time with a lag, you will start seeing normal service being resumed and the resistance levels going down again.

But that happens over a long period of time, so going up and coming back down. And, actually, the coming back down again is usually longer than the going up----

**MR MACKINTOSH:** Right.



**DR MUMFORD:** But that's not what I think happened here.

**MR MACKINTOSH:** Well, if we were to look at the Harvey Wood graph, the one that prompted Professor Leanord's idea, as it were, which I think we can find in Bundle 19, Document 19, which starts at page 143-- and if we can step forward and keep going, keep going. I think it's coming up soon. Please zoom out. There we are. Is that it?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Yes, so----

**DR MUMFORD:** No, this is the use of antibiotics, it's not resistance.

**MR MACKINTOSH:** It's the next one?

**DR MUMFORD:** Yes. There you go.

**MR MACKINTOSH:** Is that the one?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Can you help us in looking at this graph to understand it correctly, from your point of view? So what's your lesson that you're drawing from this? I recognise Professor Leanord's told us what he saw in here; what do you see here?

**DR MUMFORD:** Okay, so this is all numbers. It's not rates and it's not percentages. It's all numbers, as I understand it.

**MR MACKINTOSH:** Why is that a

problem?

**DR MUMFORD:** Because the straightforward numbers of resistant organisms don't give you-- Because you could have three Stenotrophomonas, which would skew your data, and it's not necessarily because they've been selected out, it's because that's what come-- If we assume that there's a water source, having three Stenotrophomonas in a quarter is because you've got three Stenotrophomonas in a quarter. It's not because they've been selected out by patients having meropenem.

**MR MACKINTOSH:** So you need a rate per patient or per blood culture or per occupied bed days?

**DR MUMFORD:** So you need a rate associated with the number of isolates that you have in that quarter.

**MR MACKINTOSH:** It's a bit like a rate by positive blood cultures but slightly different?

**DR MUMFORD:** Yes, so it's percentage resistance, which is created by the number of resistant organisms divided by the number of total organisms isolated in blood cultures in that quarter.

**MR MACKINTOSH:** Right, but this is just absolute numbers?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** So what can this tell you?

**DR MUMFORD:** So what you see is-- so the solid lines with the triangles and the diamonds on are how much antibiotics you were using – so blue for Cipro, yellow for mero and blue for Tazocin – against the number of blood cultures. So "DDDs" for antibiotics means "Defined daily doses," so that's the number of doses that you were giving rather than the number of patients on antibiotics----

**MR MACKINTOSH:** So some of them might have two or three doses?

**DR MUMFORD:** Some of them would have many more than that, yes.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** So you'll see that there is a slight increase in meropenem use in the first quarter of 2018, but prior to that, it's reasonably level.

**MR MACKINTOSH:** That's the yellow line with the green squares-- green triangles?

**DR MUMFORD:** Triangles, yes, and then the dotty lines are the number of resistant gram-negative organisms, so this is the environmental organisms.

**MR MACKINTOSH:** This is using the right-hand scale?

**DR MUMFORD:** No. Yes, sorry. Yes, so it's the number of blood cultures with a resistant organism in it.

**MR MACKINTOSH:** So, for example, in early 2014, it's two?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right.

**DR MUMFORD:** And you can see for both meropenem and Tazocin that that fluctuates quite a lot and it goes up and down. If you had a high level of meropenem resistance, that would not fluctuate that much. If you were----

**MR MACKINTOSH:** It would go up there and stay up there?

**DR MUMFORD:** It would go up and it would stay up, and you can see across the bottom, you've got the purple diamonds and that's the ciprofloxacin because you haven't got any resistance to ciprofloxacin amongst the environmental organisms. Oh, I've done something weird with my screen.

**MR MACKINTOSH:** Yes, if you touch it, it doesn't like it.

**DR MUMFORD:** No.

**MR MACKINTOSH:** Effectively, is this chart showing that-- You're saying that this chart shows that there is a broadly consistent number of-- amount of meropenem use and, yes, there is an increase in meropenem infection and gram-negative cultures in early-- in the second and third quarters of 2017, but there's a big reduction in the fourth quarter and that is a no-no for a meropenem resistance? You wouldn't get that?

**DR MUMFORD:** Yes, yes.

**MR MACKINTOSH:** Right. Is there anything else you feel you need to add on this topic of meropenem resistance?

**DR MUMFORD:** Well, in the paper that I wrote, I reworked the data that's in the----

**MR MACKINTOSH:** Shall we go back to your paper, which is Bundle 21, Volume 1, page-- Thank you.

**DR MUMFORD:** And put in a percentage of resistance.

**MR MACKINTOSH:** Over the page.

**DR MUMFORD:** So you can see the red line is the percentage of resistance.

**MR MACKINTOSH:** So that's been added by you?

**DR MUMFORD:** Yes, so I've used Kathleen Harvey-Wood's data and just reworked it to show resistance rates.

**MR MACKINTOSH:** So, in a sense, that's the percentage of total blood cultures that are positive for meropenem-resistant organisms?

**DR MUMFORD:** The line, the red line.

**MR MACKINTOSH:** Red line.

**DR MUMFORD:** Yes, so you see in 2015 quarter two, you've got 100 per cent resistance because there was one positive blood culture and it was resistant to----

**MR MACKINTOSH:** Right.

**DR MUMFORD:** But that doesn't tell you that you've got a problem. That

just tells you that you just happen to have a resistant organism.

**MR MACKINTOSH:** Yes.

**DR MUMFORD:** And then, as you go across, you can still see that the rate of resistance is fluctuating quite a lot.

**MR MACKINTOSH:** But it's still there, isn't it?

**DR MUMFORD:** It's still there, but then you would expect that. In most of these quarters, but not all of them, you had two or three Cupriavidus-- sorry, not Cupriavidus, Stenotrophomonas isolated, and they are always resistant to meropenem.

**MR MACKINTOSH:** So they're skewing the data?

**DR MUMFORD:** Yes, so if you have-- So let's say, second quarter of 2017, when you've got 13 cases and you're running along at 40 per cent meropenem resistance, that's equivalent to three Stenotrophomonas and maybe a Cupriavidus or something similar.

**MR MACKINTOSH:** So you have to check that against it?

**DR MUMFORD:** So you'd have to go back and check against the log of bacteria, but it doesn't----

**MR MACKINTOSH:** But you could check that against the case notes review report, couldn't you?

**DR MUMFORD:** You could, and I could check it against the bacteraemia data.

**MR MACKINTOSH:** But without even going to the data, will the case notes review report which years everything's in?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right, okay.

**DR MUMFORD:** So there doesn't seem to be a problem with the meropenem resistance that is driving the organisms.

**MR MACKINTOSH:** Are you effectively saying the meropenem resistance is being driven by the number of meropenem-resistant organisms that are there because there's a water problem?

**DR MUMFORD:** Yes.

**MR MACKINTOSH:** Right. Now, there are a few questions that I've been asked to put to you. They may become irrelevant, but I'll ask them. (After a pause) Are you claiming that the only effect of meropenem is on fully resistant organisms?

**DR MUMFORD:** No.

**MR MACKINTOSH:** No. Are you oversimplifying the mechanism by which meropenem exerts selective pressure, implying that only fully resistant isolates will then go on to cause infections in patients, and the situation is more complex than this?

**DR MUMFORD:** No.

**MR MACKINTOSH:** No. So does it matter, for your conclusion, that there is a range of different levels of resistance in meropenem organisms?

**DR MUMFORD:** No.

**MR MACKINTOSH:** Could it be that you've misunderstood either Professor Leanord's evidence or Dr Harvey-Wood's data?

**DR MUMFORD:** I don't think so, no. I've gone back and looked at the transcript of Professor Leanord, I've gone back and looked at the transcript from Dr Harvey-Wood, and I don't think I've misunderstood anything.

**MR MACKINTOSH:** Okay. Now, if we go back to your addendum at page 775 – we're there already – you were asked specifically to comment on the potential influence of meropenem on the acquisition of Cupriavidus pauculus infection:

> "A study published in 2020 showed that only 8 per cent of Cupriavidus isolates were susceptible to meropenem (74 per cent resistant). In Dr Inkster's publication on Cupriavidus in healthcare water systems, she found that only one in five organisms found in the study were susceptible to meropenem."

Given that Cupriavidus is relatively common in water systems, the low pathogenicity, but in highly immunocompromised patients, is it plausible the selective pressure of meropenem and other broad-spectrum antibiotics was a contributing factor to a small number of these infections?

**DR MUMFORD:** Well, there is a very small number of Cupriavidus infections. I don't think that meropenem would have-- meropenem usage would have, because it would be – directly or indirectly through the environment – acquired from the water, not as a--

It doesn't form part of the microbiome of the gut, therefore there's no other mechanism apart from that 'direct/indirect from the water through the environment into the patient' route. So I don't think it would have any effect.

**MR MACKINTOSH:** On the next paragraph, 2.9, you say:

> "In the light of this high level of resistance, one [would] suggest that selection pressure by the use of meropenem could contribute to Cupriavidus infection. However, this is highly unlikely…"

Well, you just said that. If we can go back to the previous paragraph, what is the evidence of this high level of resistance? No, I'm not going to ask that question; I think you've probably covered it.

Right. I think, my Lord, this is probably a good time to peter out at the

end of this chapter and suggest that we break for the end of the day.

**THE CHAIR:** We'll do that. We'll sit again at ten o'clock tomorrow, if that's appropriate. Well, it is appropriate, but we'll see each other tomorrow morning.

**MS DEMPSTER:** Okay, thank you.

**(The witnesses withdrew)**

**THE CHAIR:** Then we'll see each other tomorrow at ten.

**(Session ends)**

**16:02**