SCOTTISH HOSPITALS INQUIRY

Hearings Commencing
29 August 2025

Day 8
29 August 2025
Dr Sara Mumford

CONTENTS

Opening Remarks 1

Mumford, Dr Sara (Affirmed)
Questioned by Mr Mackintosh 1-158

9:33

THE CHAIR: Good morning. Now, I think we're able to continue with Dr Mumford?

MR MACKINTOSH: Yes, Dr Mumford returns, my Lord.

Dr Sara Mumford
Affirmed

THE CHAIR: As you will have anticipated, we plan to take a coffee break at about half past 11, but if at any stage you want to take a break, just give me an indication. At the risk of repeating what I probably said to you before, it's very useful for me if you keep your voice up a little bit louder and slower than you would in normal conversation.

THE WITNESS: Thank you.

THE CHAIR: All right. Mr Mackintosh?

Questioned by Mr Mackintosh

MR MACKINTOSH: Thank you, my Lord. Thank you for coming back, Dr Mumford. What I'm proposing to ask you about is in three areas. I think I had intended to ask rather more questions about the HAD Report than I previously did, but I don't, for now, feel the need to.

But I'm going to focus on three topics, one being the work of Mr Mookerjee and the changes he's made to his report in recent days; secondly, a discussion about risk and the concept of how risk and the concept of safety relate to each other in terms of risk management based on your report on that subject; thirdly, just intend to see where your original conclusions given in your original report and your evidence last year with Ms Dempster have evolved, if they have since then, in result of the HAD Report and possibly Mr Mookerjee's work. I'm proposing to do that latter part after lunch. Hopefully, it'll form three neat parts during the day.

If I might turn to Mr Mookerjee's recent evidence on Tuesday, did you have the opportunity of watching his evidence or reading the transcript for it?

A I saw some of it and I've read the transcript.

Q Thank you. How much of Dr Chaput's evidence did you see the previous week?

A A little bit.

Q A little bit. Now, if we might start by a report produced by Dr Chaput in bundle 44, volume 4, document 1, page 3. Volume 4 of 44. Thank you. So, I wonder if you've seen this report before from December?

A Yes.

Q Now, in essence, what did you

understand was the point being raised by Dr Chaput in respect of your work?

A So, my understanding is that Dr Chaput felt that we had not included or we'd been very selective in including-- which organisms had been included in the calculations that Mr Mookerjee did and then I had taken that into my report and used an inferior data set to suggest what the difference was between the comparator units and my-- and the Schiehallion Unit.

Q Because the reality is that you're the microbiologist, so the definition of which microorganisms are relevant comes from you, not Mr Mookerjee?

A So, originally, myself, Ms Dempster, Mr Walker, as another microbiologist, and Mr Mookerjee got together and went through and compared all of the data-- all of the environmental organisms that had been identified in all-- in several different reports – so, in the CNR, in the HPS report, in the data that we had from GGC – and put that together and made sure that Mr Mookerjee understood which were environmental organisms and which were not.

The reason that we did this is because (a) he's not a microbiologist and (b) he had some in his data set that he was trying to include, including things like Haemophilus and Salmonella, which clearly are not environmental organisms.

So we just wanted to have that clarity that we agreed on what an environmental organism was, and so we used all of the reports together.

Q Was there ever a single list setting out all those organisms placed in any of the reports by you, Ms Dempster, Mr Mookerjee, or indeed Dr Walker, as far as you're aware, a single master list?

A I know that-- I think Mr Mookerjee had a list, but I don't think that it was that list. I think he had the list of organisms that we found in the Schiehallion Unit.

Q When you were working on this, was it the Inquiry's intention that you, Ms Dempster and Mr Mookerjee would produce a joint report?

A Initially, yeah.

Q Initially, and could it be that I asked you to separate your reports so that you and Ms Dempster produced what became the qualitative report and Mr Mookerjee produced the quantitative report?

A Yes.

Q So, if we look at Dr Chaput's paper and, in a sense, take it short by going to page 5 of the bundle, she presents in two tables, on this page and the next page, a list of organisms. Now, what I want simply to understand is: are you saying that, effectively, she was arguing that there are organisms on this

list that weren't seen at Queen Elizabeth that she thought you hadn't taken account of in Sid's calculations?

A Yes, there are organisms on this list that did not appear in the Schiehallion Unit data set. She is wrong in thinking that they weren't taken into account. Sid took all of these organisms into account when he did his calculations.

Q Would you accept that, to some extent, the fact there isn't a master list in any of these reports might have been part of the cause for her being wrong in that respect?

A Entirely. Yes, in retrospect, that should have been included.

Q If we go to Sid's report-- Mr Mookerjee's-- well, we shouldn't call him Sid. We should call him Mr Mookerjee, and I do that as well, and go to bundle 21, volume 1, document 1, and we look at-- I just might let it load up on my computer. I'll try again, but my computer's now decided to open all the bundles on the computer at once. There we are.

So, if we go to his report, which is bundle 21, volume 1, document 1 at page 19, yes, 19, the table at paragraph 7.1. If we look at his case definition for the first row on the table, which we see the first three lines here, so the "Data" is "Patient infection episodes" and we go over the page and we go back to the previous page, and the "Data specifics" is "Queen Elizabeth including RHC". The case definition is "Gram Negative bacteria – environmental [over the page] and enteric group and fungi", and for comparator institutions it's the same wording. Might that be in a sense the closest he comes to saying it's the same data set, same list of infections?

A Yeah.

Q So, if you were to go back to Dr Chaput's report in volume 4 of bundle 44, which we were looking at a moment ago, and go to page 6, is it your understanding that everything on this list was included in his process either, if it's on this page, in the comparator units or, if it was on the previous pages, on either the comparative units or the Queen Elizabeth?

A They were included, yes, even the Salmonella, which I don't agree should've been on there, but yes.

Q If we take that off the screen, I don't know whether you saw this part of-- Sorry, you wrote a report in response, which is bundle 44, volume 4, document 2, page 9, and this was prepared in May. If you go to page 10, what do you say in page 10? Is this you explaining your answer to a question I asked you in the Glasgow 3 hearing about this issue in paragraph 4?

A Yes, yeah.

Q So your evidence in the Glasgow 3 hearing was, to this extent, inaccurate in that you gave the impression that he had removed organisms from comparator data sites which did not appear in the Schiehallion data?

A At that time, yes.

Q It may have been the way I asked you the question, to be fair, but you did say that.

A Yes, and I hadn't reviewed Mr Mookerjee's workings at all in coming to that conclusion, which I should've done.

Q Now, over the next page on page 11, did you provide a table for the Great Ormond Street comparator infection count?

A Yes.

Q Now, that then prompts another issue, which we'll come back to that in a moment, but what I want to do is to put to you, if we take that off the screen, what my colleague Mr Connal discussed with Dr Chaput.

Now, he asked her-- she'd used the word "bias" in her statement and he felt he wanted to ask her about it. She explored that in some detail, but eventually I get the impression that she had been concerned that a choice of only looking at infections found in the Schiehallion Unit would expose sort of analytical bias towards or against Glasgow. I know that's not what was done, but do you understand why she might say that?

A I think so. I think, you know, we were asked to look at environmental organisms arising from a particular environment or potentially arising from a particular environment, and so it made sense to us to look at the patients who had been in that physical environment and not spread the net wider to patients who may have been admitted with the-- with haemato-oncology conditions but had not been on the Schiehallion Unit when they became unwell with a bloodstream infection. So we were very much looking at patients exposed to the environment.

Q But your comparison considered all the potential infections, even the ones that, as it were, didn't happen in that location in the comparison. His comparison, rather, compared that subset of the potential infections that occurred in Glasgow with that subset of the potential infections that occurred in the comparator units.

A Yeah, and we counted them in the same way.

Q Right. Now, if we think about Dr Chaput's then issues with Mr Mookerjee's exercise, what I wanted to do was, because Mr Mookerjee explained in evidence that he'd discussed the

matter with you, now, ultimately he took the position that in respect of some parts of Dr Chaput's criticism he accepted them, or at least he accepted to work with them for the purposes of his exercise, and in some he didn't accept them. What I was proposing to do is go through, in a sense, the five headings and understand from you what involvement you had in discussions with him.

So, if we go to his report, which is bundle 44, volume 10, which has not yet been put on the website because we're waiting to add something to it, and we go to page 4-- sorry, volume 9, and we go over the next page and the next page. If we go one more page. Right, it's about four pages further on. Sorry, I haven't got mine on my screen. If we go to the annex, which follows after that, after that. There we are. If we go to page 18. I'll get there eventually.

Right, now, what I want to do is look at each of these hospitals in turn. Now, if I understand correctly, Dr Chaput's criticism was that she does not believe that Cardiff and the Vale were deduplicated, and Mr Mookerjee does believe that Cardiff and the Vale were deduplicated. Did you get involved in that discussion at all?

A No, not at all.

Q No. In respect of Leeds, to one extent, there's the same tension between the two of them. Did you get involved in that discussion?

A No.

Q No. Over the page on page 19, there's then a question around the use of a partial year in 2016 in Leeds. Did you get involved in that?

A No.

Q No. Over the next one, there's then a discussion about whether Oxford deduplicated. They didn't say anything about deduplication, but did you get involved in that?

A No.

Q Now, before we look at Great Ormond Street, Mr Mookerjee's broad approach seems to have been, "We asked them a question in an FOI request that requested deduplicated data. Unless they're really overt that they haven't done it, I will work on the assumption that they did." Is that your understanding of his approach?

A That's my understanding of his approach, yeah.

Q What's your view of that as a sort of practical approach in this field?

A I think that there is an option when you put an FOI out that if you don't understand the data when it comes back, that you go back and ask for some clarification, and I think that that possibly could have been done. I mean, I agree with him that, you know, if you ask for an

FOI, you try to rely on what you get, but I think that the vagueness of some of the information that came back would suggest that he should've gone back for some clarification.

Q Do you have any difficulty with him using the data he received for these three hospitals for the reasons he used them?

A So, if they deduplicated further, the rates would only go down, not up.

Q What effect would that have on the study he was trying to carry out?

A So that would lower the mean rate of infection in the comparator units, so that would very much play into suggesting a bigger gap between what we observed in the Schiehallion Unit and what was coming back from the comparator units. So I don't think it is-- Whilst it may have made a difference if they haven't deduplicated, it would not have brought the two any closer together. It would've pushed them further apart.

Q So, if Mr Mookerjee's position is that for some years there is a statistical significance in the difference, that's a statistical significance would only have got larger?

A Yeah.

Q We turn to Great Ormond Street. Now, if we can go over the page, do you understand the point that both Mr Mookerjee and Dr Chaput are making about these three columns provided by Great Ormond Street now that you look at this data set?

A Yeah.

Q What do you understand to be the issue, if there is one, around the "Episode14Day" column on the right-hand side?

A I assumed that that was the deduplicated column.

Q Right.

A It is-- You know, to the uninitiated in deduplication, it would suggest that, "Why are there zeros in there?" because clearly there's been an episode, but I would say they're either cases that have already been seen----

Q Elsewhere in the list.

A -- elsewhere in the list or have not been-- because we asked specifically for data from the haem-onc units in these comparators, that if they had the first diagnosis or first blood culture taken in A&E, for example, or a clinical decision unit, that that would count and everything else----

Q That would count in deduplication.

A -- taken on the unit would then have been deduplicated out, hence the zeros.

Q So, if you had a patient who is received in A&E, they take a blood

sample----

A Yeah.

Q -- then within 14 days, they're on the Paediatric Haemato-Oncology Unit, that would deduplicate to zero from one?

A If they had another blood culture taken growing the same organism.

Q Yes, because it wouldn't be necessarily an infection acquired-- might not be an infection acquired in the Haem-Onc Unit.

A That's not the reason.

Q No?

A The reason would be that within 14 days it's assumed to be the same infection.

Q Right.

A So you don't report it twice.

Q However, Mr Mookerjee's evidence was that he was now, for the purposes of the study, proposing to accept Dr Chaput's view that she should use the right-hand column----

A Mm-hmm.

Q -- and has now used it. Did you have any role in-- Did you have a conversation with him about that before he gave evidence?

A I did talk to him before he did that about what the-- that "Episode14Day" column meant because-- and around the zeros and so on and suggested to him that he needed to look at that and do the calculations based on that column.

Q Did you know that was what Dr Chaput was suggesting he do?

A Yes.

Q Right. If we move on through Dr Chaput's paper onto the next page, the GGC deduplication exercise. Now, it's probably easier to look at the end of this table, which is on page 24. So, if I understand what Dr Chaput has said here, she noticed that the total number of infections counted by Mr Mookerjee at the Schiehallion Unit by his definition is 187 after his deduplication, and her view is that 159 should be the figure after deduplication. Did you have a conversation with Mr Mookerjee about her issues?

A I did, because when I read this I thought I just needed to check it for myself. So I went through the spreadsheet of, you know, the 215,000 lines and deduplicated manually for each organism where there was a disagreement between Dr Chaput and Mr Mookerjee. And I found that in the majority of cases, I agreed with Dr Chaput and not with Mr Mookerjee, so we did have a conversation about him looking at it again, you know, what was the reason-- potential reason for him getting a different outcome, and whether

or not his coding that he'd deduplicated based on was correct and that perhaps he should be having another look at it, doing it again.

Q And he ultimately decided to proceed on what I suppose you could describe as a Chaput-inspired calculation, because Dr Chaput has chosen not to provide an annual figure within 159, but he's now created one.

A Yes.

Q Was that something that you were aware he had in mind when you spoke to him or was that something that happened after you spoke to him?

A No, I really left him to it and, you know, suggested he take another look and set him off doing that.

Q Do you have any view about the idea of him creating an annual number of infections for Schiehallion that in a sense is inspired by Dr Chaput's comments, probably not necessarily exactly what she would do, and comes up with a total 159 as a way to resolve this issue?

A It needed to be looked at. In order to be able to look at the rates, it needed to be done on an annual basis.

Q Now, what would be the effect, or what is the effect, of moving from a number of infections in the Schiehallion overall rate that was 187 in the original quantitative report down to 159 in-- I think I invented the phrase the Chaput-inspired rate. Again, thinking about the comparison exercise, what's the effect of that?

A It would, in places, reduce the rate of infection in the Schiehallion Unit, the observed rate, and bring that closer to the comparator unit.

Q Is that inevitable, because I think actually in Mr Mookerjee's number there is a year when it goes up?

A It-- Well, it shouldn't go up because it should have been-- he should have had the organisms in the right year to start with.

Q Right. Now, if we then----

A Although the rate would-- you know, the number wouldn't change, but the rate-- No, that's not right. No.

Q Okay. If we go to his conclusions, which he set out earlier in this document, put it in a chart. Well, it's in page 16 and over the page on 17. No, 16. Yes, that's what I wanted to come across. So, this is the paper he attached to the note, but this isn't the paper that he ultimately spoke to. We have that. It's going into a bundle, but it hasn't yet gone in. We don't have that at the moment. Have you looked at his final calculations, the ones he gave evidence earlier in the week on?

A I've looked at the-- I've seen the paper that he did eventually.

Q He did eventually, yes. Now, I'm looking nervously at my colleague I realise I probably haven't told I want to see this document. We'll take this off the screen. What do you understand to be Mr Mookerjee's final conclusions?

A That there is-- there remains, after all of the recalculation, including the GOSH recalculation which has taken the comparator down-- that there remains a statistically significant difference in the rates for three years: 2016, 2017 and 2018.

Q Now, I understand that you're not actually in a position to be able to give evidence about whether there is a significant difference. That's not your thing.

A Absolutely not.

Q No. Is there any other aspect of the data that he produces that remains the same? The charts or the trends or the differences?

A I think that the shape of the curve remains roughly the same, which is kind of the significant thing because the-- the shape of the curve is seen in many, many different reports and shows the increase in rate across those years from 2016 to 2018.

Q Now, after all that change, what should we make of Mr Mookerjee's final document? I mean, what I've done is I've asked for him to provide the tables that contain all the numbers applied in the chi-squared p-value calculation. I may have misdescribed that, his statistical exercise.

I've asked core participants to-- We'll get back to them probably today and I've asked core participants to respond within two weeks if they, for example, have any contribution they want to make about that calculation, and I've set two weeks because a witness in the Part 3 hearing I think could speak to this, and I will deal with the responses when they come in, but other than that issue about statistical significance of the calculation, what should we do with Mr Mookerjee's, as it were, final conclusions?

A I think they're so similar to the conclusions that other authors, including the HPS and CNR have, made that they hold some validity in that the shape of the curve is the same, but the-- the significant difference-- and I don't think that has changed, but I can understand that there is weariness around----

Q Well, that's what I wanted to put to you because I suppose there's two countervailing positions. One is that when an expert changes their mind in response to questions put to them over a period of time, starting last year when he realised that the admission day data he'd been given was only overnight data, and

then the changes he made when it was put to him that 2A patients ended up elsewhere in the hospital and he hadn't taken account of that, and now this-- One view is that that damages an expert because they become to some extent unreliable. You worry is there going to be another change around the corner, and therefore you don't give them any weight.

Another view, which to be fair is the one that Mr Mookerjee has expressed, is that the process of carrying out epidemiology is a continuous dialogue and you would expect such discussions to take place. It's just, unfortunately for him, in contrast to many of the other reports, we've done it all in public, often in these hearings. Do you have any view on whether either or both or neither of those perspectives have value?

A I think there's undoubtedly been a lot of scrutiny on what Mr Mookerjee has done, more so than other reports which have been brought into the Inquiry. I think I was interested in Dr Drumright's observations that epidemiology is inherently inaccurate and that you will always find inaccuracies in data such as this, but I think the overriding factor is that the curve is the same, the increase in infections is seen across all of the reports that we have. But I'm not in a position to say whether or not it's epidemiologically sound because I'm not an epidemiologist.

Q What I'm proposing to do is I'll come back to the weight you want to give it this afternoon when we revisit your conclusions from your original report and your evidence from November.

A Okay.

Q We'll also talk about the HAD Report too, of course, who have been through their own journey as well. Let's move on now to a topic that relates to your risk management report. So, this is in bundle 44, volume 6, and at page 4. It's document 1. We asked you to prepare a report on risk as it relates to the current safety of the water and ventilation system, and where does your experience in risk and how it managed come from?

A So, I've been in medical management for many years, probably about-- well, coming up to 20 years but not quite, in one way or another. I've spent 18 years as director of infection prevention and control where, you know, risk management is kind of the bread and butter of what you do in-- in infection control and certainly at that level where you're looking more strategically than operationally. I've held various clinical management roles where I've been-- I've led on the management of risk in pathology departments, in radiology departments, other clinical settings.

I spent five years as a deputy medical director, where part of my role was around supporting risk management across the trust; and then for the last year and ten months, eight months, I've been the chief medical officer at my trust and I sit on the board and we manage board-level risks; and I'm also co-chair of our Patient Safety Oversight Group where again we manage risk and co-chair of our Risk & Regulation Committee, again which deals directly with risk and particularly in relation to regulation of clinical activities.

Q My first question is: are you willing to adopt this report as part of your evidence?

A Yes.

Q Yes. What I want to do is to understand firstly-- You've quoted from other documents in this report. You've provided us charts from the Northern Ireland Infection Control Manual, from an NHS England Principles of Assessing Risks and you've referred to a number of documents, including the Orange Book, and I wondered to what extent are the concepts in here specific to the health sector? Or is risk management a rather wider concept?

A Risk management is a much wider concept. I mean, every industry, every-- you know, schools, I mean, every part of society has to manage risk. I think what is unique to the health sector is the patient safety aspect of it and managing the risk around patient safety and taking the impact on patients when risk management-- during your risk management is really key to everything that we-- we do in the health sector.

Q I wonder if we can look at the report and go to page 5. I hope I'm not being unfair but, paragraph 3, is that your original phrasing or is it something you've acquired from elsewhere?

A I'm sure it's influenced from elsewhere, but it did come out of my brain rather than somewhere else.

Q I mean, what's the influence of this idea?

A I think it-- Safe effective person-centred care is one of those things that we-- it's an idea and a concept across health, in relatively recent years in those terms. It's something that, you know, we have to think about on a day-to-day basis. You know, patient first, patient at the centre of everything that we do. It's patient safety being absolutely paramount in the way that we run the hospitals, manage-- manage risk, manage everything that we do. So I think it's a very common concept within health, and it's something that is really important to maintain in all of the thinking around how we manage risk.

Q Had it always been-- the health

sector in the UK, has it always been, in modern terms, patient-centred, person-centred?

A I mean, I've been around in health for 40 years or so, and I think it's-- theoretically, yes, but I think the focus has very much shifted during my career to overtly be around patient safety.

Q From your perspective, where do you think the pressure points have come to shift that focus? How's that shift in focus happened?

A I think there's a realisation that, you know, over the years, our thinking has evolved. Over the years, we've become more aware of the importance of our patients. I think it's very different from-- You know, 40 years ago, it was: you just tell the patient what you're doing and that's it; you're doing it.

And now we would discuss with the patient, we'd make sure the patient was comfortable with the plan, we would take their thoughts and feelings into consideration. We would very much explain all of the potential risks, potential for something to go wrong in their care, what the side effects of their care might be, so it's very much a shift to a better communication, better support for the patient, which has just evolved over many years.

Q Does that involve a different understanding of consent compared to, say, 40 years ago? Even though the legal test might not change, but the different practical understanding?

A From a practical point of view, yes. I mean, you know, the old adage that, you know, doctor knows best and doctor will tell you what you're doing and, you know, how he's going to manage your case or even not, but just do it anyway, has very much changed to this very much patient-centred approach to care now.

Q And so how does that extend into the environment of a hospital?

A So that means that the environment has to be as good as it can be to make it safe and comfortable for patients. I mean, I think a good example of it, leaving aside-- is maternity care. So now you won't find a maternity unit that hasn't got a birthing pool, that hasn't got lots of beanbags and balls for birthing mothers to sit on. They tend to be much more homely than clinical.

We have birth centres which are very much made into more of a bedroom than a clinical setting to give birth, and I think that-- So it's making a clinical setting more conducive for the correct care, but it's also thinking about the safety aspects and what could potentially harm the patient around the built environment that we've placed them into.

Q Yes, I'm going to come back to

"safe" probably after the coffee break in more detail, but, at this stage, you've discussed "comfortable" there in the last few minutes, last few sentences, but what do you mean by "safe"? You've used it twice in that paragraph. What do you think "safe" means?

A So, "safe" depends on the patient-- to some extent on the patient that you are dealing with, so----

THE CHAIR: Sorry, I just missed that. It depends on----?

A The patient that you are dealing with.

THE CHAIR: Right.

A So some patients will be more vulnerable, so those who are immunosuppressed, those who are receiving chemotherapy. The patients at extremes of age will be more vulnerable than your average man in the street who is normally fit and healthy and so on. And it's not just about the building, what it looks like; it's things like how safe the furniture is that you have in an environment. So can the patient catch-- you know, trap a limb in the side of a bed, for example?

MR MACKINTOSH: Can they fall out of bed?

A Can they fall out of bed? Can they trap a limb? You know, what's the risk-- if they do get out of bed, what's the risk of them then falling over, and what mitigation do you need to put in place to alert people if they've got out of bed? And so on. So it very much depends on the patient themselves what will constitute "safe".

And so, to that end, a patient in hospital, if we take for example an elderly patient, they would likely have a falls risk assessment to see what their risk of falling over would be and whether or not, if they came out as having a falls risk, that they would put mitigation in place around that patient.

They would have a nutrition risk assessment to make sure that their nutrition is good. They would have a pressure damage risk assessment. Do they have pressure damage now? Are they going to be bedbound for a while? What do we need to do to ensure that that patient does not develop a pressure area or a pressure sore? And so on.

So there's multiple risk assessments that you would do for a patient to ensure that they are in a safe environment, and "environment" here not just meaning the physical space but also the care space, if you like.

Q Although we'll get into this in more detail, you see "safe" and "risk" to be connected?

A Absolutely.

Q Right. Well, let's talk about that. We'll stay with the risk for a moment

and come back to “safe”. So, paragraph 4, you describe the risk management process, and you seem to have six steps in it. Now, I wondered whether, to some extent, you got-- that’s just your normal practice or whether it comes from a particular place.

A I think it’s fairly standard. It’s almost something that you don’t think about because that’s what we do. So, if I think about my risk register, if we’ve identified a hazard or we identified an issue that could potentially cause harm, we would open a risk. The risk register then naturally pulls you through to: what is the actual risk? What is the risk and how is it going to be manifested if it comes true?

And then you do your risk assessment: what do you need to do in order to control the risk? And then, once you’ve implemented your risk measures, what does that do then to the risk score? So you have an original risk score and you have a current risk score.

Once you’ve implemented measures, or maybe before you’ve implemented the measures, your risk score will be the same as the initial risk score, but then, when you review your risk every month, you will see that second current risk score going down. And then you’ll have a target risk score, which is where you want to get to, and so the process is-- that’s just what we do.

Q Now, I want to show you a document which you have referred to in here which had a chart that I thought I might want to ask you about, but since it’s the Orange Book, you might not be comfortable discussing this chart, and so let’s look at it and see what you think when we get there. I was hoping to have given you notice about this.

So it’s bundle 44, volume 6, document 11, and the document starts at page 128. I want to first ask you about the Orange Book and whether you’ve used it. You’ve referred to it, but to what extent would you use this as a source?

A So, it’s not a day-to-day reference book by any means.

Q No.

A It’s a kind of overview, so it’s there to refer to if you need it, but it’s not something that you would use in daily practice if your processes are set up.

Q I wonder if we can go to page 150, section D, “Risk management processes”, main principle. There are lots of very exciting graphics in the Orange Book, but this one seems the simplest. I wondered if you’d come across this idea of a four-part structure to the process of risk identification assessment, risk treatment, risk monitoring and risk reporting, and whether that bears any relationship to

what you do in practice?

A Well, it's not the process that I use on a day-to-day basis, but it does fit into what we do, and it says the same thing that I've just been talking about. It's: you identify your risk; you assess your risk; your formal risk assessment.

You would then put your mitigations in place – that's the risk treatment – so you would put your actions in place and then you monitor the risk as you go and as your actions are implemented. And then you can-- throughout that, you report and make sure that that the governance structure around your risk is in place.

Q If we can take that opportunity to go back to your report. That's 44, volume 6, page 5. The first step seems to be identifying hazards, and you define that as recognising anything that can cause harm, such as equipment, procedures or environmental factors. To what extent does identifying a hazard involve acknowledging it exists formally?

A You can't identify it as a hazard unless you recognise that it exists because, once you recognise it exists, you would then have to do some form of risk assessment, whether that's in your head or a formal written one, to identify it as a hazard rather than a----

Q So could you identify a risk in your head and decide it's not worth then considering any more?

A Yeah. It wouldn't be very good practice, but you could do it.

Q Right. Now, you are operating at the scale, now, of a trust.

A Yeah.

Q And you have one hospital?

A We have three.

Q Three? Sorry, I wasn't paying attention. You have three hospitals. Now, I'm assuming your trust is not as big as Greater Glasgow and Clyde.

A It's not.

Q No. Do you maintain a single record of your risks in the organisation or multiple ones?

A So we have a single overarching risk register, but it's held on a database which enables you to pull out risks relevant at different levels. So our clinical services are divided into divisions, so six divisions. We can pull out all the risks related to one division to show that, and below that we have directorates. We can pull out each directorate's risks, but there is-- it's one database, if you like.

Q But there will be directorate risks that don't get reported to the top-level process?

A Yeah.

Q What is the sort of thought process that decides whether you consider a risk at the directorate level or the division level or the whole

organisation level in your organisation?

A So we have the governance structure, which looks at risk, and each of our divisions would bring their entire risk register, all of their risks, to that meeting for oversight. So it's an executive-level meeting where we would look-- we have the risk register there for that division.

The division would identify-- obviously, you read the papers beforehand, but the division would-- would bring forward any risks that they were concerned about, particularly red risks, and any concerns that the executives had that they were not comfortable with – whether it was that they weren't comfortable with the mitigation or that they felt that it needed to be escalated – would then take that up to our non-executive-level quality committee, which is a subcommittee of the board, for further examination.

To the side of that, we also have, at board level, a red risk report, which is a review of all of our red risks, which we do at the board once every three months.

Q I want to go on to the next page of the report, page 6, where you discuss identification and mitigation, and you've reproduced a chart from the Northern Ireland Regional Infection Prevention and Control Manual. Now, I didn't reproduce it because I felt we've got one National Infection Prevention and Control Manual. It might create confusion to have a second one in the papers, but what do you understand is being presented here in this triangular-shaped chart?

A So, this is a-- the hierarchy of controls is something that we use, particularly in infection control, because it's a really neat way of expressing what you need to do to manage a risk. So, it's an upside-down triangle. So, elimination is-- of the risk completely, just taking the risk way, is obviously the most effective way of reducing that risk, and it goes all the way down. You substitute it for something else.

That's not always possible. That was quite an exciting subject in COVID. Engineering controls, how do we do that? Do we-- how do we separate the risk or the hazard from the patients? The administrative controls, do we write a SOP? How do we change the way people work? Down to PPE which is the least effective but is often where we end up.

Q So the first two involve, to some degree, getting rid of the risk?

A Yeah.

Q Engineering controls is a physical change to the building system or whatever it is?

A Yeah.

Q Administrative controls is telling people how to behave so they aren't impacted by the risk, or less?

A Yeah.

Q The PPE is a barrier?

A Yeah.

Q Right. If we look at the bottom of the page, you started a paragraph:

> "In the context of the QEUH/RHC built environment examples (not an exhaustive list) [I appreciate] of mitigation according to the Hierarchy of Controls…"

And you've tried to see issues you know about in the Inquiry's references in terms of these elements. So, your example of eliminations are-- Why would you have implementing of chlorine dioxide as an elimination risk?

A It's a mitigation, not a risk.

Q Sorry, elimination-- I'll start my sentence again because I misspoke. Why would you have a chlorine dioxide dosing system as an example of a mitigation that eliminates a risk?

A Because the idea of a chlorine dioxide dosing of a water system is to reduce the bacterial contamination of the water system.

Q Does----

A In its simplest terms.

Q Does that eliminate the risk then?

A Potentially, or it eliminates some of the risk.

Q Right, and then you've put down the replacement of taps and hand wash basins----

A Yeah.

Q -- in a ward as another example of elimination of risk. Is that the same idea? You're just removing that problem in its entirety.

A Yeah, replacing it with something that is more effective. So, you know, the style-- the physical style and design of the wash hand basins changed, which made them less likely to splash, for example.

Q I did wonder why you had mobile HEPA filtration units in Ward 6A in elimination. How does filtering the air in the room with a filtration unit eliminate any risk?

A Well, again, it's-- you're taking elimination as being complete.

Q So, if they work, it's elimination?

A So, it's a mitigation. It's not a solution. So it doesn't-- none of these things are going to be 100 per cent effective, but they mitigate some of the risk, therefore----

Q I just wonder why----

A -- they are methods of eliminating.

Q I can appreciate that replacing the tap, if the tap is the problem,

eliminates a risk. What I'm having difficulty with is how mobile HEPA filtration units can eliminate a risk and yet you've put installing HEPA filters, which actually filter the air as it comes into the room, as an engineering control, and I just wonder whether there's----

A Because that's----

Q -- an overlap?

A Yeah, because it is an engineering control. It's not an elimination control, if you like. It's probably a slightly moot point as to, you know, where you would-- where you would put it from that point of view, but it is basically an engineering control.

Q Because one of the questions that has arisen before is, if you have a risk and you take some step to mitigate it and you don't completely eliminate it, you might well have successfully mitigated it, but the risk is still there.

A Yeah.

Q Is that a reasonable way to understand it?

A Yeah.

Q We had a discussion about this with Dr Agrawal.

A So you decrease the risk.

Q But if you fully eliminate the risk, then the risk isn't there anymore.

A Mm.

Q Now, that "Mm" is doing some work there. Could you expand on that?

A Sorry. So, if you eliminate a risk, which-- and I'm struggling because I can't really think of an example where you can absolutely 100 per cent eliminate a risk. It's-- Risk management is all about mitigating a risk down to an acceptable level. Theoretically, you can reduce risk-- well, you can reduce risk down to a point where you say, "We've done this. We've got this risk down to an acceptable level. We're comfortable with the level of the risk. We're going to close that risk," because-- but there are other risks that you can mitigate down, but you say, "Actually, it's still a risk, and I'm not going to--"

So, for example, you could have the best rate in the country for healthcare-associated infections, the mandatory-- Let's take C. diff. You could have the best rate in the country for C. diff but still want to keep that on your risk register because it remains an issue because there's always some part of that that you can't control. Even though you're the best in the country, you'd want to keep that on your risk register as a relatively low risk.

Q So your understanding is that, for the sort of risk that we are talking about in terms of water and ventilation systems, your perspective on this is that elimination is very difficult?

A Yeah.

Q Can you think of any of the things that we've discussed in this Inquiry, given that I think you've read early drafts of Dr Walker's report, where there is a absolute elimination that could or was done to one of these risks that you're aware of through the Inquiry?

A I think there's lots of ways where risk was created. (After a pause) No, I don't think I can, off the top of my head.

Q So, just to put an example which is worth thinking about, you have a ventilation system as Ward 4B was originally built that was considered to be sufficiently risky that the patients went back to the Beatson. Then work is done, and the patients return. You wouldn't see that as an elimination of risk. It's a reduction by mitigation of that risk. It remains a risk.

A Yeah, because, I mean, there's a saying that nothing in health is 100 per cent, so nothing in clinical medicine is 100 per cent. There would still be a small residual risk to those patients.

Q If you think about----

A Just because-- just because they're so immunosuppressed.

Q You think of the example of the Arjo baths----

A Yeah.

Q -- which seemed important at the time they were fitted, but they no longer exist in the hospital. Is that a potential example of an elimination? If you take away a piece of equipment that you're worried about?

A Yes. Yes, because you remove the bath with its flexible hoses.

Q I mean, you might put a new one in that has its own risks, but that particular risk is eliminated.

A Yeah.

Q If we move on to the concept of a risk register, you see benefits from using a risk register. Do you see any disadvantages from using a risk register?

A No, it has to be a good thing to be aware of risk and to be-- and to monitor risk. But a risk register can give a false sense of security if it's not managed properly. So, if someone puts something on a risk register and goes, "There you go. I've put it on the risk register. Phew, that's okay then," that is not the way to manage a risk. That is writing something down and then pretending it's gone away. So it has to be managed.

Q You've described in paragraph 7 that risk should be:

> "… proactively and responsively added to the register. An adverse event, which identifies an unmitigated risk, will trigger an addition to the register but active

risk management will also include horizon scanning and having regard for available data to identify potential for risks to be realised."

Does that come from anywhere, that concept of you should add things to a risk register, or is it just, in a sense, practice?

A It's just practice. It's just how things are done for-- and I mentioned horizon scanning because-- and that can take many forms but, you know, it includes things like, you know, seeing what's coming around the corner. So predicting what the impact of the NHS 10-year plan, for example, is going to be and adding risk into your risk register if there is an adverse risk there. But you should be looking.

Q So, I mean, I'm not going to put it on the screen, but if there was an entry in the Greater Glasgow and Clyde Risk Register back in 2009 discussing the effect of a decision to move to single rooms, that would be an example of a horizon scanning entry in there, looking forward about something they know is coming but hasn't yet arisen? Is that what you sort of mean?

A Yeah, yeah.

Q Just for completeness, that's on page 9 of bundle 45. Can they also arise internally within an organisation because you're aware that something is changing in your organisation and that creates risks?

A Yes, absolutely, and it could be, you know-- you know, changing a management structure, for example, could result in staff being unhappy, which could create people not being happy at work and then becoming inefficient and then productivity going down, and so on. So it's that kind of thing as well.

Q Now, this section which we're going to go through reads a bit like some principles. If we turn to the next one, you've got, "Every risk should have a"-- No, not the next page. The next number, 8:

"Every risk should have a risk owner at an appropriate level within the organisation. For organisation-wide risks, this should be at executive level."

Well, firstly, is that practice, or have you got it from somewhere? Is it just the way that you see things being done?

A That's just how you do it.

Q All right. "For organisation-wide risks". I wonder what that means, because it occurs to me that you could mean one of two things. It could mean something like that risk I just mentioned, that if you're moving to single rooms, it'll affect across the organisation as they get rolled out. Or it could mean a risk that whilst it's localised to a particular division or directorate or sector, it's so significant

that it'll affect the whole organisation if it eventuates. Do you mean both or only one?

A So, I think it is-- So, for example, I'm the owner of our healthcare-associated infection risk. So I own that, the risk of healthcare-associated infections arising across the organisation. I also own the risk around resident doctors going on strike, both of which, you know, affect the organisation in different ways. The resident doctors going on strike is one that's realised and the HCAI one is one that may or may not be realised, and we have controls in place to mitigate some of that but for the resident doctor strike, we-- -- the controls are around how we cope with it, not how-- not preventing them going on strike, if you see what I mean. So I think if you have a risk that affects the whole organisation, it should have a high-level owner.

Q What about a risk-- Well, firstly, is there any difference in your-- you're making some statements of principle here, and I'm inevitably about to ask you in due course to apply them to what you know about the Queen Elizabeth. I just wondered, before I do that, whether there is a difference in the way one might discuss how a risk is managed once it's on a risk register and under process, and a view about whether it should be on a risk register at all, and thirdly at which level it should be at.

Are there any areas where you would be less willing to not quite be adamant but have strong views between those sort of different choices, because it strikes me that the first choice is: do you put it on the risk register and do you mitigate it and go through the process? The second choice is: how do you put it through that process? Then subordinate to that is: where in the organisation does the risk get managed?

Those are three different issues you talked about. If I start asking you about particular risks, is there any consistency in the level of willingness you are to have an opinion, because obviously you're talking about someone else's organisation? You can't have a full knowledge about their organisation. Are there are some areas where it's clearer than others, a bit like the way if you criticise a fellow clinician----

A Yeah.

Q -- your criticisms are different than if you-- A judgment of a clinician is one thing, but to completely fail to spot a condition might be something else. Do you have a gradation, or am I asking a terribly unclear question?

A Yeah, I'm not quite sure what the question is, to be honest.

Q So the question is: is there any

difference, in your eyes, about whether you're entitled to have an opinion as an external viewer about whether something should be on a risk register at all – yes, no – compared to how is it managed once it's there? Do you feel that, as an external viewer, you should have a different level of opinion on those things?

A I think I can have an opinion on what my expectation might be for a similar event happening in my organisation. I can have-- I think it's an opinion rather than a criticism.

Q I understand. So, to go back to this question in 8 about appropriate levels, before I ask you a question, I want to understand some theoretical concepts before I phrase the question. Imagine – I'm sure you do – you have within your hospital services that use a particular piece of equipment, and there will no doubt be risks arising from that piece of equipment. You're nodding. Remember the transcript person.

A Sorry, yes.

Q Now, if you've got a piece of equipment in a service that's in one division of your hospital, one directorate, what are the principles that decide whether it ends up on just the risk registers for that small part of the organisation or it makes it up to the top level of the organisation? How would you discuss such a theoretical example?

A So, if you had a piece of equipment, say you had a CT scanner which was coming to the end of its life or had exceeded the end of its life and, you know, was in need of replacement, but there was no money and it couldn't be replaced, for example, that would be a risk which was-- and it kept breaking down, so your risk is growing because it's unstable and therefore, you know, you're increasing the risk. So that would be a risk which was particular to that directorate, particular to that division because they would carry that risk.

But when it got to the point that it was a red risk, in that, you know, patients-- scans were being delayed, patients' treatments were being delayed, so it was having an adverse effect on patients, and in some places possibly a severe delay affecting the patients, and it was certain to happen, then that would elevate the risk score to 15, 16. And in that situation, I would expect that to be reviewed at board level.

Q So something can be localised until it becomes much more likely to happen and its consequences are more severe?

A Yeah.

Q Right. You've mentioned in 9 that:

"Risk management is a dynamic process of reviewing risks,

assessing effectiveness of mitigation and reassessing the risk score in light of improvements. Implementing mitigating actions may decrease both the likelihood and consequence of the risk…"

You've produced a risk matrix here, and that's where I think 15, which is given in evidence, comes from in the next----

A Yeah. Actually, my calculation was wrong. It would probably be a 20.

Q A 20----

A Yeah.

Q -- so it's when it goes red. How do you get to those calculations? Is it a multiplication exercise?

A It is, yeah.

Q So, if you score----

A So you go down and across and----

Q So, if you say that something's a minor risk that's possible, it's 2 times 3 equals 6.

A Yeah.

Q And minimal risk that's almost certain becomes a 5.

A Yeah.

Q Right. Now, 10:

"Risk scores are pertinent to the level of safety (or 'unsafety') which can be identified. For example, a risk was almost certain to be realised but the consequence would be minimal or minor would not result in unsafe environment. For a risk that was also almost certain to be realised but where the consequence was severe even fatal, if unmitigated, would result in the area being described as 'unsafe'."

So, is it your position that the connection between risk and safety is about consequences and likelihood?

A Yeah, because you have to be able to measure it somehow, and----

Q Now, we----

A -- doing that risk assessment would draw you to a measurement.

Q We asked you and your colleagues a series of questions in the Inquiry, and Key Questions 1 to 3 all used a variation on the idea that "unsafe" was defined as an avoidable level of risk. Are you happy with that definition in our questions?

A Well, if you translate that into a risk matrix, just using the word "avoidable" alone is not enough to be able to determine safety or unsafety.

Q So our question might have effectively only used one half of the calculation, as it were.

A Yeah.

Q We've just considered the prospect of it being realised.

A Yes, whereas you need to think about the consequence to the patients of it being realised.

Q Well, we'll come back to that at the end of your evidence this afternoon. My Lord.

THE CHAIR: Right, sorry, it was just-- I'm not sure that I heard the full part of Dr Mumford's answer. I think I got the step of having to have regard to likelihood of occurrence.

A Yeah.

THE CHAIR: What did you say after that?

A And the consequence of that happening.

THE CHAIR: And the consequence, right.

MR MACKINTOSH: Now, before we go and look at some risks, as it were, let's complete proceeding through your report. You've discussed in paragraph 11 the idea of a risk appetite and the concept of tolerance. What do you mean by that?

A Risk appetite and tolerance are how risk-averse or otherwise an organisation is, so-- and different risks will possibly carry different risk tolerances. So, for example, if you have a patient safety risk, your risk tolerance is going to be really quite low if a patient can come to serious harm as a result of that risk being realised. If-- I've given the example of a financial risk. The tolerance of that might be much higher, and you might be comfortable with a higher target score for your risk, so we talked about target scores being in the risk register.

Q And this is the scores in that scale of 1 to 25?

A Yeah, so you might feel that if you had a financial risk with a moderate consequence and it was possible, then that score is 9. That's a kind of medium risk. You might be comfortable with that for a financial risk, but actually would you be comfortable if the consequence for the patient was moderate harm and that was still possible that that would happen? You possibly wouldn't, and you might prefer to mitigate that down and say, "Actually, I want that to be unlikely to happen."

Q To what extent does this concept of risk appetite or toleration actually involve not so much what the numerical score is but understanding the two elements within it? So, if you look on the chart above, there are two points that score 8 and one point that score 9. They're not actually the same because they involve different levels of consequence and likelihood. So to what extent does an understanding of a toleration of risk or a risk appetite involve thinking about more than a simple numerical score? It's about, "What's our tolerance of consequence and what's our tolerance of likelihood?"

A Yeah.

Q How does this idea of tolerance or risk appetite link, going back to the discussion we had before about patient-centred care and modern ideas of openness and informing patients and consent in the modern sense?

A How does a risk score link back to that?

Q Yes. So, I mean, to what extent does an organisation's tolerance of risk have to take account of the patient's tolerance of risk?

A Yeah, so I think there will be occasions when having a particular surgery, for example, for a patient will present a risk to that patient. It won't present necessarily a risk to the organisation, but it will present a risk to that patient, and then the patient will have to-- you know, you might say to them, "You've got a 10 per cent chance of--" say if you were having a thyroid operation, and I don't know the actual numbers for this happening, but thyroid operation, you can cut one of the nerves to the larynx and make-- change people's voices.

So suppose you said to a patient, "There's a 10 per cent chance that during this surgery, because we've got a slightly incompetent surgeon doing it, your nerve will be cut and you might lose your voice." And the patient might say, "Actually, I'm not willing to take that risk." On the other hand, you put your top surgeon on the job, and the top surgeon says, "Well, actually, there's a 1 per cent chance in my hands-- Like, the last 100 patients that I've done this surgery on, only one of them has lost their voice." So the patient may say, "Actually, I'm comfortable with that because that's, you know, 99 per cent chance that I'm going to be absolutely fine," and they might be much more comfortable with that and say, "I'll have the good surgeon than the trainee," in that circumstance.

Q What about the sort of building risks we're talking about here? So I don't want to get into a specific one, but you can imagine a theoretical, imaginary risk that involves there is a feature of the building that gives rise to a risk, and that risk might have a low likelihood of happening and a medium consequence if it does. The organisation might have a particular attitude to that risk and tolerance. What about the ability of the patient or patients who are being treated in that space? Where do they get an input into their tolerance of that risk?

A So I think that's quite a tricky question because the likelihood is that they wouldn't because that would-- that risk would have been accepted by the organisation. What you described would be a kind of medium-6 risk with-- and it's unlikely that that would be disclosed to

the patients.

Q At what point do the risks of these sort, the physical environment risks-- I mean, where on that Figure 2 matrix do we have to get to before you have to start, in your view, disclosing it to the patients? Again, I'm not talking about any specific example but----

A I think it varies. So, for example, we have-- we have a process. If we have a COVID patient, for example, who we discover in a six-bedded bay, so all of those other patients have been exposed to COVID and you-- it's nothing-- there's nothing you can do to prevent it. The patient was-- didn't have COVID when they came in or wasn't showing any symptoms, but the day after they were admitted they developed COVID symptoms and we did a test and they were positive. So, we tell all those other patients, but then we move that patient out into a side room to protect the other patients from further coming into contact with COVID. However, they've all spent the night in that six-bedded bay with the patient, so one of them may develop COVID in the next five days.

On the other hand, we've got an empty bed, and we have no beds, and we have 20 patients in A&E waiting for a bed. So we say to the patients who are waiting-- we risk assess them, as in, are they very old and frail, elderly? Have they got any underlying disorders which would make them particularly likely to develop infection? Are they immunosuppressed? Are they on steroids for whatever reason? And then we look at the other patients and we will say to them, "We can pop you into a bed now on a ward, but it's in a bay where a patient has previously had COVID and the other patients in there have been in contact with that patient and so may develop COVID in the next few days. Are you willing to take that risk?"

Now, that's an example of where, you know, the risk is-- the consequence is probably moderate because COVID is not-- in a genuinely healthy person is not severe in most people anymore, but there's a-- it's a fairly high likelihood that they will be further exposed to another patient who becomes symptomatic with COVID. So therefore you've got a score of 12 and you really-- and that's partly around giving-- making patients-- you know, giving them the information that they need to be able to assess whether they want to take that risk, but it's also a known risk that we would be subjecting that patient to and that we have to disclose to the patient because we know that that is a likely thing to happen.

Q Just because you've described this in some detail, do they generally accept the risk?

A Not often, no.

Q No? Right, and I think you've discussed in paragraph 12 that risk tolerance further refines different cohorts of patients, so I think we're familiar with that, so we'll go over the page. Then the discussion of the regular review of risk registers. Now, before we get on to that, you discuss the idea of an organisation's attitude to risk and its tolerance. Can an organisation be said to have tolerated the risk it has not identified or put in its risk register?

A Those two are two different things. So, is there a risk that they haven't identified and nobody in the organisation knows that that risk exists? There's really-- Should they have identified it? It's a good question to ask. Would it-- Could it be reasonably-- be expected that they would have identified it? But if it's absolutely, you know, you cannot expect anyone to have recognised this risk, this risk happens, then you're not tolerating it; you just don't know about it.

Q But if there have been meetings or email communications or SBARs or anything like this about a particular risk and it doesn't make its way onto a risk register, is it appropriate describe the organisation as tolerating the risk, or is that to mix two concepts?

A I-- It depends what level of the

organisation you are saying is tolerating that risk. If it's been escalated through a governance process, then you-- and they-- it still hasn't been recognised and put onto the risk register, then you can say, yes, they are tolerating that risk in a kind of-- you know----

Q But not in a risk registry sort of tolerating it----

A But not in a kind of risk registry sort of a way. But if it has stopped at a low level and no one has escalated it and no one at that level has recognised the significance of it and either escalated it or put it on the risk register themselves, because anybody in an organisation can discuss a risk and potentially put it onto the risk register, then that's something different. So it----

Q That's not risk register toleration; that's something else.

A Yeah, that's-- because the-- if it stops at a fairly low level in the organisation so that the structure of the organisation is not aware of it, then the organisation as a-- as an entity cannot be said to be tolerating that risk.

Q So, in a sense, there seems to be multiple factors here. There's the, "Who knows about it? What do they do about it in terms of escalating it or putting it on the risk register?" But it's only once it's on a risk register that it falls into this category that you discussed, I think, in----

A No, because I-- Well----

Q Or being at risk of-- the organisation actually choosing to tolerate it.

A So, with one caveat there. So, it could have-- it could have gone up through the governance structure and nobody recognised the significance of it, and therefore it not reaching the risk register, because it-- The risk register doesn't just happen. Somebody has to say-- you know, which we do on a very regular basis. You know, someone will talk to us about something that's happening and we'll go, "Have you put that on the risk register? If you haven't, you should."

Q If you take an example, a hypothetical example, someone writes a report that identifies a risk, and so one place it could stop is that the person who reads the report just doesn't escalate it any further, and then you can't say the organisation is tolerating the risk because the organisation doesn't know. The next stage is you might have a conversation on, "Should the organisation know?" but it actually doesn't, and you're nodding again.

A Sorry. Yes.

Q The next stage is that it does leave that individual lower-level person who knows about the report and it goes up in the organisation, and either it gets onto the risk register or a person either doesn't put it on the risk register because they chose not to or just doesn't think about it.

A Yes.

Q To what extent, at that stage, could you be saying the organisation is tolerating the risk?

A I think you-- you potentially could, and it could be that actually even though something is escalated, it's not recognised for the risk that it is----

Q So you might get a lower-level person saying, "I'm worried about X," and then it goes up to a more senior person who reads that message and goes, "Well, you might be, but I'm not for these reasons," and that could well be the organisation tolerating risk because that person is senior enough to, in a sense, speak for the organisation?

A Potentially, yeah.

Q Potentially, right. Paragraph 14. Sorry, paragraph 13, review. When you say "board level", in your organisation, because I think we have to put your experience in context-- You mentioned a non-exec committee who are looking at risk registers, so can you describe them a little bit more clearly?

A So, we have a series of board subcommittees which are chaired by non-executive directors who sit on the board.

Q Yes.

A They chair these board subcommittees, which kind of filters some of the-- So, it raises information up to board level non-executives, but-- and executives, but it-- and then an escalation report goes to the board, rather than all of the information to all of these committees.

Q So these board subcommittees----

A They're filters.

Q -- are effectively hearing about things independently rather than through the executive board members.

A Yeah.

Q And is there one that reviews your risk register?

A Yes, Quality Committee.

Q Now, the papers of that committee, they will report up to the board?

A Yes.

Q Do they report regularly on risk or exceptions, or what's the sort of standard that gets into a board report?

A So it-- at that level it will-- it will usually be exception reporting from the Quality Committee, but then next to that is a review of red risks, which goes separately to the board every three months.

Q But that review is coming out of the executive side, the red risk review?

A Yes.

Q Right. In terms of your public accountability outside the board, I'm assuming your board papers eventually end up on your website and are publicly available, subject to----

A Public boards do, yeah.

Q Subject to commercial confidentiality----

A Yes.

Q This non-executive committee that deals with risk reports, do those papers end up externally to the organisation or they just stay within the organisation?

A No, they stay within the organisation. I think they are FOI-able, but----

Q The reason I ask that is because, in terms of the public accountability of your organisation, how does the risk register make its way onto the main board and therefore into the generally public domain reporting? Which bits of it? Is it just the exceptions? Is it just the red risks? What do you put on your public spaces?

A It will be the exceptions. I'm trying to remember which part of the board the risk register goes to. I can't remember----

Q The reason I asked – and maybe the answer will be sufficient – is could it be that most of this process that you've described in your organisation remains below the level of the public

reporting minutes? So, for example, I can't go and look on your website and discover that you've got a red risk over a CAT scan in one of your directorates?

A Only if it went up through the Quality Committee papers because the papers for the board are publicly available.

Q Right. So the papers for the Quality Committee end up on the board papers as an attachment.

A Yeah.

Q Right. So the discussion of organisational level risks ends up in your board papers and ends up being public, subject to the normal confidentiality commercial exceptions?

A Yeah.

Q Right. Now, what are you saying at 14?

A So, systems thinking is the concept of when you're looking at a risk, you don't just think about the risk in the finite area. So, if we go back to the CT scanner, for example, you would think about how that impacts across the-- across the organisation, or even outside the organisation. So you may think about: how does it impact on patients? What does that do to, for instance, your cancer standards and your cancer diagnostic standards? How does that impact on GPs if our-- if your CT scanning capacity goes down? So what's the wider impact in the patient population? How does that impact on outpatient clinics and follow-up patients and the timing of follow-up of patients and so on?

So you would think much more widely rather than just thinking about that CT scanner, and you can use the same sort of thinking about when you're making a change which may impact. So, if you're making a change, you need to think not just about where that change actually happens, but the ripple effect of that change on other parts.

Q Right, and then in 15, in the context of the residual risk, do we return back to risk appetite and toleration again, that you have to end up with residual risk that stays within your toleration threshold?

A Yes.

Q Now, what do you mean by "oversight of risk when an organisation is vital to ensure safety"?

A So this is what we've talked about in the governance process----

Q Right.

A -- and how risk is viewed and making sure that, you know, the person who is holding that risk-- or the person who's holding the risk is doing everything and that the risk is moving forwards. So sometimes you'll find a risk that just sits at a 20, stays at a 20, stays at a 20, and

actually you need challenge, which is where the oversight comes in, to go into that to say, "Actually, you're not having an impact on this. We've reviewed it and reviewed it, and none of your actions are actually having the impact that you would want to in order to reduce this risk down to the target level."

Q But you can only do oversight if the risk is on the register in the first place?

A Yeah.

Q In 17, you describe what a risk appetite is and the benefits of using it. I wondered if you could perhaps give an example – maybe a reference to this unfortunate CAT scanner – of how you would think through the process of accepting a risk. So, if you're going to accept the risk of the CAT scanner for some reason – maybe because you don't have the money to replace it – what's the framework you would apply to that sort of decision process?

A So, you would have to look at the impact. You'd have to be comfortable that all mitigation that you could possibly put in place had been put in place. You'd have to look at the impact of that and what the prospect for buying a new scanner in the future will actually look like in order to say, so, you know, "We haven't got any money this year, but next year it will be the number-one priority on our capital programme," for example. So you may say, "We can't do anything about it just now, but in nine months' time we will have the money and we will make sure that that is the first"----

Q So you can time limit the risk? You can say----

A Yeah.

Q "Because I know that you're going to make it top priority"----

A Yeah, so you would tolerate it for a set period of time.

Q Right. (After a pause) What I want to do now, I think, is to move on to the section you've called "Risk and Safety" on the next page, page 10. What I felt it was important to do was to just take you through this section. Then we'll have, after the coffee break, a more structured discussion about particular risks.

You're effectively raising two ways that you can see a risk-- identify a risk. You identify a risk because something has happened and you think it might happen again, or you identify a risk because it hasn't happened yet but you noticed it.

A Yeah.

Q Yes? You have the final sentence:

"The response to the risk in terms of recognition, acceptance

and mitigation, together with the risk management and governance, are key to determine the level of safety."

Now, at one level, that sentence seems to wrap up the entire paper in a single sentence, but can you expand on that by explaining how the response to a risk – its recognition, acceptance and mitigation – might turn something that previously had been thought to be safe to something is unsafe? Or am I asking the wrong question?

A Sorry, is that the wrong way around, that you're trying to turn something which you've recognised as potentially unsafe into something safe?

Q That's it. So, if you have something that is unsafe, how is it that recognition, acceptance and mitigation can turn it into safe?

A So, recognising it is part of the challenge. You accept that there is a risk and then you put your mitigation in place. The mitigation, as we discussed, needs to be something that will reduce the risk level, so where it-- It can't necessarily reduce the consequence if that risk is realised.

So the impact on a patient would still be the same whether-- if it happened, but what you can do is alter the likelihood. So you alter the likelihood of it happening by your mitigation and you drive down the risk score to the level which you accept or tolerate that risk.

Q And that might well – or at least it should do – push you below the unsafe threshold that you have in your mind?

A It has to.

Q Right.

A Now-- and that level may change depending on your patient population that-- where the risk is, but it has to push it down into "safe".

Q Now, just to look at, say, in terms of your own chart, if we go back to page 8. Is it possible, or is it the wrong question, to look at that chart and say there are some of those 25 squares where you are considering something to be unsafe, and some of those squares where you're considering it to be effectively safe? Or am I asking the wrong question in this context?

A I would say it depends.

Q It depends, right.

A But, clearly, something that is going to have a major consequence or be severe and is almost certain to happen – definitely unsafe.

Q Yes.

A Something that's likely to happen that's going to have a major or severe consequence – also unsafe.

If you go to the other end of the

spectrum, something that is rare and therefore extremely unlikely to happen, but we know it would have a severe consequence, if you've put all of the mitigation in place that is possible, then you may have to accept that risk, even if it's in a particular-- particularly vulnerable patient.

Q What I wanted to ask about now was the idea of how you assess these two requirements, these two thresholds, because consequence might be easier to assess because, if a risk eventuates, the patient will suffer consequence X, and you're a hospital, so you're quite good at assessing what consequence X means for people.

A Mm-hmm.

Q So is it ever difficult working out what the consequence is and how serious that is?

A Yes, it's-- Even when something has happened and you've examined something and investigated what happened, it is still sometimes difficult to put a measure onto the harm that has then been caused, so there are difficulties.

Q I mean, it'd be helpful to get some examples around that because it sounds quite complicated. If we take some examples of-- Let's imagine the one we were dealing with, which is the environmental infections that we discussed at the start of the morning's evidence. You might have a question of: what's the consequence of getting one of those infections?

A Mm-hmm. I think that would probably-- possibly be easier to----

Q An easier one?

A -- to assess.

Q What about the airborne infections we've been talking about, the Aspergilluses, the Cryptococcuses? Is that one where you might find it harder to out what the consequence is?

A Well, only from the point of view of the patient population. So we know----

Q No, but I'm ignoring likelihood; I want to come back to that. I'm just thinking of the patient who got the thing you were trying to avoid them getting. You've explained – and I think we understand that – that, for a certain group of patients, getting the environmental infections is bad. Everyone seems to understand that.

A So there's obviously a spectrum of consequence, isn't there? So, if you acquire Aspergillus infection, you've got anything from a moderate consequence, say, which keeps you in hospital for a week, right up to a severe consequence, which may be-- may have a fatal outcome. So you would have a

range of consequences and that would then play back into the individual patients and their vulnerabilities.

Q And that would play into the assessment of consequences?

A Yeah.

Q Now, I do appreciate there are more harmful consequences than simply waterborne and airborne infections, but, in this Inquiry, that seems to probably cover it. But if we look at likelihood, how easy is it to assess likelihood when you're looking at a risk register, and what do you do when you just don't know?

If you think about it, think of the difficulties you and Dr Agrawal had over what is the likelihood of catching Aspergillus in a paediatric haemato - oncolgy population. You two don't agree. We haven't gone over it in great detail, but it's fair to say you don't agree. How do you assess likelihood in that sort of environment?

A So, that's quite challenging and would require you to do a really comprehensive risk assessment. I think it would hinge around whether-- I mean, so you're opening-- so when you open the risk, so your initial score, let's take-- So things like, "Is the ventilation to regulation?" would be a really important question. "Is there building work in the vicinity?" would be another really important question to ask. They would

impact on the likelihood of you acquiring Aspergillus in those situations.

Q What do you do about the fact that it does seem, in this Inquiry, that there isn't an awful lot of direct evidence about the impact, particularly of air change rates, on the likelihood of acquiring air borne infections? Because we had Professor Humphreys at the very beginning, discussion of that work-- Is it Lillie(?), doing the works-- operation of his in the 70s? We've heard evidence from Dr Agrawal, Mr Poplett, Mr Bennett.

I'm going to forget people, but we've had lots of evidence from both sides of the divide, and it does seem – and perhaps even Dr Drumright and Mr Mookerjee have agreed – there's not a statistical significance in the Aspergillus signal for the paediatric patients that they looked at. How does a simple, almost ignorant lack of knowledge about the chance of harm happening-- how does that feed into a risk register?

A So, that's absolutely bread and butter for a risk register. It's the risk of something occurring. So, if on day one of the hospital opening it had been recognised that the ventilation was not HEPA-filtered, that the ceiling tiles were not sealed, that the rooms were not positive pressure and that there were thermal wheels present and that there

were chilled beams and all of the rest of the issues around the ventilation in the Schiehallion Unit-- If on day one of the hospital opening that had been recognised, then the theoretical risk-- you don't need to have realised the risk, as in it hasn't had to come true to assess that, but you would say, "This ventilation system has not been built to regulation, specification, or"----

Q Guidance, not regulation.

A -- "to the SHTM"----

Q Guidance, not regulation.

A Sorry, guidance. Not been built to guidance. The guidance is there in an evidence-based-- it's been constructed in an evidence-based manner based on fairly old research, but good research nevertheless around what ventilation needs to look like and it's there for a reason. It's there to prevent harm. So in that situation you would say, "This is a really high risk to our patients."

Q But why would you say that on this two-axis chart?

A Because the consequence potentially for a haem-onc child could have a fatal outcome and therefore it has to be severe, so you're already in the top row of the chart.

Q Can we put the chart back on the screen please?

A If you then look at, you know, "Is it possible? Is it likely? Is it almost certain?" or, even, "Is it unlikely?", well, it's not really unlikely anymore because you've built a ventilation system which is not to the guidance, unless you believe the guidance is not worth it, not worth----

Q But that's my point, is that----

A -- having.

Q -- there is an argument that it is----

A But it's generally accepted as being a standard to which we want to-- to attain in building a new building.

Q Because if we----

A So, then you look at, "Is it possible?" Yes, it's possible. "Is it likely?" Well, actually, there's a lot of building work going on on the site and-- which would play in, because you've got an unfiltered ventilation, and so unfiltered air intake coming into the room which is not positively pressured, which will also take in air from other sources when the door is opened. So, "Is it likely?" or, "Is it almost certain?" Well, it still remains rare, or unusual, shall we say. So it's not almost certain, but probably you would stick at "Likely". So you'd have a 20 risk.

Q So, if we----

A If you didn't know any of what we know.

Q So, there is a countervailing view, as you know, that there's no evidential basis for-- I'm looking at this in the context of non-specially ventilated

spaces, but there's no evidential basis for air change rates in general. So, if we take that discussion you just had and we transfer it, just before the coffee break, to a general ward. So, now, presumably, the consequences are less serious. You're nodding.

A Yes, sorry. Yes.

Q So that pulls it down the scores because we now move from being – how did you have it before? – the consequences were severe. It moves them down into the lower levels of that chart.

A Yes.

Q But I'm just wondering, it doesn't matter whether-- the same issue applies, presumably, whether it's the non-filtered spaces in Ward 2A with the vulnerable patients or the non-filtered spaces in the general wards. The question is: what is the impact, on your assessment, of a lack of knowledge of the likelihood? Because what we're being told is that air change rates, HEPA filtration – the guidance isn't evidence-based. We should not think of it as it's out of date. It doesn't have real validity anymore. How does that debate find its way into this risk matrix?

A I think when the SHTM and the HTMs were first written, they were written with good evidence around operating theatre ventilation, which was extrapolated out. Because now that we have generally very-- relatively low infection rates in these areas, you can't repeat the experiments that were done at the time, which makes the evidence base really challenging. However, what we do know is that-- what we do know is that we know the rates of-- or we know the incidence of Aspergillus infection, to some extent, in different patient groups. It's unusual to find it in patients unless they have chronic lung conditions in-- or are immunosuppressed or are severely immunosuppressed like the haem-onc patients, and we know that there's a lot of Aspergillus about. So we know that most people are exposed to it at some point in their lives and don't develop infection. But we do know that, certain situations, patients do develop it, and it has been linked in the past with things like building work.

So, whilst it's very easy to say the HTMs, the SHTM-- it's not evidence-based, but we don't have anything better and we have to have something that our buildings are built against in order to protect our patients, and it's been picked up across the board. The JC----

Q It doesn't require HEPA filtration?

A It doesn't require HEPA filtration, but it does require other parts of ventilation, but we know that-- you know,

we know that having building work in the same locality as patients who are very immunosuppressed adds an additional risk. We spend quite a lot of time prophylaxing our patients against that additional risk. If we have things which we think are going to mitigate that risk, including HEPA filtration, why would you not do----

Q No, I do appreciate that, but just to stay with the likelihood line----

A Yeah.

Q -- I get the impression you're not saying-- well, where are you-- You would put this, and I know it's only your opinion, and I'm using it as a thought experiment rather than relying on your opinion on how to manage haem-onc patients, but you would put it up at "Likely" or "Possible". I think somebody else might say, "There's not an evidence base. I'll put it down at 'Rare'."

A But actually, as long as-- as long as-- you having that recognised as a risk on your risk register and doing something about it is the key thing: the recognition, the doing something about it. Being picky about whether you make it a 15 or a 20 is not the most important thing. It's how you mitigate it and what your risk tolerance is and how you-- how you reduce it.

Q Thank you. My Lord, this might be a good point to break for coffee.

THE CHAIR: Well, we'll take our coffee break, Dr Mumford, and try and be back at 5 to 12?

THE WITNESS: Thank you.

THE CHAIR: Thank you.

(<u>Short break</u>)

THE CHAIR: Can I remind people in the room that conversation can distract the witness and therefore perhaps should be minimised? Now, Mr Mackintosh.

MR MACKINTOSH: Thank you, my Lord. Dr Mumford, I wonder if I could just return to one thing in your report which I think I glossed over and didn't give you the opportunity to talk about, which is on page 5 of bundle 44, volume 6, page 5, paragraph 4.1. There we are, yes. So you had a six-stage process, and the first stage you have as "Identify hazards", and I wonder if you could explain perhaps in a sense what's the difference between a hazard and a risk.

A So a hazard causes a risk.

Q Can something be considered about whether it is a hazard and then one decides it's not a hazard?

A So a hazard is-- yeah, so a hazard is anything that can cause harm. It doesn't have to be-- you know, it doesn't have to be a bucket on the floor that people can trip over. It can be faulty equipment. It can be something-- the

way that we're doing something. It can be something environmental, and then that translates into, "So, we've seen this. Does it present a risk to our patients, to our organisation, to our staff, whatever?"

Q Is there possibly in some ways a little read across between a hazard in this context and our potentially deficient features? It's a thing that could cause harm----

A Yes, and it can be an absence of a thing which produces a hazard.

Q Equally, it can be a process?

A Yes.

Q So, for example, a dysfunctional team, that could be a hazard?

A Potentially, yeah.

Q Right. What I wanted to do was to then look at a group of hazards or potentially deficient features or issues that we have looked at, and there's quite a long list. Now, obviously I'm conscious that you're familiar with all these because you've discussed them in your reports. You've reviewed reports by Dr Walker, Mr Bennett, Mr Poplett. You've reviewed reports and statements by other people. You've read contemporary documents, like the DMA Canyon report or the Innovative Design Solutions report or Mr Leiper's report.

So what I'm hoping is, as we go along, we can have a conversation about each of these things. I'll try and summarise them, and please, if you think I've mis-summarised, tell me. Equally, I would point out to those watching that I'm just summarising them, so I can't give a full definition of a particular potentially deficient feature because we probably haven't got time. So, in some instances, I'll use a shorthand, and I'm hoping that you will know what I'm talking about as an issue, and so we can have a conversation about topics without spending as an exhaustive amount of time to fully defining every single topic.

A Right.

Q But you shouldn't hesitate to pull me up if you think my definition is flawed or you don't understand it or you think I've missed something of significance, because you've had an opportunity to look – and I emphasise "look" – at bundle 45, the GGC risk register. Presumably, you haven't read the whole thing.

A Not cover to cover, no.

Q No. I mean, it's about 800 pages, the PDF. Don't worry, I'm not about to put it on screen. We had to redact it because most of the risks that NHSGGC properly manage have nothing to do with the remit of this Inquiry, and therefore most of that PDF is black because we redacted out the contents. But I know you've looked at parts of it,

and so what I'm going to do is we may look at a couple of pages on the way past and discuss them.

So, what I wanted to do to start off with is the idea that risks might arise from the very process of building a hospital. Have you been involved in procuring a new unit or a new ward or a new extension or a new hospital?

A So, when I first came into post as a DIPC at Maidstone and Tunbridge Wells, we had a new hospital under construction.

Q Right, so I wonder if one can think about the sort of hazards or sort of issues we know have arisen in this context. So we know, for example, that there was a decision made to build the single rooms in the hospital with an air change rate of 2.5 to 3 air changes an hour, 40 litres a second. Now, you're familiar with that decision? Remember, you can't just nod.

A Sorry. Yes, I am.

Q I wonder if you could help me about how you would think about this in the context of risk management and the extent to which you would anticipate this would make its way onto a corporate, as opposed to a project or departmental or sector risk register, if it ought to be managed, if it needs to be managed.

A So, every big project like that, you know, when even-- you know, just

building a new ward or-- let alone a new hospital, has a big project risk register which addresses all of the issues. And, in my experience, there is a governance purely around that big project, which is a project board which has executive representation on it. I think from the risk point of view, for a risk to be escalated off that project board-- off that project risk register and onto a trust risk register, it would have to be really quite significant, although there are some things.

One example I can think of is that we had a risk on our trust risk register related to moving the patients into the new hospital, which wasn't on the project risk register. That was on the trust risk register.

Q When you say, "really quite significant", is this scores in the 15-20s territory that you're having in mind, or are we thinking about something else?

A Yeah, and it-- I think it would be more that it would have-- that the impact would be felt organisationally as well as in the defined project.

Q So you would have to have an impact outside the project across the organisation?

A Mm, yes.

Q If you think about the other three issues that we have come across that I want to ask you about, so I'm going to put these three to you and then we'll

come back to that question again.

So there's the use of chilled beams in many, many rooms and wards. There's the pre-filling of the water system 18 months before handover and the decision to go ahead and use Horne Optitherm taps after the meeting with HPS in June 2014. Now, thinking about that question of should those issues get out of the project risk register to a corporate level, how would you see the debate – if there is one – about whether they should, those four or any of them?

A I think probably during the construction and up to the point of handover, which isn't of course the same as opening the hospital, that they would stay on the project risk register, and then at the point of handover they would probably be-- if they were still on the risk register for the project, then they may transfer over into the main risk register.

Q I suppose that's not quite an answer, but if you look at the corporate risk register for, in this case, the Greater Glasgow and Clyde Health Board, it just acquired a new hospital. At this stage, these four things have happened. Do you feel strongly or not about whether they should have been on the corporate risk register after handover? That is the air change rate derogation decision, the use of chilled beams, the fact of the water system being pre-filled, and the use of Horne Optitherm taps across the hospital.

A I think for three out of the four, I would say yes.

Q What's the one you wouldn't say?

A The chilled beams.

Q Why is that?

A Because at the point of construction and handover, the SHTM guidance didn't have the same caveats in it around chilled beams as it does now, because now it has the information that they shouldn't be used-- or they should be thought about really carefully if you want to use them in healthcare and that they have to have separate agreement from a ventilation group, and I think that wouldn't necessarily have been recognised as the risk that perhaps the-- from the evidence presented to the Inquiry that we now think it is.

Q So, if we put that to one side and go back to the air change ventilation derogation, what are the issues around why that should be on a corporate risk register at that point? If you have a strong view.

A I think it should. I think it presents a risk to some populations of patients. It----

Q Why do you say that? For example, if you think back to the chief executive of the construction company, he was very clear that he understood it. I

mean, he's not a technical expert, but very clear that there's a position to be advanced that it doesn't pose a risk to general patients.

A And that may be the case, and that's why I said general populations because I think it's-- it's very, very difficult to measure whether or not it has been a risk to the general population of patients, but for certain populations I remember that there was no-- Perhaps a more specific risk might have been that that was-- that that was implemented across the entire hospital without change for use of wards.

Q So places like Ward 2A and----

A 2A, 2B, 4B----

Q PICU?

A -- ITU, 4C, yes. So that derogation was used across the whole hospital, rather than following the guidance which specified different levels of air change for different areas and ensuring that those were-- that was followed. So that would probably be the risk that you would want to have rather than----

Q The specialist part, as it were.

A Yes, rather than the derogation as a whole.

Q What about the point that it seems-- and we haven't heard from all the witnesses yet, but it seems quite possible that outwith the Project team there wasn't an awareness of the existence of this derogation. So how does that affect the discussion we previously had about how can you put something on the risk register if the organisation corporately doesn't know about it?

A So-- And it may not have been recognised as a risk even in the project, I don't know, because if you did have an executive-led project board, you would expect that if it had been on the risk-- excuse me, if it had been on the risk register, that that would have been a subject of some discussion at that project board, or if the derogations had individually gone to that project board or however the governance was run, but if it wasn't recognised as a risk by the project, then it wouldn't have been escalated.

Q And then it wouldn't have made its way around the corporate register.

A Yeah.

Q If we look at the pre-filling of the water system, if that's one of those ones you think should be on the register, do you have a strong view about it and on what basis should it be on the corporate register?

A Well, I-- as you know, I'm no water expert, but 18 months in advance of use does seem like an awfully long

time just to the untrained eye.

Q We're going to get Mr Poplett's view on this. Maybe we'll come back to that when we talk about the water system as a whole. The Horne Optitherm taps, given the terms of the meeting, I wonder if we can put the minutes of the meeting on the screen. Bundle 15, document 9, page 692. It is not on the document list and I'm grateful to my colleague for hunting it down. It is, fantastic. So, 5 June 2014, it's a meeting at the South Glasgow Hospital chaired by Mr Stewart from HFS with representatives from the Health Board, Health Protection Scotland and including Dr Walker. If we go on two pages and we look at the actions and look at 5.3, stop me if you think I'm going too far away from your expertise, but the last sentence:

> "There was no need to apply additional flow control facilities or remove flow straighteners and any residual, perceived or potential risk would form part of routine management processes."

Do you have a view about whether those residual perceived or potential risks should have made their way onto a risk register?

A I like to think that I would have made-- if I'd come across that in the build of my hospital, I would have put that on the risk register.

Q When you say you like to think, you're not necessarily sure people would do?

A No, I like to think that I would. I-- You know, I think there is a lot about it, isn't there? It's-- There's the risk that the routine management process would not be done properly. That's a risk. Maybe that should be on the risk register. I think the-- with the benefit of retrospection, you can say, "Well, that was a mistake."

Q Are you----

A At the time, they had all of these experts in the room, and they made what is quoted as a "unanimous agreement" that they would stick with what they had. I know that Dr Walker's view is-- of that meeting is slightly different and that he wasn't part-- he didn't feel that he was part of that decision making. However, I think they've-- they have recognised that there is a potential risk there. They know what has happened in Belfast. They've taken advice. It was very clear from what happened in Belfast that the flow straightener was a huge part of that outbreak, that it did need management.

I think the way this is written suggests that they'd said, "Oh, yeah, don't worry about that. It'll be part of the routine maintenance programme. Don't worry about it." Whereas actually what

they needed was a very clear action to double-check that that is part of the routine maintenance and then they needed a programme of audit to ensure that it did actually happen.

Q And would that come about through the risk management process?

A So, yes, because there's-- I mean, perceived or potential, there is-- there is an absolute risk which was well recognised, which was in the literature, which was evidence based. You know, the guidance had changed to accommodate that known risk, but they chose to accept that known risk, and I don't think the response that we have written there is strong enough.

Q If we move on to the water system as a whole now. Obviously we've all heard evidence about the April 2015 DMA Canyon L8 risk assessment. I am not proposing to go to it, and this identifies risks. To what extent do you feel comfortable about talking about the need to put a water system, domestic water system, on a risk register as a hazard that causes risk that requires to be managed?

A So, if-- assuming that that had been shared and that that report had been widely known about in the organisation, that should absolutely have been on the risk register.

Q Are you the duty holder for your hospital trust?

A Yes.

Q So do your hospital water systems get onto a risk register all the time, or will they only get on if they had a report like this one?

A Or an identified problem.

Q Or an identified problem, but would they be there all the time as a risk to have and manage all the time?

A Not-- Well, at some level you would expect to have a risk around, at the Estates department level, you know, the water management or management of the water system and so on. There would be something there.

Q So you'd expect that----

A So potential failure of the management system.

Q So, within the management structure for water, there should be a risk management process.

A Yeah.

Q But it would only get escalated to the corporate level if there was a problem.

A Yeah.

Q Right. In that context, the pre-filling of the system, should we see that as-- or if you don't have an opinion because it's not your field, tell me. The question is whether we see that as part of, by this point, the water system as a whole or a separate hazard that requires

to be considered.

A You see, it is and-- I don't want to say it is and it isn't. It's one of those situations where it depends. You would think that-- naturally think that pre-filling a water system would be a risk that far ahead of it being used, but in isolation, without knowing what the management processes were around that-- but it's hard to see how that early on in the construction or that early on in the-- yeah, in construction, that you could have a comprehensive flushing regime, checking regime, which would actually be complete enough to manage that.

Q I mean, the plumbing subcontractors are clear they had a comprehensive flushing regime, and we've got Mr Poplett's report, so we'll come back to that. So are you basically on the edge of your expertise here and----

A I-- Yeah, I'm----

Q Right, well, we'll move on. Now, we've previously talked about Ward 4B and Ward 2A, so let's start with Ward 4B. Now, we know that Ward 4B is found to have problems with the ventilation system, not being what people expect, and after five weeks the patients return to the Beatson, and then various papers go to committees – Acute Services Committee, I think – after Dr Armstrong revises them, and eventually the ward is refitted.

Although changes are made and HEPA filters are added, it doesn't meet SHTM 03-01 requirements, although it's a considerable improvement. Now, of that journey which I've summarised very briefly, where do you think it should have appeared in a corporate-level risk register?

A Right at the beginning.

Q Would it stay there, even when the patients went back to the Beatson?

A Yes, because you still-- you then have-- Moving the patients back to the Beatson is part of your mitigation. It doesn't remove your risk because you've then got to complete your mitigations and move the patients back, because the Beatson should've closed and the patients should've been in the QEUH.

Q So the original hazard is the non-compliant 4B, and then everything else follows after that?

A Yeah.

Q What about the view that something like this is not a corporate-level risk, although it's a regional BMT unit?

A There's a lot-- One of the things you have to consider in where you put the risk is-- it's not just about who's responsible for it, you know, where it sits from the corporate management point of view. It's also about reputational risk. The reputational risk here was high

because you have a brand-new hospital and you've moved patients out because it's not safe.

So, from a corporate point of view, I would say that that is where it needs to sit because from the-- The corporate management of that risk or corporate oversight of that risk is going to be really important in managing how it's presented, what your reputational risk looks like and how you-- how you manage the outcomes of that.

Q Is there a judgment point, though, here-- is that, to what extent is it reasonable to think that, well, you could actually just manage this within acute services or within regional sector, and it doesn't need to make its way up to board level because it's actually just being managed by the teams in those units? How do you respond to that suggestion?

A I mean, you could, but, as I said, where are you then going to manage your reputational risk? So, theoretically, you could, of course, manage it in acute services level and let everybody get on with it, but the oversight of how that was managed and how you deal with it and the governance around it strikes me that it needs to have that senior oversight.

Q Well, let's move on to Ward 2A. Now, I have to say that I'm always a little bit unclear to the extent to which

people realised all the ways that Ward 2A wasn't in compliance with SHTM 03 in 2015, but, "It wasn't to some extent," seems to be clear.

So, in the summer of 2015, we know there was a discussion of risk around commencing a particular bone marrow transplant in Ward 2A in the summer of 2015 because we've discussed it with Dr Armstrong and Professor Gibson, amongst others, and seen minutes. Should that have made it to a corporate risk register?

A (After a pause) I think it depends exactly what was known at the time.

Q So, for example, we know there weren't HEPA filters in the housings. They fitted the HEPA filters. Does that need to make it to a corporate risk register?

A I think it should certainly have been escalated as a risk through the governance structure. Now, whether that meant that the risk itself should be up there-- I mean, ultimately, we got to the point where of course it needed to be because of everything else that happened subsequently, but at that point the fact of the lack of HEPA filtration should certainly have been something that was escalated----

Q Even though it was fixed?

A It's a significant-- it's a

significant issue with the way that the ward was constructed.

Q Even though, in respect of those isolation rooms, it was fixed? They got the units in from Northern Ireland, if my memory serves me correctly.

A But in the meantime-- Because that didn't just take a day, did it? So something as significant as that, where you have to make a reasonably major change to something, even if it wasn't-- I'm not suggesting that the risk should have been sitting at that level, but the governance process to raise concern should have gone up there.

Q Is this about making sure that it's formally reported and recorded?

A Yeah, yeah.

Q Now, we do now know that the ward wasn't validated, but, again, it's not entirely clear that was something that was understood in 2015. We had some evidence from Dr Agrawal about-- in the context of adult patients in a BMT ward. He felt that using a ward that had an unvalidated ventilation was unsafe, but when pressed about that, he saw it was more-- that this was because of lack of knowledge. He did not know what-- There might be something terrible wrong; he doesn't know. Therefore, it's unsafe.

I realise that validation wasn't something that was immediately cottoned onto in the Queen Elizabeth, but once it was realised there was no validation of the ventilation system, where should that have gone in terms of this register?

A So, again, I would say that that could-- I think it probably should-- the conversation, the reporting, should definitely have gone up to the Board, and Board, at that point, would've-- "Well what's happening in the ventilation in the rest of the hospital?" And I would have expected that response. You know, was the ITU ventilation validated? Was the PICU ventilation validated?

All of the other wards that should have had some level of specialist ventilation, that's what you would extrapolate out of that report going up. But for the actuality of it going-- that could have initially been managed locally and at the same time as getting somebody in to validate the system.

Q Right. What about the awareness when it's had that the isolation rooms in the new hospital weren't-- are all built as PPVL rooms as per the employer's requirements? Once that's realised-- Because I know there's a gradual process of switching some of them over to different sorts and we have that in our PPPs, but when, if at all, should that make it to a corporate-level risk register?

A So that, again-- I mean, I think by this point you're building a picture of

flaws in the construction of the new build, and that should-- the reporting of all of these things should be coalescing into a board-level risk at this point.

Q And that would involve reporting it to a board-level subcommittee at the very least?

A Yeah.

Q Do you recollect there was the email from Mr Powrie to Dr Inkster and others about the air change rates in May 2016, when they find out about the derogation? Is that something you can-- you remember reading about?

A I think so, yes.

Q Now, I appreciate that's about the air change rates we've already discussed, and you've explained that you felt that the air change rates, certainly for specialist ventilation spaces, should be on a risk register.

What's the process that should be happening in terms of management once that 2016 realisation happens, that you realise that there's been this decision – at this point, seven years before – that involves air change rates being lower than the guidance? What should happen in terms of risk management at that point?

A So, I would expect that a group would be put together to examine all of the issues together, that a

comprehensive risk assessment would be done of the whole site to determine where your risk points are, and to further test what the air changes actually were in reality compared with what they thought they were on paper.

Q Now, before we go and look at a little bit of the couple of pages on the risk register, there have obviously been two bits of spend on improvements to the ventilation system, one involving Ward 4B, fitted out for June 2018, and one involving the rebuilt 2A/2B for March '22. Are those processes something that requires a consideration of risk? I mean, have you done it right? Or is it just all good news? You just changed the scorings on the existing risks?

A No, you have to-- you have to-- Part of the process is some form of check, so you would want to get yourself into a position where you-- Let's take 2A/2B. You'd want to get yourself into a position where you can close that risk that is related to all of the issues.

You would have to have, before you could do that, the validation of the new ventilation system, you'd have to have the water testing, you'd have to have all of these things identified, and the sign-off, the comprehensive sign-off of that as a build.

Q So the completion-- the removal of the Ward 2A/2B risk, whatever

you'd previously assessed that to be-- Is a risk management structured process looking at the building work, so you're checking that you've done all these things in order to remove it?

A Yeah, it would be the same sign-off as you'd do for any refurbishment.

Q What I want to do is show you two entries, one of which you drew to my attention, one of which I thought was interesting. So this is bundle 45, the redacted version, he says rather loudly, page 141. Now, this is a risk register from August '15, and the top row is, in fact, the Vale of Leven report. A reference is not relevant now. It's jumping a lot on my screen. Thank you.

Now, I wonder if you-- You draw my attention to the last entry, which is 12.3, "Description of risk: catastrophic event occurs causing inability to use South Glasgow University Hospital", and why do you think that was worth considering?

A The timing of this was August 2015, wasn't it?

Q So it's three months after handover.

A Yes, but it was also, I thought, probably in response to moving the patients out of 4B.

Q So you don't know? You're just wondering whether there's a connection?

A But the timing is right, isn't it? The patients were only there for a couple---

Q I mean, it might be it was on the earlier register, because this is August '15. If you look at the one above, 12.2, "Disruption of services during transition to new hospitals". Now, transition had occurred by August '15, so it might be we've just not gotten a-- a one that's a few months before.

A Mm.

Q What I'm wondering is if we can look at how you manage the idea of a catastrophic event here, and you've got a score of-- likelihood score of 3 and an impact of 5, and a risk priority and a risk rating. What I'm wondering is not to get you to assess those, because that's not the purpose of your evidence, but to ask: what sort of things would an entry have said around about this time dealing with what was found to be suboptimal about the new hospital? What might you have said in an entry in the summer of 2015?

A I'm sorry, I don't understand the question.

Q So, if you were trying to record-- You've said that the Ward 4B failings of the ventilation system should be recorded in the register. You've said the Ward 2A ventilation system should be recorded in the register at this point, and you've discussed the possibility of

whether the water system might, but it's not within your area of expertise. I just wondered, when you're building a new hospital, is one of the risks we don't build the hospital we intended to build, and whether that should have been recorded in the register at this point?

A I think a catastrophic event is a kind of catch-all phrase----

Q Right.

A -- to include everything that you could possibly think of, really, if it had that impact that it meant you couldn't use all or part of the hospital.

Q So you feel that's just a sort of catch-all event that may cover a lot of things within it?

A Yeah.

Q Right. I wonder if we can go to page 333, and this is from a corporate risk register in August '18. Now, the date isn't here, but that is the date. Now, it's risk Datix ID 2190. The accountable owner is the medical director, and the description of risk is:

> "Failure to implement national guidance, systems and policies in relation to water safety."

This appears six weeks after the DMA Canyon report emerges. I suppose my real question is, in the way this is phrased, is this not just a generic risk around-- it looks like a generic risk around water? It doesn't mention the Queen Elizabeth. It doesn't mention DMA Canyon. It doesn't mention anything.

A It does look generic. It doesn't describe what the risk is. So, the risk is more like risk of harm to patients due to the "Failure to implement national guidance, systems and policies". It is a catch-all thing, but the mitigation, they're not mitigation actions. They're things, they're committees, apart from, "Sampling in response to clinical cases", but that kind of is a bit checking after you've got a clinical case rather than actually preventative, because what you would want is to have a preventative programme in place rather than have a water-- well, you need a water safety group, which should then-- but that's-- these are not the actions and controls that you would expect----

Q The reason I ask----

A -- in response to that risk.

Q We know that the Health Board set up a Water Safety Group for the hospital, began a massive programme of water testing, installed the chlorine dioxide system, and I think, in Dr Chaput's words, they carried out more water testing in this hospital than any other hospital in the UK, in her opinion. I appreciate this is only six weeks after they discovered the problem and it may be that Mr Walsh's group is still working,

but would you expect to see some of these sorts of things listed in the entry?

A Absolutely.

Q What's your view-- If we're right, of course-- I'm saying this, that we're not going to take you to the register – that would be an inefficient use of time – but if we're right as an Inquiry team to suspect that the other risks we discussed are not recorded in the register in '15, '16, '17, what would be your view about that?

A I think you would have to see if they are-- any other risk registers apart from the corporate one.

Q So it might be there lower down?

A Maybe on different risk registers. There may be an Estates risk register, for example, where some of them appear, but you would expect-- you would expect them to have been recognised and identified as risks.

Q Now, do we see later entries-- I'll give an example of a later entry. So, this is at-- no, I'm not going to go to that one. So, it might be there are later entries with more detail in the risk register, and that's good.

A Yes.

Q But when we think about the events before the start of the water incident, if there's no mention of any of these other issues before the start of the water incident, and either they're not here

or they're on a lower-level risk register, do you have a view about that?

A I think-- I think it all hinges around the non-recognition of the importance of the DMA Canyon report.

Q Right.

A Which, you know, identified the non-compliance and the issues with the water system, and I think, if that-- for that to not be identified and not be recognised as a major risk, then everything else kind of falls down following that.

Q When you say everything else, do you mean the ventilation ones as well?

A Well, the ventilation ones-- Sorry, I was concentrating on water. Ventilation ones, yes. I mean, you know, from-- those have been recognised very early on, and you would expect to see them on the risk register.

Q In terms of the DMA Canyon report, because it's not escalated or seemingly not escalated, that may be a better explanation for its non-appearance on the risk register than anything else?

A Unless you find it on an Estates risk register somewhere, but I'd be-- yeah, but certainly, you know, to open a hospital and have a non-compliant water system that-- as it opens, should be a corporate risk.

Q What I want to do is go back to your report – so that's bundle 44, volume

6, page 10 – and to continue looking at----

THE CHAIR: Sorry, I think it's entirely my fault. It seems quite clear that the DMA Canyon report was instructed in 2015 but then lost sight of and only came to the attention of anyone who did anything about it in about June 2018. Now, it's just to understand Mr Mackintosh's questions and your answers. Now, the question was: if before the start of the water incident-- So I take it that's March 2018?

MR MACKINTOSH: Yes, indeed, my Lord.

THE CHAIR: It was not on the corporate risk register, any view about that, and I've noted you were saying it all hinges on a non-recognition of the importance----

MR MACKINTOSH: Maybe I'll turn----

THE CHAIR: -- of the DMA Canyon report. I'm just----

MR MACKINTOSH: I'll turn it into a question, my Lord. It may be my mistake.

THE CHAIR: Right, okay.

MR MACKINTOSH: To what extent is the fact that any risk of any level arising from the water system, whether it's pre-filled or the Horne taps or any of that stuff, is not on the risk register prior to the start of the water incident is-- in fact, that largely will be explained by the fact that it wasn't escalated within the organisation?

A Yes, I think so, because if it's not escalated within the organisation, then nobody has oversight of it and nobody is ensuring-- even though there is a Water Safety Group and that's what they should have been doing, nobody's checking that all of the management of that system is to plan.

Q Thank you. I'm proposing to go to page 12 of your report and look at your conclusion, but before I do that I want just to ask you a couple of questions about "safe" again. So, if I recollect what you were saying before, that something is unsafe if there are serious consequences which have a higher prospect of happening. You're nodding.

A Sorry.

Q But if we go back to the original part in your report, which is the process on page 5. Just to recap: we had at 4.1, "Identify the hazards"; 4.2, "Determine who might be harmed"; 4.3, "Evaluate the risks"; 4.4, "Implement measures to minimise the risk". Then you've got 4.5, over the page, "Record the significant findings" and review and update. I think your evidence was that, somewhere in that process of choosing the control measures and implementing them, you're deciding on your tolerance of risk.

A Yes, I think you have to have

all of your information in place.

Q Before you do that?

A So, you need to know what your risk assessment looks like. You know what the findings are. You know what the control measures that are available to you are, and then you can put that together as to what risk you're willing to tolerate.

Q Now, if you decide as an organisation through a process fully informed with all that assessment----

A Yeah.

Q -- that you're prepared to tolerate a particular risk, is it ever fair to describe that hazard as causing something that's unsafe?

A So, unsafe in the moment or unsafe because you're willing to accept an unsafe level of risk?

Q Well, to some extent, is this an internal logic, that if you go through a proper health and safety risk management process----

A Yeah.

Q -- you decide the hazard, you review the hazard, you identify the risks, you look at your mitigations, you apply the mitigation chart that's in front of us on the screen, you come up with a plan----

A Yeah.

Q -- and you decide what risks you're going to tolerate, to what extent is it legitimate to criticise what comes out of

that as unsafe, to sort of second-guess the process?

A It's not necessarily your outputs that's unsafe. It's where you start that can be-- will be unsafe.

Q But if you do all these things-- So, if you start with something that if you didn't address it would be unsafe and then you take all the steps necessary and you decide to tolerate a certain level of risk and you reach a conclusion, will that now be safe?

A But you said, "will be unsafe if you don't address it", but actually it is unsafe at that point.

Q Right. So, if you have a hazard that is unsafe, that you assess, that you identify the risks, you choose a mitigation strategy, you decide what risk you're going to tolerate, you then do that, is it ever still going to be unsafe at the end of that process?

A It will continue to be unsafe until you manage to bring that-- the risk score down. So it may be-- it may be that it takes time to affect the risk score. So your mitigations may take time to implement. They may-- in order to-- and you may have to put other systems in place. So it's like, "Can you fix a water system?" "Well, we can, but it's going to take a lot of work and a lot of time." "Well, actually, we'll-- so we'll put filters on all the taps as a mitigation," but that

doesn't stop your water system being unsafe in the meantime. It just means that you are protecting your patients.

Q From an unsafe water system?

A Yeah.

Q We go back to your conclusions on page 12. So, in paragraph 26, this is effectively your replacement for the definition that we had sent to you. So you're no longer saying "… is unsafe and unmitigated… avoidable risk to patients". You now have a more complex idea that you:

> "… consider whether all risks have been recognised and then whether those risks have been mitigated to an acceptable level and are being actively managed…"

That's your definition of "unsafe".

A Yeah.

Q So something that, if unaddressed, would be unsafe can be made safe by being recognised and then-- having its risks recognised and those risks mitigated and actively managed?

A Yeah.

Q You then have something at paragraph 30 which strikes me as possibly new, so I wonder if you can take me through what you're saying in paragraph 30.

A So the most recent data that we were given on bloodstream infections was for the first eight months of 2023.

Q This is an extension of your 214,000 rows spreadsheet effectively?

A Yeah, which wasn't used in the calculations and the chart. It just went up to 2022, but the data that we were given shows that there are still infections with environmental organisms. Now, that doesn't mean that it's not safe----

Q Right.

A -- because we know that there is-- you know, that other similar units are also seeing a level of infections.

Q Because that's what Mr Mookerjee's study told us.

A Yes, exactly, and we know that the lines cross and, you know, they get-- the Schiehallion Unit rate is well down compared to the comparator units----

Q In fact, maybe lower than some of the comparator----

A Yeah, by the-- by 2022. So the question is: is everybody happy with that? Do we recognise that the risk is being managed? Do we recognise that mitigation has been put in place, engineering controls have been put in place and that we have got that rate down to as low as we think that we can reasonably expect to go?

Q And so, what's your view about the extent to which that might be the case?

A Well, I think if the-- you know, if everything remains as it is, so the rates

remain where they are or go lower, that the water continues to be managed, that the management system is stable, is-- you know, that the testing continues and doesn't show up any weird things or, you know, unsafe levels of organisms----

Q When you say “weird things”, you mean organisms?

A Yeah, so unsafe levels of organisms and stays within the expected parameters, then I think you can say that from that point of view that it is safe.

Q Because you've applied that logic of thinking about what the risk is?

A Because you are doing everything that you can to prevent the infections.

Q Even if it wasn't put on the risk register at the time you'd like it to have been put on, you can still say that it's now not unsafe?

A Yeah.

Q So, to some extent, this discussion about risk register is not definitive. You can have something that's not on the risk register and be concerned about that and yet the problem is actually being managed in reality, just not through the risk management process?

A Yes, you can. It's not ideal.

Q Why is it not ideal?

A Because it doesn't give you visibility and it's not the best governance process, if you have something that's

happening on the side but you don't recognise it in your risk register.

Q Also, would it make it harder for the fact that you're doing it to be known, as it were, at the part of your Board minutes that make it into the public domain?

A Yeah, yeah.

Q My Lord, this is probably a good time to stop for the lunch break. I just indicate for my colleagues in the room that was me probably at the end of my section on risk, and I would be grateful if anybody has any Rule 9 questions on risk to get them over the lunch break because it means I can do them straight after lunch. That might help logically.

THE CHAIR: I can see that might make sense. We'll take our lunch break now, Dr Mumford, and try and sit again at two o’clock.

THE WITNESS: Okay.

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

THE CHAIR: Good afternoon, Dr Mumford.

THE WITNESS: Afternoon.

THE CHAIR: Mr Mackintosh?

MR MACKINTOSH: My Lord, thank you. I’ve got one follow-up question from the risk conversation, which is this. It relates to Ward 4B. Should Ward 4B stay

on a high-level risk register to the present day due to the ventilation system that is now in place in the ward not having a HEPA-filtered corridor and there being a backup air handling unit? So, in a sense, should the partial compliance with SHTM 03-01 cause 4B to stay on the risk register, in a sense, forever while that remains unchanged?

A You can't have-- Well, you shouldn't have risks that just stay open forever because it suggests that you're not managing the risk. I think it depends if there has been a conversation which is, "This is the risk assessment associated with this area and we accept that there is this level of risk," and that would enable you to close the risk and accept that level risk within the ward.

Q So, if you decide that you're going to accept the ventilation system in 4B as it currently is completed that doesn't quite meet SHTM 03-01 standards and you make that decision, would you close that off even if the mechanism to do that involves some form of a continuous mitigation plan in the way you manage the patients, for example? Does the fact that you're still doing something that you might well be doing mean you have to keep it on the register?

A Only if you need to keep changing that. If you reach a point where your business as usual, so the standard way in which you manage the patients and the environment, is no longer going to change and you accept that that is how it is going to be, then you can document that decision-making process alongside an updated risk assessment and close the risk.

Q Thank you. What I want to do now, Dr Mumford, is move to effectively back to where you were with your report last year. So your report, which is bundle 21, volume 1, document 4, had at page 128 a "Scope of the report and evidence considered" section, and if we jump onto the next page, we see that you had three different sections: "Evidence of the water and ventilation systems being in a state that created an opportunity for patients to be exposed to pathogens", "Infection pattern" and "The prior reporting and analysis of others on the question of infection link".

Now, with the exception of possibly the new evidence about pre-filling the water system, is the main area of new material the "Infection pattern" section? I'm thinking of the HAD Report particularly.

A Yeah, I think that even though it's come out eventually with the same answer as everybody else, yes, that would be the new evidence.

Q And Mr Mookerjee's work falls within the "Infection pattern" section as

well?

A Yeah.

Q Right, what I'm proposing to do is to discuss infection patterns. So, we jump to page 130. You listed the Annex F of the Oversight Board report, a timeline, Mr Mookerjee's report is 8.20, and then you looked at the prior reporting. I suppose what we should do is look at the HAD Report in its current form in respect to infection patterns and Mr Mookerjee's report and then see where that takes you.

So, what I'd like to do is to go to the HAD Report and look at their list of environmentally-relevant microorganisms, which is at bundle 44, volume 1, document 1, page 97. This is Tables 11A to 14. Now, I wondered if you had given any thought to the extent to which this list is similar to the master list that you were using for the comparison exercise that Sid did, Mr Mookerjee did.

A It's similar. There are obviously some bacteria which don't appear on the QEUH list that we were working with because we didn't look at any infections that occurred in Yorkhill and we didn't look at any infections which were primarily-- so which were first detected on wards outside the Schiehallion Unit.

Q If we look at the HPS groupings of infections, that's bundle 7, document 6. It's the October 2019 HPS review at page 219. We have four groupings there: gram-negative bacteria, gram-positive bacteria, environmental bacteria, and then environmental including enteric group. Do you have any views about the similarities or differences between your master group, the HAD group we just looked at this first page of, and any of these groups?

A So, the HPS list was included in the comparison that we did to come up with our master list. I must admit, I haven't compared that list with the HAD list, so I can't be 100 per cent sure that there aren't organisms on that list which aren't on-- that are on the HAD list that aren't on our list, but we took this list and we took the CNR list and so on, and so we had the widest-- I think we had widest possible-- so I'd be surprised if there was anything in the HAD that we hadn't included.

Q If I remember correctly, Professor Hawkey gave evidence that the environmental enteric group-- I think Ms Cairns as well. There's been a sort of general view that the environmental enteric group might not be too dissimilar from Professor Hawkey's environmentally-relevant group in the HAD. Do you have any view about that? For the purposes of looking at the differences in trends in epidemiology

studies and things.

A No, because those on the enteric list, those organisms were the environmental including enteric group, the additional organisms there were in our master list.

Q Right. I wonder if we can go to back to the HAD Reports. That's bundle 44, volume 1, document 1, but this time to page 117. Now, there's Figure 21, which is, "Bloodstream infections attributable to organisms with no environmental relevance at Yorkhill and QEUH with a fitted line showing change over time". Over the page on 118, there's the same but for environmentally relevant organisms. Now, when you saw these two charts, did you have any views about their value?

A I thought that, because they were comparing the QEUH with Yorkhill, that that perhaps wasn't the best comparison given that the length of time of it was much longer, but also, comparing it with Yorkhill and saying, "So it's okay because it's the same," is not ideal. You would hope that with what they thought they were moving into in the Schiehallion Unit in QEUH was state-of-the-art, protected environment, and all the rest of it, that you would actually see a drop. So comparison with Yorkhill isn't really valid. It doesn't-- because you don't know on a wider reference scale

with more hospitals whether that's actually still a high rate.

Q I mean, the HAD authors expressed the view that the comparison is valid because it's the same effective population of patients being treated by the same team in, broadly speaking, the same way in the same unit, and therefore there are quite a lot of similarities between treatment of paediatric and haemato-oncology patients at Yorkhill and at the----

A It's not about the treatment, it's about the environment that they were, in and you cannot-- I don't think you can compare one with the other. I mean, I know no details about the unit at Yorkhill. I don't know what the ventilation was like. I don't know what the water was like. I think it's-- You cannot compare it. You cannot compare the two. But the scale, only taking it by year, doesn't show you the-- doesn't show you the true curve. Putting a line through it is not----

Q Well, we'll come back to the line in the moment. Just about the comparison, because we didn't have access to details of the units or the water system or the ventilation systems for Leeds, Cardiff and Vale----

A No.

Q -- Oxford, or Great Ormond Street. So why is there an issue about this approach when I think you would

take the view there isn't an issue about the other approach?

A Because you've got no reference for it being a good baseline to compare with if you-- Just comparing one unit with another unit doesn't give you that variety in order to be able to say what the mean level is. But also, you know, this doesn't take into account any of the-- everything else that we know that was going on and the views of the staff that there was a problem, and it doesn't take into account also-- I mean, it shows that everything lifted off the zero line, but it doesn't demonstrate that that is a problem, which in fact----

Q So, if we just think about the views of the staff and come back to the zero line in a moment, I think the view expressed by Professor Hawkey and Dr Agrawal and Dr Drumright is that, by producing these charts as analysis of BSI rates, almost in a sense in ignorance of what was going on the time, they're not encumbered by-- they're not influenced by looking out for changes that you would expect if the staff are talking about the right things accurately, and that is an agnostic approach. Do you see any value in that?

A It's an approach. I think it take-- it fails to take into account everything else that we know that was-- that was going on.

Q What's this point you make about bringing it off from the ground?

A So, throughout the Yorkhill data, you can see that the numbers keep going back to the zero line, but we have this lifting off of the numbers away from the zero line which is quite sustained for a period of time and which must represent an issue of some description, because the levels from 2015/16 are obviously very low and close to the baseline. So there must be something happening there but, because of the scale of the chart and the way it's laid out, you lose that richness of data within it.

Q If you go back to the previous page, what, if anything, should we draw from the fact that, I think as Professor Stevens wanted to point out, there's no point when the environmental infections touch zero until the very end in 2022?

A It's the non-environmental.

Q Non-environmental, sorry.

A Again, you know, you can argue that the green part of the graph, which is QEUH, shows an improvement, obviously, and then we've got a downward trend line and, again, it doesn't take into account everything that was happening in the-- in the hospital at the time.

Q It's probably worth just checking that a lot of these points are

addressed in your report on the HAD Report, which I should probably take you, at least formally. So that's bundle 44, volume 2, page 739, and then a joint report you do with Mr Mookerjee in the same bundle, page 1282. Are you content to adopt these as part of your evidence?

A Yes.

Q Yes. If we go back to page 118. Sorry, volume 2, page-- volume 1, page 118. There we are. Next page, please. Do you see anything important about the choice of a y-axis on these two figures, so Figure 22 and Figure 21, in the sense that the y-axis for Figure 22 reaches a peak which has a maximum extent of 25, and if you go and look at Figure 21 on the previous page, it reaches a maximum of 40. Does that pose any difficulty for us interpreting the images?

A I mean, it would be nice to have them on the same scale, but it also says that, you know, the non-environmental bloodstream infections are more common than the environmental ones because they're at higher numbers, but nothing more than that.

Q I'd like to look at-- I mean, I think I'm trying to cut this short in one sense. So, if we go to the HAD response document, which is bundle 44, volume 5, document 2, and we go to page 50, when you saw this, what was your response to the change from Figure 22 to Figure 2.F.3?

A So, I felt that it did now represent, and clearly represent, that there had been the peak in 2017/18 which was more or less the same shape, but it's not a-- it's not a-- what's the word-- I'm not used to looking at GAM charts.

Q Right, but in terms of the conclusion that is set out in paragraph 2.F.13 from the HAD authors, is that in any way different from the position they'd taken before?

A Yes, absolutely, because in the first paper it was a, "There's nothing to see here," but in the second, in this addendum, it's clear that there is something to see and that there is a peak.

Q If we go over the page on to page 51, then we see another GAM chart in 2.F.4 for the environmental. Did you have an opportunity to listen to Dr Drumright's evidence in any part?

A I listened to a small part of it, but I got lost in the statistics.

Q So, I want to just put something which, if I recollect correctly, she was discussing. If we go back to the previous page, I think it was her who gave the evidence that when you look at a GAM chart, it's when the linear plus smooth line leaves the area which is

shaded blue here, which is the standard deviations for the-- interval linear trend line, that you know something unusual has happened. Then I discussed with her what it might show, and what I wondered was whether you had seen a similar shaped chart in other earlier epidemiological investigations that you've looked at as part of your report.

A Yes, so most of them do show that there was a drop. There was a-- So there was a reduction in the latter half of 2015 after the move to the new hospital, so the number of environmental bacteria went down initially, and then towards the end of 2016 started to climb, and then we had the peak, 2017-18, and then it started to drop again in 2019.

Q So who are the authors we see that in?

A So, I think the HPS report. I think Kennedy's report. Certainly, Mr Mookerjee's report.

Q So, if we look at HPS first, that's bundle 7, and we'll start with the situational awareness report. So, that's bundle 7, document 5, but at page 205 we have a situational awareness report and the list of slightly different bacteria groups at the bottom. If we go on to page 210, at Figure 3 we have the environmental group in this study. So did you use this report in your earlier original report for the Inquiry?

A Yeah. We did refer to it, yeah.

Q So how does this report, in your eyes, connect to what Dr Drumright and her colleagues ultimately found?

A So, this shows that the-- I mean, SPC charts are not ideal for demonstrating this, but it shows that the drop at-- in 2015----

Q Can I just check something you-- because there was a piece of evidence that came in after the hearing. I was corrected in the closing submissions from NSS. I seem to have misunderstood that the mean line on that chart, the centre line, as it's recorded there, is driven by the data points before the opening of the new hospital only. It's not driven by the whole chart. Is that something you'd appreciated?

A I don't-- No, I don't think I had appreciated----

Q Sorry, I interrupted you. Do continue, please.

A So, it shows that-- she shows that the-- most of the dots are on the baseline in the latter half of 2015 and early 2016, and then it shows that you get more dots above the centre line going into 2017 and 2018, and then you start seeing exceedances above-- right up to above the confidence limit, towards the middle of 2018. So it shows that rise in infections and, again, away from the baseline.

Q If we go to page 214 for the October report and then we go to page 230, and this is Figure 6, an SPC chart in October 2019, "environmental including enteric". A slightly different group. Did you look at this in your previous report?

A Yes.

Q What would you say that you see in here compared to the ultimate conclusions of Dr Drumright?

A I think it shows, again, that-- exactly the same thing, and then you can-- there are-- the base-- the lowest dots come back down to the baseline in 2019 and then sort of settle more around the midline, but-- So it shows very much the same thing.

Q If we look at Dr Kennedy's work-- I recognise in your report, you-- Dr Kennedy didn't add much to what was done by HPS, or am I being unfair to Dr Kennedy?

A No, I think that's true.

Q But if we look at his report, he spoke to-- his 2019 report, and we go to bundle 6, document 28, and we go to page 107, and this is the chart he spoke to in the final report that he produced. When you looked at his report before, why was it that you didn't see that it added anything to what you've previously seen in HPS?

A So, I think it shows very much the same shaped curve. The thing that he's added, which isn't there in the HPS, is to recognise the difference between the number of organisms and the number of cases, recognising that there's polymicrobial infections in----

Q Yes, because I wondered----

A -- some patients.

Q I wonder if you can clear up why polymicrobial infections is a concept we need to pay attention to.

A So, I know there's been some discussion about polymicrobial infections and whether or not they're real, but they do show, in my view, a higher level of contamination of the environment or whichever source it is that you choose for the patients to get their infections from, and we saw a lot-- sorry, we saw a higher number than one might expect of polymicrobial infections, including-- which included environmental organisms.

Q This chart is a way of showing that?

A Yeah.

Q So how does it show that in, for example, 2018, if you could explain which line is which, as it were?

A So, the solid red line is the number of cases, so the number of patients who had a-- and it's a deduplicated rate, I presume, as the number of patients who had a positive blood culture and bloodstream infection. But then the blue dotty line is the number

of organisms seen. So you can see that, particularly between April to June, you'll see that very high peak, which is way above the number of cases, which is double the number of cases, which suggests that you've got quite a high number of polymicrobial episodes. We----

Q This will be children where you found two gram-negatives on this list within the same sterile sample?

A Yeah.

Q If we go back to the HPS work, starting with the situational awareness report in bundle 7, I wondered if – and I may have misunderstood this – we might see something like that in Figure 4, which is on page 211. Does this start telling us about polymicrobial outbreaks or have I misunderstood the spots? Or is this a different measure? It's a recurrent outbreak chart.

A So the, "Dots represent", it says, "the first and recurrent episodes of the same species from the same patient." So it doesn't-- it doesn't tell you which of the cases are polymicrobial.

Q In fact, do either of the HPS reports show you polymicrobial cases, as far as you recollect?

A Not to my recollection, no.

Q So where else, apart from Dr Kennedy, do we find a sort of visual discussion/presentation of polymicrobial infections?

A I'm not sure there is one, to be honest.

Q I know you discussed it in your report----

A Mm.

Q -- and I'm not proposing to go back to it, but there's a section in your report, you discuss when they occur and things. But did you pull that therefore – the stuff in your report – from your original data set you were provided by GGC?

A Yeah.

Q Are these the rows-- So, Mr Mookerjee was explaining it in the context of data management, that in a single row in that big spreadsheet or a single blood sample, there would be a row, a column, a box even, that would contain multiple codes for two, three or four different microorganisms found in the same sample. Those will all be polymicrobial cases?

A Yes.

Q Is that how you would have generated the text in the report about polymicrobial cases? You'd literally have counted them?

A Yes.

Q Is there any other way you could have done it, other than reading IMT minutes, I suppose?

A You could-- yes, you could, I

mean, reproduce a graph very similar to Dr Kennedy's----

Q Yes.

A -- and do it that way.

Q Well, let's take that off the screen. I just wondered, therefore, if we're thinking about the incidence of infections, as you called this section of your report, you had the access to some previous analysis by Dr Kennedy, by HPS. Did you actually consider Ms Harvey-Wood and Dr Peters' charts when you wrote your report?

A Yes.

Q Yes, those three sources. Then you also had HAD and you've had Mr Mookerjee.

A Just going to correct myself. I don't think I'd seen it when we wrote the report----

Q Right.

A -- the Peters and Harvey-Wood report. I think we saw that subsequently, I think.

Q Well, I think we should probably just look at it for that reason, just to give you opportunity to----

A But I'm not 100 per cent sure.

Q Well, we'll go to bundle 19-- Well, actually, no. You must have done so because----

A Did I mention it?

Q -- it's in bundle 19.

A Yeah.

Q So, the fact that it's in bundle 19, we would only have put it in there if you'd referred to it----

A Okay----

Q -- in the report.

A -- so we did, yeah.

Q So you did. Right. If you want to go to it, tell me, but could it be the case that that report doesn't do rates by----

A No, that does numbers.

Q -- bed days? It does numbers.

A Yeah.

Q I wanted to check something I've understood before I say it rashly somewhere and get told I'm wrong. You can obviously count infections and kind of episodes, and you've done that with Mr Mookerjee. Again, you're nodding, yes.

A Sorry, yes.

Q HAD have done that?

A Yes.

Q HPS have done that?

A Yeah.

Q Dr Kennedy's done that, and in different ways you've all calculated rates?

A Yes.

Q Dr Kennedy has also calculated a way of presenting the polymicrobial issue----

A Yes.

Q -- in his chart?

A But for a limited number of organisms.

Q A limited number of organisms,

because that's just the Dr Inkster list of organisms that's at the end of his report. We can just put that on the screen just for clarity. So, we'll go back to bundle 6 and we'll go to page 121. So, this list of organisms, which is much more limited than yours and HPS's.

A Yeah.

Q So you calculated it for that, and then we have the various colour block charts from HPS of what sort of organisms they were.

A Yes.

Q But they're not measuring polymicrobial-ness, if that's a thing.

A No, I don't think-- I don't think they put a case line in as well, did they? No.

Q Well, we can go back and look at them if you want to be sure. So, it's bundle 7. It's the redacted one, sorry. Bundle 7, at page 232. The section here is, "Diversity of… Organisms". Then page 233 has a chart for the organisms, deduplicated at species level per genus. So they don't measure polymicrobials either?

A No, because they do how many-- the percentage of how many-- of episodes that each organism appears in.

Q So I wanted to just check that, in a sense, these three different ways of looking at the incidence – that is the overall number of episodes, whether there are multiple organisms in the episodes, and what the species are – are there any other aspects to this incidence of infections sort of topic that you want to draw our attention? Because we can see how many there are, how polymicrobial they are, and what they are. Is there anything else that we need to think about in terms of what the data is showing to go back to your original heading, which was "Infection patterns"?

A No, I don't think so.

Q Could we take that off the screen and go back to your report? So that's bundle 21, volume 1, page 130. You've looked at those sources, and then you've looked at source 3, the other reports, which-- we'll jump over the page to 131. What I wanted to do now was to ask you to consider the idea of what Dr Drumright referred to as counterfactuals in understanding her chart. Now, you're not an epidemiologist----

A No.

Q -- but you are a microbiologist and an infection control doctor. So, if we go back to page 50 on the HAD response documents, that's bundle 44, volume 5, page 50. If we make that the whole top half of the screen, the whole screen, and we try not to worry about the fact it's a GAM chart.

I discussed with Dr Drumright two scenarios that she'd been asked to

investigate. That is the widespread contamination of the water system and inadequate ventilation. Now, I think she would say she didn't know what the nature of the widespread contamination was or how the ventilation was inadequate, but she knew that was two things she was looking for. But you do know what's been suggested about those two things, don't you?

A Yeah.

Q Yes, so she also suggested some counterfactuals, which Mr Mookerjee referred to as "confounders". Are you familiar with either phrase?

A So, "counterfactuals" is not a phrase that I would use. "Confounding factors" is probably something that is more likely to-- for me to come up. I'd say----

Q How would you define a confounding factor?

A So, a confounding factor is something that complicates or goes against your theory. It's, you know-- If you think that you know the mechanism of how an infection arises, then a confounding factor is something that would present an argument to change your thought process on it.

Q But if what is meant by "counterfactual" is an alternative mechanism by which this effect could be caused, would that still be a confounding factor?

A Yeah.

Q Right. Now, over the discussion with Dr Drumright, I think she had five or possibly four counterfactuals, and I want to suggest them to you and ask you to think-- for your comments: (a) are they plausible or not implausible? I think that's the way I put it with her. Then, once you've done that, we might see where you see them sitting in her data.

So, the first one was line infections. Now, am I right in thinking that you're familiar with the work of the CLABSI group and we don't need to go to documents about that?

A Yes.

Q Then she also discussed the impact of single room and nursing pressures. Is that something that you saw or discussed in your report?

A To some extent, but not-- we didn't overly concentrate on it, I don't think.

Q Now, I appreciate we will have to go through all the evidence we've reviewed, but of the material you reviewed, what discussion was there of single rooms and nursing pressures as a possible cause of increasing infections that you remember seeing?

A It was actually very little. I don't think that it came up in any of the

PAG or the IMT minutes that I read. I mean, it's a well-known phenomenon that if you put all your patients in a single room, the nursing pressure increases enormously because all your patients are behind doors and you can't see them all and it takes a lot more-- it takes a higher ratio of nurses to patients in order to be able to provide good care and safe care.

Q But is it not implausible that single room nursing pressures might have a part to play in the numbers of either environmental or non-environmental BSI that the HAD see?

A I think that one would expect that the number of patients-- sorry, the number of nursing staff to provide safe staffing levels on a unit such as the Schiehallion Unit had been carefully assessed and that it wouldn't be a huge problem.

On the other hand, you can find that if nurses are highly pressurised and they have less time to care and less time to complete their role, that they can, on occasion, be forced to cut corners. But we didn't see any evidence of that, I don't think, in anything that we read.

Q Would that include the CNR Overview Report and their discussions of nursing and nursing practice?

A I can't remember, to be honest.

Q Okay. There's then been a discussion about antibiotic prescribing patterns. Now, there's obviously been a lot of evidence about meropenem, and you've given evidence about it; I'm not proposing to revisit it.

Then there's been more evidence arising in the last week about whether we should look at ciprofloxacin. From your perspective, having looked at all this material, was there any evidence to suggest that ciprofloxacin or meropenem was driving infection rates?

A So, from the ciprofloxacin point of view, there's no doubt that the amount of ciprofloxacin decreased quite dramatically at one point – I think 2018 – because it was decided to give it as prophylaxis for-- against infection for the children.

On the other hand, we also-- we have evidence in Dr Peters' and Ms Harvey-Wood's presentation that the rate of ciprofloxacin-resistant organisms clung tightly to the zero line all the way through their piece of work. So, although there's high usage, there was no evidence that ciprofloxacin resistance was an issue at all.

Q What about meropenem? What's your final view on that?

A Meropenem was-- went in peaks and troughs, as you might expect with any antimicrobial that you're going to

use in that kind of unit. There were also peaks and troughs in resistance rates, but because the evidence that was presented was in numbers in Dr Peters' and Ms Harvey-Wood's presentation, whilst you can take a percentage out of it, the numbers were so small that it would be hard to think that one peak here and then a few months later another peak was more than coincidence, when maybe it was two organisms or three organisms. It could have just been due to natural variation, so I don't think there's conclusive evidence that meropenem was driving any resistance.

And the other thing to note is that it was not mentioned in any of the PAGs or IMTs around the environmental organisms. There was no mention of particularly resistant organisms other than those which-- like Acinetobacter, which is naturally resistant, there was no reference to increased resistance to antimicrobials or multidrug resistant organisms.

Q Now, the next one that Dr Drumright raised was the possibility that the contamination in either the laboratories or at the time samples were taken might have a role in driving infection numbers. Do you have any view about whether you've seen any material in any of the evidence to suggest that was a concern in the period from '15 to,

say, '20?

A So, I think that was raised in-- I can't remember whose report it was, but there was one report which suggested that there was a change in laboratory practice to-- or surmised that there might have been a change in laboratory practice to identify more organisms in blood cultures.

That was clearly not the case because part of the standards to which microbiology laboratories work is that if an organism is found in a blood culture, you identify it. You don't go, "Oh, I'm not going to do that one. I'll just do this organism." You identify organisms that appear in blood cultures.

So, unless there was previous poor practice in microbiology – which I know Ms Harvey-Wood has absolutely categorically said that was not the case – there doesn't seem to be any issue.

Q I think, to be fair, Dr Chaput has also been very keen to defend the competencies of the laboratories as a regulated accredited laboratory.

A Yeah, I'm sure.

Q The next thing is team dynamics. I mean, that's my phrase, but I think by the way that Dr Drumright was discussing it, it's the idea that people aren't working well together in the broadest sense. I put to her it might

include Estates people, Infection Control, microbiologists, treating clinicians, more senior management. Now, she didn't have any access to any of the evidence about this, other than the most-- whatever she picked up from reading material after the HAD Report was written.

Now, you have, no doubt, picked up a lot of this evidence. I'm not going to ask you to tell me who, amongst the protagonists in these discussions, you-- you prefer their evidence or not; that's not what I'm asking you to do. It's more at a high level to ask you whether it's plausible or not implausible that suboptimal team dynamics between all these people could have contributed to these infection rates in both environmental and non-environmental organisms.

A I think it's plausible that it might have an effect, and you can imagine a scenario where some Estates work needs to be done and the request for that to happen is made, but the dynamics are such that the Estates team choose not to do it, or that another part of the team doesn't want to talk to Estates about doing some repair work.

I think between the-- There might also have been some antagonism between different parts of the clinical team, or clinical team and Infection Control. However that worked, you can see that there is potential for things to maybe not go as well as they might.

Q Now, there was one aspect of it which I wanted just to put to you. If you think this is overly complex and you just can't do this, I'd be grateful if you told me. Now, if we look at Dr Drumright's chart in Figure 2.F.3, and if we could make it so the right-hand half of the chart is the whole screen from, say, 2014 onwards. That's good.

I think Dr Drumright's position was that the change down is in early 2018, but we should be careful with that, that date, and that it's back down below the-- actually below the trend in 2020 but, again, we should be careful with that date. We've heard evidence that issues of team dynamics continue into certainly the autumn of 2019. You may well be aware of the events I'm talking about around the chair of the IMT and who that's to be.

Now, to what extent is anyone entitled to look at that chart and go, "Well, by the time we get to the point where those events are happening, whatever the merits of the different perspectives taken, the infection rate's already quite well down, and therefore that can't be driving the infection rates." Or am I thinking about this the wrong way, or is the data unable to tell me these things?

A I think the data is unable to tell

you that.

Q Right, that's probably too much detail on my part. I'm thinking about it too much.

A I think you might be trying to retrofit a theory into----

Q Right. I won't do that, then. Thank you. But if we stay at the high level, how would we consider the question of team dynamics in respect of environmental and non-environmental organisms? Would we expect to see them both or one or neither or----?

A Well, that's a good question. I think that's really difficult to answer.

Q Why is it difficult to answer?

A Because you'd first have to work out what effect that team dynamic was actually having and what it was about the dynamic that was pushing the infection rate, and then you'd have to see if there was a difference between environmental and non-environmental. And you've got other conflicting things, like the CLABSI work, going in there, which is very much reducing and-- well, it reduces all of it but particularly the non-environmental and, out of that non-environmental group, the gram-positive. So you've got a lot of factors all working----

Q Mm-hmm.

A -- together. To actually pull the effect that a team dynamic actually had

on all of that is really challenging to do.

Q Okay. The question I eventually asked quite a few people was, using the concept of "some", i.e., being more than trivial but certainly not half, to what extent are you comfortable with the idea that this data for the environmentals-- well, let's look at the non-environmentals first, page 51, for the non-environmentals in Figure 2.F.4, is consistent with some of those infections being caused by line infections, central line BSI, and indeed maps onto the reaction to the CLABSI issue?

A So the curve, this curve, compared with the environmental curve, is slightly left shifted in the timeline.

Q Yes.

A So the peak is 2017, not 2018. My recollection is that the CLABSI work started in 2017.

Q Well, let's go look at the chart that was produced at the end of that, which is the presentation by Dr Kennedy and Ms Rodgers, September 2019, bundle 27, volume 13, document 13 at page 77. Now, I suppose we should read this with Ms Rodgers' evidence in her statement in mind, but I won't take you to the statement. If we look at the next page, we have a complicated chart recording total CLABSI infections in blue and gram-negative CLABSI in red and bed occupancy in green, and I wonder if

that's the chart you're thinking of when you were just talking about the dates of CLABSI infections.

A I was thinking more about when the CLABSI project itself started, which I think was 2017.

Q I'll just check Ms Rodgers' statement.

A Or it might've been 2018.

Q Sorry, I opened it in the wrong document format. It'll take a moment to open. I want to get this right. So, looking at Ms Rodgers' statement, she describes the work as starting in 2016. This is paragraph 133 of her statement. She describes the main Quality Improvement Group starting in January '17 – that's paragraph 143 of her statement – and the first meeting of the CLABSI group is in May 2017.

A Yeah, and that's when the decline in numbers-- apart from the spike in March '18, that's when the CLABSI numbers started to go down.

Q So, to go back to Figure 51 on the HAD response document, page 51, which is bundle 44, volume 5, page 51, to what extent would some of these infections be explained by line infections?

A So, the peak in 2017 dropping off then is-- it follows that same line, same shape.

Q Do you feel there's a consistency there?

A Yeah.

Q If we go back to the previous chart on page 50, this is the environmental infections, 2.F.3. What's your view about whether environmental BSI might be affected by line infection rates of the sort being tackled by the CLABSI group?

A So, you're obviously going to get a few gram-- sorry, a few environmental organisms in with your CLABSIs, but not-- nowhere near as many as your non-environmental----

Q In fact, can we see, if we go back to bundle 27, volume 13 on the page we were on, which is page 78, that Ms Rodgers has plotted the gram-negative CLABSIs along the bottom of the chart?

A Yeah.

Q So that's smaller?

A Yes, absolutely, and your gram-positives are the bulk of those.

Q If we go back to bundle 44, volume 5----

A But the peak, so during 2017 when that CLABSI work has started and the other curve is going down, you can see the curve here is still going up.

Q Right. Now, I think we've now dealt with all the counterfactuals that Dr Drumright had raised with us. Do you want to discuss the prospect that adequate ventilation might be contributing

to these infection rates?

A I'm happy to discuss it if that's what you----

Q Do you think there is any part of this data, this peak, if that's what it is, in 2018 of environmental PSI is being driven by ventilation?

A I don't think that you can extrapolate-- from that graph, you can't extrapolate, "That's due to ventilation."

Q But if we turn to the contamination of the water system, which you've been told about in Dr Walker's report and you've read about in other documents, to what extent would you think that some of that peak of environmental paediatric BSI recorded by the HAD team in Figure 2.F.3 might be caused by-- in some way connected to the water system?

A Well, my view, as I put in my report, is that there is an association with the water.

Q In terms of the proportion of the infections that are water-related, are you able to help us?

A So, to give a-- I think it's very difficult to give you a percentage of how many of the environmental infections are directly due to the water. I think a reasonable number of them will be. I think there's obviously different routes of transmission, which we've talked about in the report, and they're not all directly water to patient. Some of them are indirect water to surface to patient and so on, but there's no doubt in my mind that a large number of those infections are going to be related to the water.

Q We'll take that off the screen. What I want to do is to think about your final conclusions, which you address in your report, chapter 11, bundle 21, volume 1, page 175. Obviously, you've given more evidence. I'm not posing to walk through that again, partly because Ms Dempsey's not here as well, but how do you respond to the suggestion that your conclusions both there and in your oral evidence in November last year are undermined by reliance on the conclusions of Mr Mookerjee, which has been critiqued in various ways?

A I don't think the conclusions here are undermined by it. I think the graph stands, the shape of the graph stands. There's clearly been an increase in infections in-- with environmental organisms, which has been reproduced in various different reports, including the addendum to the HAD Report. I think, you know, the-- there's no doubt that the water was contaminated and that there was widespread contamination of the water system, and so I don't think that-- I mean, some of the detail of numbers and things which I put into my report will be affected by the changes in Mr

Mookerjee's data, but the overall conclusion I don't think is changed.

Q To what extent does the journey of the HAD team influence or affect your conclusions as well?

A I think it-- you know, having had more information, they've-- they concur with a lot of the views that have been expressed to the Inquiry, so I think they now believe that there is a peak of infections and that they can demonstrate that there was a peak, and they accept that there was contamination of water.

Q I don't think they do accept that.

A They don't? Okay.

Q No, I don't think they do accept that. I'm not sure that's Professor Hawkey's position.

A Okay.

Q But in terms of the data, you might well be right. Let's go to page 179, which is your final paragraph:

> "On the balance of probabilities, it is our expert opinion that the cases of environmental gram-negative blood stream infections, Mycobacterium chelonae, cryptococcosis, aspergillosis seen in Schiehallion Unit patients were strongly associated with contaminated water and waste water system and inadequate ventilation system on wards 2A, 2B and 6A."

Let's deal only-- well, pull out of that reference to Cryptococcosis, Aspergillosis and the ventilation system, so just look at it in respect of water. Do you stand by that conclusion, or do you want to adjust it in any way if we ignore the ventilation aspects?

A Yes, I think that stands. I don't-- I haven't seen any evidence to change that----

Q When it comes to Aspergillosis, you've obviously seen the work done by Dr Drumright and Mr Mookerjee on statistical significance of changes in rates, if there are any changes.

A Yeah.

Q Does that affect your conclusion about an association between the ventilation system and Aspergillosis infections in the Schiehallion Unit?

A I think there was clearly a risk, a risk that was unnecessary for those patients. I think that I might not say that it was strongly associated, but I would say that it was associated.

Q So, even though Dr Agrawal's data, albeit he's the only person who's tried, and Dr Drumright and Mr Mookerjee's analysis can't find a statistically significant change in rates between the two hospitals, you still feel it's associated?

A I think I-- Well, the risk is clearly there.

Q So what's the risk in your eyes?

A The HEPA filtration was absent, that you were recycling air through the thermal wheel, that there was potential for buildup of dust and therefore spores on the chilled beams, that the rooms were negative pressure when they should've been positive. I think that there is certainly a highly-- that there is an associated risk which was avoidable with the ventilation system.

Q But isn't the result of Dr Agrawal's numbers and Mr Mookerjee and Dr Drumright's calculations to show that even if there was a theoretical risk, it didn't actually happen, and therefore is "associated" the right word to use?

A I think-- I think it's very difficult in those small numbers, and it's small numbers which prevented them having any significant as-- any significant statistical significance. I think it's very difficult to prove it one way or the other.

Q Now, no one's done any statistics on Cryptococcosis.

A No.

Q I'm not going to reopen with you the reporting of Cryptococcosis cases to ARHAI. You gave evidence about that at the end of your evidence and we'll pick it up with ARHAI and GGC witnesses in four weeks' time, but have you in any way changed your view in respect of the link between those cases and the ventilation system that you described in this paragraph?

A Well, again, I think, you know, there is clearly a risk there. I think-- I haven't seen anything that would change my view of the risk. So, no, I don't think I would. There was clearly a lot of cases of Cryptococcosis----

Q When you say, "a lot", you mean----?

A Well, if you-- Yeah, I think more than the-- more than one would expect.

Q I mean, you did attempt to-- or was it Mr Bennett attempted to work out what the national rate was and didn't succeed, in his own eyes?

A No, because it's very difficult to get the data.

Q So what I'm wondering is whether your conclusion of a strong association with the ventilation system for Cryptococcosis can be criticised simply because there's so little evidence that you're making a sort of leap of judgment based on a theoretical risk.

A Possibly, but it's an opinion.

Q But do you-- I mean-----

A And I think, you know, on the balance of probabilities. it's surprising how many cases of Cryptococcosis there

have been in such a small geographical area and associated with the same hospital.

Q So, the other question I wanted to ask you about this was just to look at level of confidence or volume of evidence. There's different ways of doing this, because obviously the Inquiry has to make a determination on burden of proof and its own standards, and that's for the Inquiry and not for you, but do you see any difference in the amount of evidence available to you in respect of, say, the water on one side and these ventilation decisions on the other?

A Absolutely. I mean, the ventilation-- the evidence of poor ventilation is entirely about the physical issues with the ventilation. So the way-- the way it's been put in, the build, the way it's been-- the level at which it was working, the construction of it, the use of thermal wheels and so on, and the way that the isolation rooms have been built. So all of that is purely physical, and there is very, very little microbiological evidence.

Q I suppose the thing to do then, to move on to, is to try and knit the discussion about risk and patient-centred care back to this conclusion. If we stay in the area of the water system and water contamination, I think the answer is-- Is it your view there are points when-- Well, are there points when the water contamination system adversely impacted on patient safety and care?

A Yes.

Q When were they for the water system?

A So, I think we-- you know, far back as the very first case of Mycobacterium chelonae. Sorry, take that back, the very first case of Cupriavidus.

Q In 2016?

A Yeah.

Q Is that the aseptic pharmacy case?

A Yes. So there you have a proven link between the pharmacy sink and the case, and that's absolute evidence that it has impacted on patient safety because that patient acquired an infection.

Q From the evidence available to you, when does that impact cease?

A I think probably, to be confident that it was-- had ceased, would be when the patients moved back into the Schiehallion Unit after the----

Q So March '22?

A Yeah.

Q Right.

A Even though the curve was clearly going down prior to that, I think to be really confident you would have to say when they moved back.

Q You wouldn't take the view that-- There's a view expressed by, I think, Mr Kelly and Mr Clarkson, amongst others, that the interventions on the ward system were so significant, but that certainly in '21 and '20 you might have had a better, much more reduced level of microbial proliferation?

A Yes----

Q And the filters are on.

A Yeah, but they were still using point of use filters and still having-- they'd still got other mitigation in place. So, to be confident that those issues have been resolved, it would be when they move back into the Schiehallion.

Q Then if we turn to ventilation, when do you feel that the adequacy of ventilation – if ever – adversely impacts patient safety and care?

A I think that's very, very difficult to assess. You can argue that because we know that the ventilation wasn't up to specification and it wasn't in line with SHTM 03-01, then you could say that all of the time that those patients were in areas where they had out of spec ventilation that they were at additional risk, and I know there's arguments around that but, you know, if you-- if you just stick to they were in an out of specification ventilation system, then you can say that there's increased risk.

When they move back into the Schiehallion, with the compliant ventilation that they have in that unit now, then you've absolutely done everything that you can to ensure that the risk is as low as it possibly can be, given current knowledge and wisdom on what makes a good ventilation system.

Q If you were to accept the alternative view that there isn't an evidential basis for the general guidance in SHTM 03-01, can you make statements about individual wards? So when did the adequacy of ventilation adversely impact patients in Ward 2A? How would you analyse that same sort of period?

A Well, it would be from day one that they moved in when the ventilation was not built to the specification.

Q Ward 4B, Adult BMT? Would it just be that five-week period and then the period since they moved back, or something else?

A So they-- there's that risk for all of the time prior to the upgrading and then it's-- because it's still not quite in specification, there would still be a risk but, as we discussed, possibly an accepted risk related to the HEPA-filtered corridors and so on.

Q Now, are there any points when you're of the view that the buildings of the Queen Elizabeth or Royal Hospital for Children did not provide a suitable

environment for the delivery of safe, effective person-centred care, or is that basically just the same answers you've just given?

A I think it's probably the same answer.

Q Right. My Lord, I think I've asked all the questions I plan to ask Dr Mumford. I do suspect there might be some questions in the room. I wonder if we might take a 10-minute break just to find out what's going on.

THE CHAIR: Let's do that. As you're aware, Dr Mumford, the procedure we've adopted is to allow legal representatives an opportunity to pose additional questions if they have additional questions to propose. So, if I can ask you to return to the witness room for about 10 minutes.

THE WITNESS: Thank you.

(Short break)

THE CHAIR: Mr Mackintosh?

MR MACKINTOSH: I have four questions, my Lord.

THE CHAIR: Four questions.

THE WITNESS: Thank you.

MR MACKINTOSH: Dr Mumford, my first question relates to your Aspergillus conclusion that you went down from a strong association to an association. I was asked the question of whether you'd fully taken account of issues found in and recorded in IMT minutes that may be relevant to Aspergillus and were thought to be relevant, in terms of tears in ductwork in ceiling voids, water dripping from chilled beams, ongoing construction near the Paediatric Haemato-Oncology Ward, water leaks in ceilings, and mould found and mouldy ceiling tiles removed.

Whilst I did ask you about the data that Dr Agrawal had created, to what extent do you feel that those factors speak to something more than an association between the environment and the Aspergillus system-- the ventilation system and Aspergillus?

A So, I think they do have to be taken into account. I think I mentioned some of them, but not all of them, earlier. But I'm not sure-- not sure if, given the-- given the-- I know I said I thought the numbers were so small that you-- that was why we couldn't get a statistically significant-- or possibly one of the reasons why we couldn't get a statistically significant difference, but I do wonder if the lack of that statistical difference does have to kind of temper my previous conclusion on it. So, I do believe there is an association, but I'm not sure that there is enough clear evidence to say it's strongly associated.

Q Okay. Now, the next thing

turns to Mr Mookerjee's calculations. Now, you were explaining how you were aware that his latest calculations reach a conclusion there is statistical significance between the difference between the overall Schiehallion rate, as inspired by Dr Chaput's observations, and the overall comparator rate, including the right-hand column of Great Ormond Street.

A Yeah.

Q He set that out in his own opinion, and you don't feel that you're qualified to assess whether he's accurate in terms of statistics?

A Yeah.

Q Have I got that right?

A Well, I wouldn't know how to reproduce them.

Q No. If he was shown that his correlation analysis that he's recorded in that table – and we're providing the background tables to core participants – was flawed, how would that affect your final conclusion?

A I think I would----

Q In respect of-- Sorry.

A I would have to rely more on the data in other people's papers. So, you know, the finding of the same shaped graph in every report, the increase and then followed by the decrease in cases, I think that is so-- that's really important because it shows that everybody is finding the same out of the data that is--

they all-- they work with. So, I think I rely on both Mr Mookerjee and everybody-- all of the other authors of papers that have done statistical work and shown the same graph shape, which shows a significant increase in cases.

On the comparator unit, I think we're confident about the GOSH data and even the GOSH data on its own. Even if you took out all of the other comparators, if we're not-- you know, if you say that we're not 100 per cent certain that his interpretation is correct, we are comfortable with the GOSH data, and the GOSH data, as a comparator, does show that significant difference in the data between GOSH and Schiehallion.

Q Thank you. This is a rather specific question, which I'm sure you can work out the context it's been placed in. If you move patients from one part of a hospital to another in order to mitigate a risk arising from the environment, should you ensure that in the new location they're not exposed to the same environment?

A Well, ideally not, and I think this is one of the-- one of the issues with moving the patients to 6A, was that, you know, the same-- you know, there was-- there was issues encountered in that environment too. Again, there was no HEPA filtration and mobile HEPA filtration machines had to be put in. There was

need to decant the patients into CDU in order to do some rectification in the-- in the ensuite bathrooms or shower rooms because of mould, and so on. So I think, you know, yes, in an ideal world, you would want to put them in the safest possible place. In reality, that is not always what happens.

Q My final question is-- turn then back to consent. So, if you-- when I say "you", if a hospital management consultant team, sector or whatever, has to treat patients in a space that is not built in compliance with Scottish Government guidance, particularly guidance that's been around for a bit, do you think that those patients have to be told and be able to have consent to being treated in a building that doesn't meet guidance for their country?

A So, before I answer the question, I would say that, you know, every time the guidance changes, a number of hospital buildings will go out of the guidance, as it were. So they will move from having previously been within the guidance at the time that they were built to moving outside as the guidance develops. So, as we stand today, not all hospitals in the UK are compliant with SHTM 04-01 or 03-01 because the guidance develops at a greater speed than hospital buildings are upgraded.
So, with that caveat, if you were-- I think it depends what it-- what the risk is that's associated with it. I think you would have to do the risk assessment. If the risk was low, I think there is little to be gained. We do-- we do have a duty of candour for patients in the UK around sharing with patients the level of information that they need to know, particularly if something goes wrong. I think you would stand in a difficult spot if something about the built environment, which was known but which was not shared with the patient, was then found to be the cause of a patient's infection, for example, or something else that went wrong.
So I think there is a balance to be struck between telling the patients too much and distressing them for what is a theoretical risk but, where there is more than a theoretical risk, being completely open and transparent with patients, which is what we should always aspire to.

So my feeling would be that it would have to be on a situation-by-situation basis with risk assessment, with the system thinking that we talked about earlier, to determine what the risk was, how likely it was to be realised, and what the impact would be on the patients, because we cannot in reality tell patients absolutely everything about everything, and we have to make a judgment call on some of those things.

Q Thank you. Before I hand

back to Lord Brodie, I want to accord my thanks for all the assistance you've provided me with in trying to understand all this in the last two years. My Lord, I've got no further questions for Dr Mumford.

THE CHAIR: Thank you, Mr Mackintosh. Can I add my thanks, my thanks for your attendance today, Dr Mumford, your previous attendance, and all the work that has gone into that evidence, including the work done more recently engaging with material which has come forward recently. But your evidence is now completed, and you're free to go, but you go with my very warm thanks. Thank you.

THE WITNESS: Thank you, my Lord.

(<u>The witness withdrew</u>)

THE CHAIR: Well, that concludes our proceedings for today and this week. We resume, I think, on 16 September.

MR MACKINTOSH: Yes, 16 September, my Lord, for our four-week block, which is known as Part 3. A witnesses list is occasionally being adjusted for availability but should be with core participants in the next week or so, along with an opening note, and the final version of Direction 12 will also be issues as well.

THE CHAIR: All right. So the opening note has not been distributed yet.

MR MACKINTOSH: Not yet, no.

THE CHAIR: But will be shortly----

MR MACKINTOSH: It will go out with the witness----

THE CHAIR: -- as will Direction 12 on closing statements. Thank you very much, everyone, and enjoy your weekend.

(<u>Session ends</u>)

3:50