

Tuesday, 17 October 2023

1  
2 (10.00 am)  
3 **LADY HALLETT:** Mr O'Connor.  
4 **MR O'CONNOR:** Good morning, my Lady. Our first witness this  
5 morning is Professor Steven Riley.  
6 **PROFESSOR STEVEN RILEY (sworn)**  
7 **Questions from COUNSEL TO THE INQUIRY**  
8 **MR O'CONNOR:** Do take a seat, Professor. Could you give us  
9 your full name, please.  
10 **A.** Steven Riley.  
11 **Q.** Professor, you have prepared a witness statement at our  
12 request. It's on the screen now. I know that you're  
13 familiar with the contents of that statement, and it is  
14 signed at the end of the statement with your name  
15 underneath a statement of truth saying that you believe  
16 the facts contained in the statement to be true. Is  
17 that right?  
18 **A.** That is correct.  
19 **Q.** Thank you.  
20 You are a professor of infectious disease dynamics  
21 at Imperial College London; is that right?  
22 **A.** Yep.  
23 **Q.** Is that a post you've held for some time?  
24 **A.** Yes, I think since 2016.  
25 **Q.** We've heard from other witnesses, and no doubt you'd

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1 **Q.** And you refer to something called the MRC Centre for  
2 Global Infectious Disease Analysis.  
3 **A.** Yep.  
4 **Q.** Is that a research body entirely within Imperial College  
5 or not?  
6 **A.** Yes, that's entirely within Imperial College, almost  
7 entirely within the Department of Infectious Disease  
8 Epidemiology.  
9 **Q.** Professor Ferguson, is he the head of that centre?  
10 **A.** He -- not at the current time, but he was the head of  
11 the centre until recently.  
12 **Q.** And during the pandemic he was?  
13 **A.** Yes, he was.  
14 **Q.** Yes. I'm going to ask you about the pandemic in  
15 a moment, but before 2020, I think it's right that you  
16 were a member of SPI-M?  
17 **A.** That's correct.  
18 **Q.** Sometimes referred to as the peacetime modelling  
19 committee?  
20 **A.** That's right.  
21 **Q.** Then once the pandemic started, in early 2020, you  
22 became a member of SPI-M-O, the operationalised version  
23 of that committee, that we heard about from  
24 Professor Medley?  
25 **A.** Yep, that's right.

3

1 agree, that Imperial is one of the main centres of  
2 infectious disease epidemiology in this country?  
3 **A.** Yes, that's correct.  
4 **Q.** Also on the staff at Imperial is  
5 Professor Neil Ferguson, from whom the Inquiry will be  
6 hearing later today.  
7 **A.** Yes.  
8 **Q.** You give us some detail of your career in your witness  
9 statement, Professor, and we can see, amongst other  
10 things, that earlier in your career you worked on  
11 the SARS outbreak of 2003?  
12 **A.** That's correct.  
13 **Q.** And you explain that you conducted work at that stage  
14 assessing the transmissibility of that particular virus?  
15 **A.** Yes, that's correct.  
16 **Q.** Then subsequently, is this right, you worked for some  
17 years at the University of Hong Kong?  
18 **A.** That's correct, from 2004 to 2010.  
19 **Q.** And you explain, therefore, that you were in Hong Kong  
20 during the influenza pandemic or epidemic in Hong Kong  
21 of 2009?  
22 **A.** That's correct.  
23 **Q.** Subsequently, you have been back at Imperial College  
24 since 2010?  
25 **A.** That's right.

2

1 **Q.** Also as the pandemic started, you refer to something  
2 called the Imperial College Covid-19 research team.  
3 **A.** Response team.  
4 **Q.** Sorry, response team.  
5 **A.** Yep.  
6 **Q.** In a few sentences, what was that?  
7 **A.** So that was the group of individuals within  
8 Imperial College who started working almost entirely on  
9 the response to the pandemic, the scientific -- doing  
10 scientific studies to support the response, that grew  
11 rapidly through the end of January, February and March  
12 to try to provide support.  
13 **Q.** We've heard that Imperial College was well represented  
14 on SPI-M-O. Was it that response team that was, as it  
15 were, driving the Imperial College efforts in that  
16 regard?  
17 **A.** The response team did not only support the UK response  
18 and they did not only support SPI-M-O, but yes, lots of  
19 people within the team would have been contributing to  
20 material that went to SPI-M-O.  
21 **Q.** You say it didn't only support the UK response; were you  
22 also involved with assisting other countries then?  
23 **A.** That's right. So there was work done directly to  
24 support WHO, to support US -- the US response in some  
25 ways, and individual country support through existing

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1 bilateral relationships. There was a lot of -- a lot of  
 2 work was done going in many different directions  
 3 globally.  
 4 **Q.** Thank you.  
 5 Now, we're now becoming increasingly familiar with  
 6 the structure of scientific committees. At the time,  
 7 of course, SPI-M-O reported to SAGE. You were not on  
 8 SAGE; is that right?  
 9 **A.** That's correct.  
 10 **Q.** We'll come to a more recent period where I think you did  
 11 attend some SAGE meetings, but in your role as academic  
 12 modeller in the early stage of the pandemic, you were  
 13 simply attending SPI-M-O meetings?  
 14 **A.** That's correct.  
 15 **Q.** You also were lead investigator in the REACT programme.  
 16 We've heard something about this programme already. In  
 17 full, it was the Real-time Assessment of Community  
 18 Transmission programme, and it went through various  
 19 phases, but they were all, one way or another, designed  
 20 to get a richer picture of the extent of transmission of  
 21 the virus throughout the country?  
 22 **A.** That's correct. So in collaboration with colleagues at  
 23 Imperial, we had a number of different studies under  
 24 the REACT umbrella, and I was most concerned with  
 25 REACT-1.

5

1 time?  
 2 **A.** I did continue to attend SPI-M-O. So I think I did  
 3 maintain membership. To be perfectly honest, it's not  
 4 100% clear to me in the capacity, but I did contribute  
 5 to meetings and do attend.  
 6 **Q.** But presumably you didn't have the time to be doing  
 7 the research and the modelling work that you had done  
 8 previously?  
 9 **A.** That's correct, and I stepped back from the REACT Study  
 10 when I joined UKHSA.  
 11 **Q.** It's in this capacity that there was that caveat about  
 12 SAGE attendance, because you mention in your statement  
 13 that later in the pandemic you did attend, I think you  
 14 said, two SAGE meetings, as, as it were, a UKHSA  
 15 representative?  
 16 **A.** That's correct.  
 17 **Q.** We've heard something, Professor, about the -- I don't  
 18 know if "clash" is the right word, "tension" might be  
 19 a better word, between those academic scientists, if you  
 20 like, who were members of SPI-M-O, and other committees,  
 21 on the one hand, and government scientists, government  
 22 civil servants, who were also part of that system.  
 23 First of all, do you recognise that description?  
 24 **A.** Yes. I think there are different roles. I think acting  
 25 as an independent scientist providing advice to

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1 **Q.** And that was the element of REACT which was involved in  
 2 sending PCR tests or obtaining PCR tests throughout  
 3 the country, and through that means --  
 4 **A.** That's right.  
 5 **Q.** -- an understanding of the rate of transmission?  
 6 **A.** Trying to have as least a biased sample as we could of  
 7 how many people were positive for SARS-CoV-2 at any  
 8 point in time.  
 9 **Q.** Just give us an idea of the scale of that: how many  
 10 thousands of tests were being done how frequently?  
 11 **A.** I think in the end we approached -- I think we  
 12 approached 16 million people and we received, I think,  
 13 over 2.5 million testable swabs.  
 14 **Q.** So a lot?  
 15 **A.** Yeah.  
 16 **Q.** Then lastly, and I mentioned this, since October 2021,  
 17 so some way into the pandemic, your role changed quite  
 18 dramatically. Tell us about that.  
 19 **A.** Yeah, so since October 2021 I've been seconded at 90% to  
 20 the UK Health Security Agency, where I'm part of  
 21 the group that looks after data, analytics and  
 22 surveillance.  
 23 **Q.** So, to all intents and purposes that was your main job?  
 24 **A.** Yes, yes.  
 25 **Q.** Did you continue to be a member of SPI-M-O from that

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1 government is quite a well defined and different role  
 2 from being -- acting as an official for the government  
 3 and working with those scientists, but also working --  
 4 potentially working directly with ministers.  
 5 **Q.** You have experience of, as it were, seeing the workings  
 6 of these committees from both sides, having occupied  
 7 both roles?  
 8 **A.** That's correct.  
 9 **Q.** We'll come back to that in a little while when I ask you  
 10 about some of the matters you've raised in your  
 11 statement about the ways of working of those committees.  
 12 I want first now to turn to your involvement right  
 13 at the start of the pandemic, and we heard from  
 14 Professor Woolhouse yesterday, and indeed from  
 15 Professor Costello, about their developing understanding  
 16 of the virus early in those first few weeks, really, in  
 17 January and early February of 2020.  
 18 In your statement at paragraphs 4.11 and 4.12,  
 19 perhaps we can call them up, you've copied a couple of  
 20 tweets that you sent, I think.  
 21 **A.** Yep.  
 22 **Q.** Which, as it were, record your initial developing  
 23 understanding of the pandemic.  
 24 **A.** Yes.  
 25 **Q.** So on 9 January, you say:

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1 "It's better in many ways that this incarnation  
2 appears to be less severe once infected. However, our  
3 ability to control it is driven by our ability to find  
4 cases. If being 'mild' makes it harder to find, it  
5 could pose a greater health threat."

6 Then if we can just look at the other tweet, which  
7 is on the top of the next page, I think. So you're  
8 referring to a further report, and you say  
9 the characteristics seem to be -- presumably this is one  
10 of the cases:

11 "- did not visit the market

12 "- returned on the 6th

13 "- already recovered"

14 And then you say:

15 "A version of SARS with a lower infection fatality  
16 rate could be a much bigger public health problem."

17 Could you describe, perhaps in lay terms, what the  
18 concerns you were expressing in those two tweets were,  
19 particularly with regard to the lower infection fatality  
20 rate?

21 **A.** Yeah. So thinking back to SARS-CoV-1, the virus that  
22 caused the 2003 outbreak, it had a very high infection  
23 fatality rate. It wasn't evident at the time, but  
24 afterwards we became sure it really was very high, and  
25 it also became evident there was very little

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1 **A.** That's right. So from the point of view of a virus,  
2 when you're trying to optimise your success, having  
3 a very high fatality rate is not necessarily good, from  
4 the point of view of the virus.

5 **Q.** Thank you.

6 Let's move on. In your statement you make a couple  
7 of observations about the work of SPI-M-O during  
8 February 2020.

9 If we could go, first of all, please, to  
10 paragraph 2.9. Thank you. If we could enlarge that  
11 paragraph. Paragraph 2.9, that's it.

12 So just picking it up in the second line you say:

13 "It is my view that during the early period of the

14 response, some key commissions were too narrow.

15 For example, during February 2020 we were asked for

16 views on school closures and on the impact of other

17 interventions in delaying the peak, and we were asked

18 about reasonable worst-case scenarios. We were not

19 asked about the likelihood that interventions could

20 achieve ongoing containment, nor were we asked about

21 most plausible scenarios."

22 Just pausing there for a moment, the term "ongoing

23 containment", is that a term which also means

24 suppression of the virus, keeping the R number below 1?

25 **A.** Yeah. I think as it developed later they're essentially

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1 transmission from people who -- prior to exhibiting  
2 symptoms or from that small proportion of people who  
3 didn't actually have symptoms, and it was very small for  
4 SARS-1. So when we did a lot of that work, and we kind  
5 of did some wash-up work thinking about exactly why we'd  
6 been able to control SARS-1, we started to think about  
7 properties of similar viruses that would make them much  
8 more difficult to control. And I don't have a really  
9 good published reference for this but, recalling those  
10 conversations, if it was a bit more mild, and because  
11 it's more mild there's less severe disease and possibly  
12 less disease at all, there's asymptomatic transmission,  
13 that would make stopping it much more difficult. And  
14 it's -- the overall impact is about the number of people  
15 who were infected times the severity. So the overall  
16 impact could be much, much higher, even if it was less  
17 severe.

18 **Q.** Exactly. So, I mean, one might have thought that  
19 a lower infection fatality rate would be a good thing,  
20 but what you're pointing to is that the milder symptoms  
21 make it that much harder to stop --

22 **A.** That's --

23 **Q.** -- and so even if there is a lower infection rate, it  
24 could still involve the deaths of a far larger number of  
25 people?

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1 synonyms. At that stage I was preferring the phrase  
2 "ongoing containment".

3 **Q.** But when we see the term "suppression" used in other  
4 documents, that's the same thing?

5 **A.** Yes.

6 **Q.** If we can keep that in mind, and just go, please, to  
7 another paragraph, which is 2.5, on a similar theme, you  
8 say that:

9 "[You] do not believe that SAGE and its sub-groups  
10 took sufficient account of international experiences  
11 during the early stages of the pandemic. In particular  
12 the possibility of a national lockdown should have been  
13 actively considered from 23 January onwards.

14 So bringing those two paragraphs together, you  
15 appear to be saying that the thinking was not, perhaps,  
16 on a large enough scale, or that you weren't addressing,  
17 in particular, the possibility of a lockdown early  
18 enough?

19 **A.** Yeah, I mean, it was my view then, and I think it's kind  
20 of evident elsewhere in the evidence, that the Wuhan --  
21 on 23 January, that was when the public health officials  
22 in Wuhan decided to try to contain the virus there. We  
23 certainly did not know that that would work and we did  
24 not know that that would be a good policy in the end for  
25 China, not by any stretch of the imagination, but it was

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1 incredibly innovative, although crude, and with lots and  
2 lots of negative side effects. It was actually very  
3 innovative, because no one had really thought you would  
4 go for containment from that point.

5 So my main point here is not that it would be  
6 the right thing for us to do, but it should have been  
7 actively considered because the population with  
8 the greatest experience of the virus at that point had  
9 decided to try it.

10 **Q.** Is that the point you make about international  
11 experiences, it's the comparison with China that you're  
12 talking about there?

13 **A.** Yeah, so I think that's one example. I think, you know,  
14 somewhat later, you know, much later in this timeline,  
15 there were comparisons with Italy as well.

16 **Q.** Yes.

17 **A.** But for me, because of -- because Wuhan happened first,  
18 it's perhaps the most important.

19 **Q.** So that brings us back to what you said in that first  
20 paragraph we looked at, that on SPI-M-O you were being  
21 asked about modelling school closures and other, perhaps  
22 more micro, matters. You felt, did you, that there was  
23 a bigger picture that should have been considered even  
24 at that early stage?

25 **A.** Yeah. It's not to say they weren't also important

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1 4.22 together, that might make it slightly easier.

2 So first of all you say that you and he discussed  
3 the likely speed of the pandemic in the context of  
4 vaccine investment decisions. Tell us how those two go  
5 together.

6 **A.** Yeah -- a quick comment, that just to say that with  
7 Professor Ferguson and many other members of the team,  
8 we agreed on many, many things, but that's not  
9 the business of science; the business of -- the practice  
10 of science is to talk about what you disagree with and  
11 trying to figure it out. And I'm emphasising for very  
12 deliberate reasons here some of the things that we  
13 didn't agree on.

14 **Q.** And you probably realise, Professor, that quite a few of  
15 my further questions will be about things that you and  
16 Professor Ferguson did not agree on, so we can -- it's  
17 an important point to start with, that there was  
18 an awful lot that we won't be talking about where there  
19 was a consensus between you.

20 **A.** And a lot of that is extremely valuable.

21 **Q.** Yes.

22 **A.** So, yes, so very early in the pandemic I was involved in  
23 some email discussions in very broad terms thinking  
24 about the global speed of the pandemic, and I took  
25 the view in those early discussions that we couldn't

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1 questions, but I couldn't think of elsewhere in  
2 the system where consideration was being given to some  
3 of those broader questions. So I was frustrated at  
4 the time at the narrowness of questions that we were  
5 being asked.

6 **Q.** In his evidence yesterday to the Inquiry,  
7 Professor Woolhouse referred to February 2020 as a "lost  
8 month", I think it was a quote he picked up from  
9 somewhere else. Is it a similar idea that you're  
10 expressing here?

11 **A.** I think somewhat. I think -- I did not know for sure  
12 that we wouldn't consider stringent interventions until  
13 very -- I became increasingly concerned we were not  
14 considering them at the end of February, into the  
15 beginning of March. So there was a huge amount of work  
16 going on, on lots of different issues, during February,  
17 and I didn't realise that we weren't actively  
18 considering some of these more severe interventions.

19 So in that respect, then yes, I'd agree, in not  
20 considering some things then it was a lost opportunity.

21 **Q.** Moving on, you describe in your statement having  
22 conversations with Professor Ferguson during this  
23 period.

24 If we could look, please, at page 13,  
25 paragraph 4.21. If we could perhaps look at 4.21 and

14

1 assume that it would be very rapid in the same --  
2 without -- and that there may be behaviour change  
3 whether mandated or otherwise. So I thought it could be  
4 slow enough that it was worth spending a lot of vaccines  
5 that might not be ready for nine, 12 months.

6 **Q.** And this idea of yours, of behaviour change, is  
7 something that we'll see that you came back to in  
8 a report in early March that we'll look at.

9 **A.** Yep.

10 **Q.** But when you say behaviour change, I think what you're  
11 describing is people in society reacting to the pandemic  
12 for themselves, as opposed to being told to do things by  
13 the government?

14 **A.** Not quite. So I would -- the -- we should really talk  
15 about them separately.

16 We can measure pretty well how people are behaving  
17 with respect to the transmission of these pathogens, and  
18 that may or may not be influenced by government  
19 mandation or advice, but it's kind of important to be  
20 clear: it doesn't matter how the behaviour changes, if  
21 people observe the risk and make significant changes to  
22 the way that they're behaving then the rate of  
23 transmission will go down regardless of how it happens.

24 **Q.** So perhaps a better way of putting it, the point you  
25 were wanting to make, is that even if the government

16

1 doesn't, for example, impose a lockdown or other NPIs,  
 2 it may well be that people will still change their  
 3 behaviour in a similar way?  
 4 **A.** That's also a point that I make in lots of places, yeah.  
 5 **Q.** That relates, in terms of paragraph 4.21, to the speed  
 6 of the pandemic because if people change their behaviour  
 7 it will slow the pandemic down?  
 8 **A.** Yes.  
 9 **Q.** Then on a related point, we see at paragraph 4.22 you  
 10 and Professor Ferguson discussed whether that lockdown  
 11 experiment in Wuhan would succeed or not?  
 12 **A.** Yes.  
 13 **Q.** And what was your view?  
 14 **A.** I did not know that it would succeed, whatever a measure  
 15 of success was, but I thought there was a reasonable  
 16 chance and a ... partly because I wouldn't have expected  
 17 them to try unless they thought they had a pretty good  
 18 chance. So I thought there was a reasonable chance that  
 19 it would.  
 20 **Q.** These are discussions that you describe having with  
 21 Professor Ferguson during late January and into  
 22 February. It may be that they involved other colleagues  
 23 at Imperial as well. But are these the types of debate  
 24 that you're saying perhaps ought to have been happening  
 25 at SPI-M-O and SAGE but weren't?

17

1 the size of teams, the quality of work and the amount of  
 2 work that was being produced in order to support  
 3 decisions at that point. And as -- you know, under  
 4 simple assumptions of how much resource there would have  
 5 been operating during the early phases, trying to  
 6 support even more difficult decisions, then I think  
 7 the Institute for Government's statement is good.  
 8 **Q.** What follows from that, if the point is that SAGE is  
 9 doing work that it shouldn't be doing, because it ought  
 10 to be really being done by government, does it follow  
 11 that SAGE either was or might have been actually  
 12 involved in developing policies that weren't part of its  
 13 role, or are you really more talking about a sort of  
 14 capability issue?  
 15 **A.** So I'd probably speak better to the capability issue,  
 16 and I think there's a difficult question here about how  
 17 much standing capacity a government should maintain to  
 18 provide this kind of support, because it's -- the level  
 19 of resource in October 2021 was very high, and it's  
 20 probably not appropriate -- it's definitely not  
 21 appropriate to maintain indefinitely. So I think  
 22 the difficult question here is, and I'll address the  
 23 capability rather than necessarily policy, the difficult  
 24 question is: what are the right mechanisms for  
 25 the standing level of support and what is the right

19

1 **A.** I think this was a crucial issue from the very  
 2 beginning. And I don't have a clear idea of what was  
 3 discussed at SAGE. It could have been discussed more at  
 4 SPI-M-O for sure.  
 5 **Q.** Lastly on this part, I'd like to turn to page 6 and  
 6 paragraph 2.12 of your statement, please. You were  
 7 asked about an observation made in an Institute for  
 8 Government report to the effect that in the initial  
 9 months of the pandemic ministers put too much weight on  
 10 SAGE, relying on it to fill the gap in government  
 11 strategy and decision-making that was not its role to  
 12 fill, and you indicate that you agree with that  
 13 observation.

14 I think this is one of the aspects where your  
 15 subsequent experience at UKHSA gives you an insight into  
 16 the position earlier in the pandemic, before  
 17 the capacity at UKHSA and other organisations had  
 18 developed. So can you expand on why you agree with that  
 19 observation, please.

20 **A.** Yeah. As you mentioned a few moments ago, I've had  
 21 the opportunity to see the process as an independent  
 22 scientist feeding in through SPI-M and then as a member  
 23 of UKHSA, and when I arrived at UKHSA in October 2021  
 24 the resourcing around government in terms of supporting  
 25 policy was probably at its maximum, and I could see

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1 level of confidence in scalability of support in those  
 2 early stages?  
 3 **Q.** Thank you. We can take that down.  
 4 I'd like to move on with you, please, Professor, to  
 5 address the period a few weeks later, in early March of  
 6 2020. Just by way of context and summary, we know, do  
 7 we not, that the national lockdown was announced on  
 8 23 March, and that that represented a change in  
 9 government policy from the mitigation strategy that it  
 10 had pursued previously, flattening the peak, towards one  
 11 of suppression or ongoing containment, depending on the  
 12 terminology.

13 You were, as we shall see, centrally involved in  
 14 the discussions at SPI-M-O that led towards that  
 15 decision, and in fact again, as we shall see, you  
 16 proposed the pivoting to a policy of suppression right  
 17 at the beginning of March, and that is what we will look  
 18 at now.

19 Can I start on this, please, by asking you to look  
 20 at your statement. It's paragraph 5.6 on page 23,  
 21 starting three lines -- actually on this copy it's a few  
 22 more than three lines, but five or six lines down, where  
 23 it says:

24 "On 1 March 2020, [you] drafted and circulated  
 25 a report ..."

20

1 And you give its title, "The potential benefits of  
2 ongoing containment", which we will remind ourselves  
3 means suppression.

4 You say you "hoped [that this report] could become  
5 an Imperial College Response team report". We talked  
6 about that team at the beginning, and was it the case  
7 that the team generated reports which then went to  
8 SPI-M-O?

9 **A.** We -- the team did generate reports that went directly  
10 to SPI-M-O. The type of report I'm talking about there  
11 is a public report.

12 **Q.** Right.

13 **A.** So it's worth a quick comment that, compared to prior  
14 outbreaks, the speed and transparency with which  
15 the evidence came from academic groups like Imperial was  
16 much, much better. So my primary concern was the -- us  
17 publishing reports on the website because then they  
18 were -- they could be available to SPI-M and to people  
19 all around the world as well.

20 **Q.** Right. But in any event, it was like a badged product  
21 of the response team that you hoped this report would  
22 become?

23 **A.** Yes.

24 **Q.** And you mention that it was an early version of a report  
25 which was in the end circulated a week or so later, and

21

1 never want to do it. We had to consider that  
2 possibility at that point. And that justifies that very  
3 strange looking comparison of what we were apparently  
4 planning for versus what one could conceivably think  
5 might be an option for us. Might be. Not was, but  
6 might be.

7 **Q.** Yes.

8 Now, you go on to describe, in summary,  
9 Professor Ferguson's sort of negative reaction to this  
10 report, and you actually quote him, you say:

11 "Professor Ferguson's view at the time was that  
12 'everyone in policy circles' knew that R could be  
13 brought below 1 ..."

14 Pausing there, do we mean they knew that this  
15 suppression policy was a possibility at the very least?

16 **A.** Yeah, so in the crudest level of success that you  
17 could -- if your restrictions were severe enough, you  
18 could make the incidence start to decline.

19 **Q.** Yes. And then reading on:

20 "... but that there was no appetite for the  
21 draconian measures that would be required."

22 Presumably no appetite amongst those people in  
23 policy circles, that's how we take it, is it?

24 **A.** You will be speaking to Professor Ferguson later today,  
25 so ...

23

1 we will talk through the chronology of all of that.

2 Dropping down a few lines, the crux of it, you  
3 describe, is that you pointed out that a rapid wave,  
4 similar to the realistic worst-case scenario, could lead  
5 to 464,000 deaths. But by contrast, you were positing  
6 that if there was a successful policy of immediate  
7 suppression, that could reduce it vastly to only  
8 148 deaths?

9 **A.** That's right.

10 **Q.** So was that your sort of core thinking at that stage,  
11 you were simply --

12 **A.** Yeah.

13 **Q.** -- positing those two alternatives?

14 **A.** And it -- I mean, as you present those numbers, it looks  
15 strange, in -- I mean, it felt strange to be writing  
16 that at the time, and it still looks a little bit  
17 strange to be reflecting on it.

18 I think on 28 February, WHO China delegation  
19 published their report and within that they state  
20 China's policy is to maintain control and restart  
21 the economy, so on the 28th China had committed to going  
22 full bore for economic productivity and containment.

23 So, to me, that meant that we had to consider  
24 the possibility of ongoing containment without it being  
25 unachievable or without it being so bad that we would

22

1 **Q.** How did you take it at the time? Who was he describing,  
2 do you think?

3 **A.** I think I actually mention it just a few lines lower,  
4 I put "everyone in policy circles" in quotes, or yeah,  
5 I requote "everyone in policy circles" --

6 **Q.** Let's --

7 **A.** -- because I don't actually know what that means, and  
8 I'm highlighting that that's kind of important.

9 **Q.** Yes. Let's drop down. I think the passage you're  
10 referring to is at the bottom of the page, after  
11 the tirts. You say:

12 "Professor Ferguson also commented that we were  
13 currently driving UK preparedness and planning and that  
14 we were trusted by the government."

15 So I think the "we" must mean the --  
16 Professor Ferguson and his science colleagues?

17 **A.** Again --

18 **Q.** All right, we'll ask him.

19 **A.** Yep.

20 **Q.** But:

21 "He added that this was not the same as saying that  
22 we never disagreed with government policy or the CMO,  
23 but that we did so privately and constructively."

24 He certainly seems to be stating there that "we" --  
25 take it that you can't provide us with more precision as

24

1 to what is meant, but it certainly doesn't seem to be  
 2 the government.  
 3 This group that he's describing was in charge of  
 4 pandemic policy at the time?  
 5 **A.** Could you repeat your question? I'm sorry.  
 6 **Q.** The text says:  
 7 "... we were currently driving UK preparedness and  
 8 planning and that we were trusted by the government."  
 9 **A.** Yes.  
 10 **Q.** So I appreciate that you don't want to be drawn on  
 11 stating what Professor Ferguson --  
 12 **A.** Okay.  
 13 **Q.** -- meant by that, but he appears to mean that a group  
 14 other than the government is driving the policy.  
 15 **A.** Yeah. Yes, that is what it appears to be. There's  
 16 a lot of -- there's potential importance on the word  
 17 "driving" and exactly who the "we" are. I agree that  
 18 that's -- that's how I would have understood it at  
 19 the time, but I wouldn't -- as I say, the aspect of  
 20 Professor Ferguson's reply that kind of struck me was  
 21 "everyone in policy circles", which is why I repeated it  
 22 back in quotes.  
 23 **Q.** Yes.  
 24 **A.** I think my understanding is clear from how I've replied.  
 25 **Q.** All right. Well, let's just pick up another part of  
 25

1 might suppression work, you were looking at much more --  
 2 the smaller but important issues, for example, about  
 3 school closures and so on; is it possible that  
 4 the reason SPI-M-O wasn't being asked to consider those  
 5 matters at that stage was this point you're making here,  
 6 which was that there was almost a deliberate decision  
 7 being taken not to engage with those issues, or --  
 8 **A.** That is possible, yes. Yeah, and certainly  
 9 the sentiment, yeah.  
 10 **Q.** Moving on in the chronology, then, we were looking at  
 11 that part of your statement where you describe drafting  
 12 the note on 1 March, and Professor Ferguson's reaction,  
 13 not agreeing with it. I think it's also right, I'm not  
 14 going to take you to this part of your statement, but  
 15 tell me if it's right, that he indicated around that  
 16 time that he didn't want the report to become  
 17 an official Imperial College response team report. Is  
 18 that right?  
 19 **A.** Yeah. And can you check your dates for that one? But  
 20 that's certainly -- that discussion did occur -- it  
 21 might be worth checking the dates.  
 22 **Q.** I think what you say in your statement is that that  
 23 occurred a few days later, around the 7th and 8th of  
 24 March --  
 25 **A.** Yes.

27

1 this, please. If we can go back in your statement  
 2 to 5.6, here you're commenting on another observation by  
 3 the Institute for Government.  
 4 Thank you, that's fine.  
 5 You say:  
 6 "I agree with the neutral Institute for Government  
 7 that the desire of ministers to avoid a lockdown framed  
 8 the advice commissioned from SAGE, and contributed to  
 9 the delay in considering and implementing [suppression]  
 10 measures."  
 11 So again, is that something you picked up from  
 12 Professor Ferguson, and maybe it's linked to what we  
 13 were talking about a moment ago, that there was no  
 14 appetite for lockdown-type measures early in the  
 15 pandemic?  
 16 **A.** Yeah, and I think it's based on -- I went back and --  
 17 you know, when that opinion from the Institute for  
 18 Government was put to me, I went back through the emails  
 19 to see if I, you know, did have useful evidence, and  
 20 I've put in that paragraph, you know, a specific example  
 21 of how that statement does make sense.  
 22 **Q.** So stepping back to your earlier observation that  
 23 the February was a wasted month point --  
 24 **A.** Yep.  
 25 **Q.** -- that you weren't looking at those larger issues of,  
 26

1 **Q.** -- that you prepared a further draft and he said,  
 2 "Well, I" -- it was at that stage that he said he didn't  
 3 want it to be an official Imperial College report, and  
 4 suggested that you publish it sort of separately in  
 5 a scientific journal?  
 6 **A.** That's correct.  
 7 **Q.** But we will see that you did go on to provide your note,  
 8 possibly slightly amended again, to SPI-M-O a few days  
 9 later?  
 10 **A.** Yes, that's correct.  
 11 **Q.** So let's move forward, if we can, to Monday 9 March, so  
 12 a week or so after you had first drafted the note, and  
 13 again you refer in your statement to hearing  
 14 a radio report that morning about a COBR meeting which  
 15 was due to take place and the suggestion that  
 16 the Prime Minister would be considering imposing social  
 17 distancing measures at that stage.  
 18 **A.** Yes.  
 19 **Q.** If we can then, please, go to an email exchange, we see  
 20 that that was the trigger.  
 21 Thank you.  
 22 So is it right, then, that having heard that radio  
 23 exchange, or radio report, rather, that's what prompted  
 24 you to send this email that we're looking at now?  
 25 **A.** Yes.

28

1 Q. We can see from the start that it was sent, is this  
 2 right, to the sort of SPI-M-O group email address and  
 3 also to Graham Medley, who was one of its chairs?  
 4 A. No, I think it was sent to the SPI-M secretariat and to  
 5 Graham. I don't think this was sent to the full  
 6 distribution list. I don't think all my colleagues had  
 7 the opportunity to comment.  
 8 Q. Okay, that's helpful, thank you.  
 9 If we look at the second paragraph down, we see you  
 10 stating:  
 11 "It is my considered scientific opinion that we  
 12 should implement school closures and working from home  
 13 where possible and any other social distancing measure  
 14 we can for the next three weeks. Starting as soon as  
 15 possible."  
 16 A. Yes.  
 17 Q. You refer to school closures and working from home, but  
 18 then you say -- and everything else.  
 19 A. Yes.  
 20 Q. Did you in fact mean a lockdown or something equivalent  
 21 to that?  
 22 A. Yes. Well, the "any other ... measures we can".  
 23 I wasn't aware of what would be possible.  
 24 Q. Well, we've heard that the word "lockdown", which we're  
 25 now all so familiar with, wasn't used at the outset of  
 29

1 lockdown, and then what might happen afterwards?  
 2 A. Yes.  
 3 Q. But in that context, you say:  
 4 "If you look back three weeks ..."  
 5 So to, let's say, mid-February --  
 6 A. Yep.  
 7 Q. "... the world was a very different place."  
 8 A. Yes.  
 9 Q. I wanted to ask you whether what you're saying there is  
 10 that this issue about the likelihood of NHS collapse, if  
 11 nothing changes, was different on 9 March when you sent  
 12 this email as opposed to the middle of February,  
 13 three weeks earlier, which here you're saying was a very  
 14 different place?  
 15 A. As a scientific point I don't think the -- there was no  
 16 new understanding about what the demand would be on  
 17 healthcare if behaviour did not change. I don't --  
 18 I think that's established by the 1% infection fatality  
 19 rate and the associated hospitalisation rate. So, as  
 20 a scientific consensus, I don't think that changed  
 21 during that period.  
 22 What I'm referring to there, and I'm not being very  
 23 specific about it, is our shared understanding of what  
 24 this is going to mean, you know, in and around me and in  
 25 our community in the UK and probably across Europe and  
 31

1 the pandemic, but I think it's clear you are describing  
 2 a broad set of NPIs?  
 3 A. Yeah. And I try to avoid using the word. I don't --  
 4 I don't think it's a good word, I think it's -- it  
 5 sounds, it's a lot more nuanced --  
 6 Q. Right.  
 7 A. -- than that word leads people to think of when they  
 8 start discussing it.  
 9 Q. But with that caveat, that's what you're suggesting?  
 10 A. Yeah, yeah yep.  
 11 Q. In the next paragraph, you explain the basis for this  
 12 suggestion, in effect what's become described as NHS  
 13 becoming overwhelmed.  
 14 A. Yes.  
 15 Q. You say that:  
 16 "... business as usual [in other words, without  
 17 those measures] will likely lead to the (at least  
 18 partial) collapse of our health service within that  
 19 time."  
 20 And I think you mean three weeks, that's the time  
 21 period that you're talking about in that context?  
 22 A. Yes.  
 23 Q. Just looking at the next paragraph, as well as talking  
 24 about -- you're talking about what should happen, first  
 25 of all, within the three weeks of your proposed  
 30

1 elsewhere, has changed dramatically in the previous  
 2 three weeks, and I would expect a similar change in  
 3 understanding, possibly behaviour and attitude, in the  
 4 following three weeks.  
 5 I think from recollection that's kind of what I was  
 6 trying to say, but I'm not very precise there.  
 7 Q. Sure. We might come back to that point about  
 8 the developing understanding of NHS collapse in due  
 9 course.  
 10 Just finally on this email, I think, a rather more  
 11 general point: you do refer in the third paragraph to  
 12 numerous models as a basis for your understanding that  
 13 you're expressing in the email. But equally, in the  
 14 final paragraph you make the point that this view you're  
 15 expressing is based on something rather broader than  
 16 merely modelling, if I can put it that way.  
 17 A. Yeah.  
 18 Q. Is that right? Can you explain what you're trying to  
 19 get at here?  
 20 A. Yeah, so I consider my scientific discipline to be  
 21 the study of the transmission and control of infectious  
 22 diseases. That involves properties of the virus --  
 23 Q. Don't go too quickly, Professor.  
 24 A. That involves properties of the virus, that involves  
 25 the behaviour of people, it involves the design of  
 32



1 interventions, their effectiveness, their cost  
 2 effectiveness. It's a very broad topic, and we use  
 3 evidence from lots of different sources in order to  
 4 generate a scientific view, and an evidence-based  
 5 scientific view comes from lots of different types of  
 6 evidence.

7 I think I mention -- I do mention the committee  
 8 being described as a modelling committee, and I'm  
 9 highlighting there my frustration perhaps at  
 10 the narrowness that we've discussed a moment ago, and  
 11 I'm saying -- I'm claiming a right, as a biological  
 12 scientist, to give this opinion, somewhat regardless of  
 13 any specific modelling output.

14 **Q.** Yes. If we can just look, I just want to look briefly  
 15 at the emails that followed this one. First of all,  
 16 Professor Medley responded that same morning, did he  
 17 not?

18 No, sorry, if we can go back to the document before,  
 19 but just scroll up within it. That's it.

20 At the bottom half of that page there is a response  
 21 from Professor Medley, and if we can just look, there's  
 22 a paragraph starting:

23 "We have a choice now: Full or Partial."

24 By which he means, to use the slang, full or partial  
 25 lockdown, doesn't he?

33

1 **A.** Yes, that's correct.

2 **Q.** Was that a problem which, in your view, continued?

3 **A.** Yes.

4 **Q.** Thank you. As I say, we'll come back to that.

5 So that was the exchange that you had with  
 6 Professor Medley on that day, and we can see -- if we  
 7 can now go to the next document, please -- the next day,  
 8 so on 10 March, and this again was early in the morning,  
 9 you sent an email to Sir Jeremy Farrar, who we heard  
 10 something about yesterday. He was the director of the  
 11 Wellcome Trust at the time. And we can see that you  
 12 send him a draft of your paper; is that right?

13 **A.** That's correct.

14 **Q.** And essentially you're asking him for his advice?

15 **A.** Correct.

16 **Q.** Can you expand on what you were asking him and why?

17 **A.** So, it felt to me -- it must have felt to me at the time  
 18 that there was a reluctance to put some of these ideas  
 19 on paper in a very formal way, and I -- in the other  
 20 evidence that I've submitted, you can see me having been  
 21 frustrated with that over, like, the preceding period of  
 22 time. So at this point I'm considering emailing my  
 23 paper to the entire SPI-M, where I think it would  
 24 attract a lot of attention. I didn't know -- I did not  
 25 know for sure what the right policy was. I felt

35

1 If we can see the two lines below that he's talking  
 2 about the full lockdown option, but he says:  
 3 "... we will have saved lives but at enormous cost  
 4 (health, economic etc)."

5 This is one of the points which we will come on to  
 6 see again and again, but the objection to a lockdown on  
 7 the basis of economic impact, and with that in mind, if  
 8 we can look up at the top of this page, and your  
 9 response back to Professor Medley, there's a paragraph  
 10 starting "To be honest", you say:

11 "To be honest, I have not seen any economic analysis  
 12 of an ..."

13 Then you describe I think an unsuppressed pandemic.  
 14 But you say:

15 "... but it keeps being implied to me by Neil and  
 16 others. I am happy to go sit in a room somewhere and  
 17 review that evidence or to give an opinion on email.  
 18 An awful lot of our decisions seem to rely on the idea  
 19 that the above scenario has some kind of economic  
 20 advantage over the alternatives."

21 Are we seeing here, and I think we see it in other  
 22 emails, Professor, a level of frustration on your part  
 23 about assertions being made relating to economic impacts  
 24 without any evidence being provided to support those  
 25 assertions?

34

1 I should under -- if we were doing something that  
 2 I didn't understand, that was important, not to -- not  
 3 to be too arrogant, I thought I should understand why  
 4 we're doing stuff, and if I don't, then I was willing to  
 5 push and push until I could understand why we were doing  
 6 things. But if it turned out my view actually wasn't  
 7 that useful, I could see that this would massively  
 8 disrupt -- potentially disrupt the work of  
 9 the committee, potentially need a whole load of people  
 10 to divert and handle it, if you like, in some way, so  
 11 I could see that this would potentially be a distraction  
 12 for other people and -- and it was a risk, so I was --  
 13 I valued Jeremy's opinion and I was asking him whether  
 14 he thought I should do it.

15 **LADY HALLETT:** Can I just intervene there? Sorry,  
 16 Mr O'Connor.

17 You're sitting as an independent scientist on  
 18 a committee but you felt that you shouldn't send what  
 19 was a considered but different opinion to the committee?  
 20 I'm not quite following why you thought you couldn't.

21 **A.** Maybe I was wrong, maybe I was overthinking it.  
 22 I hadn't had a lot of sleep --

23 **LADY HALLETT:** I can understand that.

24 **A.** -- in the 48 hours prior to that. But there's an awful  
 25 lot of people doing a lot of work and I didn't assume my

36

1 view was the only view or completely correct or, in the  
 2 fullness of time, would be judged as useful, I wasn't  
 3 sure that was the case. So I thought this would be  
 4 disruptive. That was my sense, that it would be  
 5 disruptive. And, you know, somewhat risky to me.  
 6 I mean, honestly, in a slightly personal professional  
 7 capacity, somewhat risky to me, and I was looking for  
 8 a little bit of advice from someone I trusted.

9 **LADY HALLETT:** Thank you.

10 **MR O'CONNOR:** Thank you.

11 Also, let's not forget, someone who was himself on  
 12 SAGE?

13 **A.** Yes, absolutely, and that's not incidental to me  
 14 choosing Professor Farrar.

15 **Q.** Now, we don't have, as far as I know, an emailed written  
 16 response from Jeremy Farrar to this email. Did he  
 17 respond?

18 **A.** Yeah, I think he did. I then went to sleep for a couple  
 19 of hours after this and then I decided to send it when  
 20 I woke up anyway, and I think Jeremy did reply  
 21 afterwards, but I'd already decided to send it in at  
 22 that point. And I think in Jeremy's book he does  
 23 mention a positive response a little bit later.

24 **Q.** It's -- we don't need to worry about this, it's cut off  
 25 on the version on the screen, but this email to him was

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1 **A.** It does two things. It certainly does add some  
 2 illustrative modelling. I think I repeat in this paper  
 3 in another paragraph that I didn't believe that  
 4 modelling was required for that switch, but I thought  
 5 that it was useful nonetheless. And it also expands on  
 6 the reasons that I held the views that I did on how  
 7 behaviour may or may not change. So I -- yeah.

8 **Q.** If we just pick this up three lines down, you say:  
 9 "The primary benefit of mitigation is that the  
 10 epidemic will be over more quickly than might otherwise  
 11 be the case, with the population having acquired herd  
 12 immunity and also having experienced a relatively low  
 13 peak."  
 14 What you're describing there is what is the sort of  
 15 perceived benefit of the mitigation strategy?

16 **A.** Yes.

17 **Q.** Squash the peak?

18 **A.** Yep.

19 **Q.** Get it over with still relatively quickly?

20 **A.** Yep.

21 **Q.** And achieve herd immunity?

22 **A.** Yep.

23 **Q.** And you, in this paper, challenge that thesis on two  
 24 grounds. One is the argument which we were looking at  
 25 a few minutes ago, which is that the NHS would collapse

39

1 sent at 6 o'clock in the morning?

2 **A.** That's right, that's before I -- yeah.

3 **Q.** As you say, you did shortly after that then, an hour or  
 4 two later, circulate the paper to the members of  
 5 SPI-M-O?

6 **A.** Yes.

7 **Q.** That then provoked an email discussion which I'm going  
 8 to take you to. Before we do that, I'd like to take you  
 9 to the paper itself briefly.

10 **A.** Yep.

11 **Q.** So for those purposes can we go to --

12 **A.** Yep.

13 **Q.** We've got it, thank you.

14 Professor, I don't want to spend too much time going  
 15 through the detail of the paper, but the passage in bold  
 16 here is a summary, is it not?

17 **A.** Yes.

18 **Q.** Is it right to say that in essential terms, like  
 19 the email that you sent to Professor Medley, you are  
 20 here calling for a switch from the mitigation strategy  
 21 to a suppression strategy?

22 **A.** Yes, that's correct.

23 **Q.** What this paper does, which perhaps the email didn't, is  
 24 to add a level of sort of modelling support for that  
 25 call?

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1 in the course of that wave; is that right?

2 **A.** The sheer number of deaths implied by the wave I think  
 3 is the first point. So the implicit health impact if  
 4 that wave were to happen is very, very large over such  
 5 a short period of time.

6 **Q.** Yes. There is a sentence about eight or nine lines down  
 7 which says:  
 8 "We show [that's presumably in this report] that  
 9 critical care facilities in the UK would be saturated  
 10 quickly."  
 11 **A.** Yes.

12 **Q.** Is that the point?

13 **A.** Yes.

14 **Q.** But then there is a separate point which takes us back  
 15 to those discussions you were having with  
 16 Professor Ferguson in January --

17 **A.** Yes.

18 **Q.** -- that maybe the mitigation strategy wouldn't quite  
 19 work out as expected anyway?

20 **A.** That's correct.

21 **Q.** Can you expand on that?

22 **A.** Yes.

23 **Q.** Or just explain it.

24 **A.** So, the benefit -- and again, given the numbers in this  
 25 paper, it's strange to talk about benefits of strategies

40

1 with those health impacts, and it felt strange at  
2 the time, and I would -- you know, anyone watching this  
3 now who thinks that we were writing these numbers and  
4 not believing them to be strange and understand their  
5 implication, that was not the case. It's just these --  
6 this -- these were the apparent choices in front of  
7 the people looking at it.

8 So the benefit of a successful mitigation is that  
9 it's over quickly, but the population would have to --  
10 could only change their behaviour somewhat in order to  
11 land just the right amount of immunity so the virus  
12 couldn't come back. Forgetting about all the other  
13 issues about immunity and things. So if you got it just  
14 right, you'd have to somehow bring transmission down  
15 through changes in behaviour.

16 If the population responded by changing even more,  
17 even more than you wanted them to, they wouldn't have to  
18 change that much more to go down to a threshold where  
19 the virus wouldn't grow, to get R to 1. And that's  
20 a break point analysis, it's -- in olden days of this  
21 kind of science, when we used differential equations and  
22 not simulations, this was quite a common way of looking  
23 at a problem to identify a key parameter and say: what's  
24 the implications of that taking a different value? And  
25 at that point the rate at which you would accumulate

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1 broader than just the UK potentially. So that's --  
2 the style then is to go to some very general points at  
3 the end. And yes, I think the point I wanted to make  
4 here is that even though there was useful evidence  
5 contained in the modelling in this report, I didn't --  
6 my view was not that it was necessary, and that actually  
7 there were -- other evidence was sufficient to arrive at  
8 a similar policy conclusion.

9 **Q.** Thank you.

10 Then if we can just finally --

11 **LADY HALLETT:** Before you do, could you just tell me what  
12 you meant by "fixed-term social distancing"? Sorry,  
13 could we highlight the passage again? The penultimate  
14 line:

15 "... [we should] adopt stringent fixed-term social  
16 distancing."

17 **A.** So that's -- I've mentioned -- I mentioned three weeks.  
18 I thought that there should be a time limit imposed on  
19 any stringent social distancing, not because we knew for  
20 sure what the impact would be by that time, but because  
21 earlier imposition had such high value that essentially  
22 the information that we would gain would put us in  
23 a different place at some known future time.

24 Because ...

25 **LADY HALLETT:** And what measures exactly did you mean by

43

1 herd immunity is very, very slow, and you're operating  
2 within an entirely overwhelmed health service.

3 **Q.** So is this right, another way of putting that same point  
4 is that if the government went down the mitigation  
5 strategy, the problem you're identifying is that  
6 the population might almost lock themselves down, to use  
7 a very general term, or at the very least change their  
8 behaviour in a way that prevented the virus spreading  
9 amongst the community as rapidly as had been expected,  
10 which would have that effect that you've described?

11 **A.** That's also a good summary, yes.

12 **Q.** I just want to take you to two other parts in this  
13 report, if I may. First of all, if we can look at  
14 page 4, please, this is the final paragraph of the  
15 report.

16 You mentioned, Professor, in answer to one of my  
17 questions, that even in this paper, which was dealing  
18 with modelling, you made the point that there were other  
19 reasons to adopt this course beyond simply modelling.  
20 Is this the passage that you had in mind, where you talk  
21 about the example of other countries leading to that  
22 conclusion as well?

23 **A.** Yeah, and a very, you know, brief comment on the style.

24 This is -- it was drafted with the intent of being  
25 a published article that would have readership much

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1 stringent social distancing?

2 **A.** So I think I'd probably go back to the email that I'd  
3 sent the previous morning for the meaning, so it was  
4 school closures, work from home, and whatever else we  
5 had, and I didn't really know what we might have at that  
6 point.

7 **LADY HALLETT:** Okay, thank you.

8 **MR O'CONNOR:** Professor, you don't like using the word, but  
9 may we use the shorthand --

10 **LADY HALLETT:** Lockdown.

11 **MR O'CONNOR:** -- lockdown?

12 **A.** You may.

13 **MR O'CONNOR:** Could we then turn to page 6, please.

14 Now, could we get as close as we can to the graph on  
15 the right-hand side, please.

16 Professor, there is a reason we'll come back to why  
17 this graph may be of some extra significance, but for  
18 the purposes of the report -- well, perhaps you can tell  
19 us in summary what these different lines show?

20 **A.** Yeah, and this is obviously -- this is intended for my  
21 scientific colleagues. I mean, it's not the most  
22 accessible presentation, it's on a log scale, so powers  
23 of 10 on the vertical axis rather than -- rather than  
24 the linear scale. And the red line is showing some  
25 hypothetical completely unmitigated, no behaviour

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1 change, massively rapid epidemic, and it goes very high.  
 2 The blue line is what I viewed as, again hypothetical,  
 3 perfectly landed mitigation.  
 4 **Q.** Just pausing there, that's the sort of squashed peak aim  
 5 that --  
 6 **A.** Yeah.  
 7 **Q.** -- at one stage the government was trying to achieve?  
 8 **A.** And it's not that squashed. That's -- we're looking at  
 9 infectious disease incidence for a whole country on  
 10 a log scale here. That's a -- you know, that's -- you  
 11 don't normally need to do that.  
 12 And then the cyan line there is the output from  
 13 the model which shows if people's behaviour was strictly  
 14 triggered by ICU being saturated. And this is -- this  
 15 is a scenario. I didn't think -- it's not a forecast.  
 16 I didn't think that that -- those features of the line  
 17 would play out exactly as are on there, but it's a --  
 18 I thought it was a very useful scenario.  
 19 Let's say we were going to let the thing spread  
 20 until we saturated ICU but then everyone is like, "I'm  
 21 not going to carry on behaving the same because I've no  
 22 longer got a ventilator available to me", you'd get this  
 23 kind of short cycle bouncing around at a very low level.  
 24 So the key thing here is the height of the cyan line is  
 25 quite low.

45

1 **Q.** So that's what you've done and that's the report we've  
 2 just looked at?  
 3 **A.** Yes, correct.  
 4 **Q.** Then if we can go forward, please, or scroll up to  
 5 the next page, within less than an hour, we see  
 6 Professor Ferguson's response, which is not a positive  
 7 one, Professor. I wanted particularly to pick up on the  
 8 third paragraph, where he says:  
 9 "I do feel strongly that we should focus on  
 10 providing an evidence based assessment of what the  
 11 policy choices are and their likely impacts, rather than  
 12 advocate for a particular policy. At least in our role  
 13 on SPI-M."  
 14 Professor, this is a point that you expand on in  
 15 your witness statement, the issue about scientific  
 16 advocacy or scientific evidence. What was  
 17 the difference of opinion here and what was your take on  
 18 it?  
 19 **A.** So I think we should be very careful describing a view  
 20 as advocacy and another view as evidence-informed  
 21 scientific opinion, and I think -- I don't think I say  
 22 so explicitly here or in the other evidence but I think  
 23 I probably show, I felt that I had an evidence-based  
 24 opinion that covered recommendations on interventions.  
 25 As I've mentioned before, our scientific discipline

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1 **Q.** So that's the turquoise line, and that's the --  
 2 **A.** Sorry, turquoise, yeah.  
 3 **Q.** -- sort of unilateral decision within the population to  
 4 dramatically reduce their movement that's -- the problem  
 5 that you were identifying potentially?  
 6 **A.** Yeah, yeah. If every time the ICU was saturated we all  
 7 changed and reduced and then we started back again,  
 8 that's what it would look like.  
 9 Then the green line is the scientifically kind of  
 10 trivial -- let's say we managed to bring the R down and  
 11 keep it down, then it's the green line.  
 12 **Q.** Thank you.  
 13 So that's your report, and as I indicated, when you  
 14 circulated, it generated a debate amongst the members of  
 15 SPI-M-O, and particularly you and Professor Ferguson.  
 16 So we can turn to that now, please, and that is  
 17 INQ000269369. Thank you.  
 18 So we've gone first to this page, where -- do we see  
 19 here, halfway down, Professor -- so we'll recall that it  
 20 was 6 in the morning when you sent that email to  
 21 Sir Jeremy Farrar, I think you said that you thought  
 22 about it a bit, maybe had a cup of tea, and then two and  
 23 a half hours later you are deciding "I'm going to send  
 24 this to the whole committee"?  
 25 **A.** That's correct, yep.

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1 includes the study of interventions and I had  
 2 an evidence-informed opinion for one intervention over  
 3 another.  
 4 I think here Professor Ferguson has chosen to  
 5 describe my view as advocacy, and by implication  
 6 the view of others as being more valid or more based in  
 7 evidence. And I think that's what -- that's my  
 8 understanding of what Professor Ferguson is saying here.  
 9 **Q.** Linked to that then is also the point which is debated  
 10 in these emails about whether a proposal such as yours  
 11 should be made without explaining exactly how it's going  
 12 to work?  
 13 **A.** Yeah, and that is a different -- that's a different  
 14 point, but linked. We disagreed on that, and I don't  
 15 think that's any more complicated than my view was,  
 16 having studied interventions against respiratory viruses  
 17 for many -- my view was that other countries had decided  
 18 to adopt this approach without necessarily knowing  
 19 exactly how it was going to work, but acknowledging that  
 20 the timing, the speed with which you adopt it is  
 21 important. So there is a trade-off there between  
 22 knowing exactly how it's going to work out for you,  
 23 but -- or doing it quickly, and my view was it was  
 24 justified to move quickly, even -- and again, even if we  
 25 didn't really know exactly how it was going to work.

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1 Q. It might also be thought that the mitigation strategy  
2 that was in place, and which, as we will see,  
3 Professor Ferguson was defensive about, I mean, there  
4 were also some quite serious doubts about how that was  
5 going to work at the time?

6 A. Yeah, I think that's true.

7 Q. Let's move on in the exchanges, if we can, which are  
8 all -- in fact, if we can move to page 3, there is  
9 an exchange between the two of you about this point  
10 about the extent to which the workings of a policy need  
11 to be demonstrated.

12 Then I want to come to -- thank you -- this one,  
13 which -- we can see we're now on the next day, it's  
14 11 March now, and so the first paragraph is the  
15 continuing debate about exactly what your role is or  
16 the role of you and Professor Ferguson and SAGE and the  
17 government and so on. But I want to come particularly  
18 to the second and third paragraphs, where  
19 Professor Ferguson said:

20 "I would also note that there is now significant  
21 momentum behind the current strategy. A huge amount of  
22 effort is going into operational planning right now.  
23 Government is aware of the projected incidence, health  
24 system demand and mortality impact. Though I ... would  
25 like to be reassured that the Cabinet is aware of what

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1 on at higher levels during February at all, and  
2 I didn't -- I didn't notice that at the time.

3 So with all due respect, you can ask  
4 Professor Ferguson.

5 Q. Yes. Just one other point on this, before we move on,  
6 the paragraph above. He says:

7 "Government is aware of the projected incidence ..."

8 So that's the anticipated mortality rate of  
9 the mitigation strategy.

10 And also "health system demand". The inference  
11 there is that, on the one hand, you're saying an awful  
12 lot of people are going to die and the health service is  
13 going to be saturated; Professor Ferguson seems to be  
14 saying the government know that but they want to do the  
15 strategy anyway?

16 A. That's correct. What you're saying is correct.

17 Q. Yes.

18 Just one other point on this set of exchanges I'd  
19 like to ask you about, and for those purposes I think we  
20 need to go back to the first page of the document.

21 Yes, thank you. Sorry, let me just make sure I've  
22 got the right reference here.

23 (Pause)

24 Yes, thank you. So you say:

25 "I understand your view."

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1 that will look like in reality."

2 Then this:

3 "The current view is that -- with difficulty -- this  
4 can be handled. Policy will not change unless we can  
5 demonstrate convincingly (rather than rhetorically) that  
6 the strategy will fail, and/or propose a concrete  
7 'better' alternative. There is limited appetite for  
8 intense social distancing policies -- it has taken  
9 considerable work to move the government to the likely  
10 current strategy."

11 The first point to be made is Professor Ferguson is  
12 not keen to move away from the mitigation policy. What  
13 did you understand by his language of, as it were,  
14 having in the first place moved the government to that  
15 strategy?

16 A. I honestly can't remember focusing on that at the time.  
17 I understood -- so, through February I didn't know what  
18 the government would do when the virus arrived, and,  
19 you know, it wasn't clear that they weren't considering  
20 really stringent interventions. To me. So it was --  
21 during the very end of February and the beginning of  
22 March it became more clear that they were -- that  
23 the government was focusing much more on mitigation. So  
24 I didn't really know whether there had been a move or  
25 a change -- or I didn't -- I didn't know what had gone

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1 This is -- sorry, let's just be clear about this,  
2 this is Professor Ferguson.

3 A. Yep.

4 Q. He says:

5 "I understand your view. But just bear in mind  
6 the Treasury advice is that 6 months of intense social  
7 distancing -- sufficient to achieve  $R < 1$ , is predicted to  
8 drive deep recession and massive business failures and  
9 job losses."

10 Then he refers to talking to someone from the  
11 US federal interest committee, and so on.

12 Do we see here again an example of the economic  
13 impact of lockdown being used to challenge that  
14 possibility?

15 A. Yes, we do, and can I comment on my --

16 Q. Yes.

17 A. -- response?

18 Q. Yes.

19 A. People who were supportive of lockdown did not for one  
20 moment think that it wouldn't have lots of massive  
21 negative consequences, but the point I make here in  
22 reply to Professor -- to Neil is that we don't have  
23 a counterfactual, we don't -- there seems to be  
24 an unstated implicit assumption that if we don't do  
25 something we're going to have a better economic outcome

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1 and a better outcome across all those other different  
2 dimensions, and I -- I didn't know why people assumed  
3 that.

4 **Q.** So there are two points, perhaps. The first is the one  
5 you've made, which is that it's all very well to say  
6 that a lockdown will be very costly, but how expensive  
7 will that turquoise unsuccessful mitigation policy -- or  
8 even the successful mitigation policy be?

9 **A.** Yep.

10 **Q.** But the second is: did you actually see these Treasury  
11 forecasts or Treasury modelling that you occasionally  
12 are being told about?

13 **A.** That's correct, yeah, that's another point, yes.

14 **Q.** And in that regard, can I take you to a further  
15 document, please, INQ000103475.

16 So this is an email from several weeks later,  
17 the end of March, so we're into lockdown by this stage,  
18 and you're discussing, on this occasion with  
19 Professor Medley and Professor Woolhouse, some further  
20 aspects of social distancing policy.

21 In fact if we can go to the next page, please, it's  
22 the paragraph starting "There are no easy choices here",  
23 you say:

24 "There are no easy choices ... While understanding  
25 that the stated government objective is to save as many

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1 **Q.** Thank you.

2 My Lady, I see the time. I've got just a couple  
3 more quick topics to cover and then I might suggest we  
4 have a break in about five minutes' time.

5 Just moving on with the chronology, Professor,  
6 the report was sent to SPI-M-O, and I think we know that  
7 it was discussed at a SAGE meeting, possibly on the same  
8 day.

9 **A.** That's correct.

10 **Q.** That then was 10 March. We will hear in due course  
11 plenty of evidence about what happened for the remainder  
12 of that week in Downing Street, and in particular  
13 a series of meetings that took place on Friday,  
14 13 March, and then over the weekend that followed, which  
15 were all central in the decision that was in the end  
16 taken to lock down.

17 Dominic Cummings has provided evidence to this  
18 Inquiry about those discussions in Downing Street which  
19 have included a picture of a whiteboard that was used at  
20 those meetings, and it's helpfully been brought up on  
21 the screen.

22 You comment in your statement you've seen this --  
23 this wasn't the first time; I think it's been in the  
24 public domain for some time -- and you thought that you  
25 could see your own work reproduced on this whiteboard.

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1 lives as possible, economic impact is also important.  
2 But has any other branch of government done a detailed  
3 assessment of what the economy would look like with  
4 a prolonged period of virus circulation at or near  
5 maximum NHS capacity?"

6 So that's the counterfactual point again. But you  
7 go on to ask:

8 "Is there a treasury team to whom we can send  
9 a plausible set of scenarios and ask directly how much  
10 better one scenario might be than another? We have  
11 a little bit of time and this question has arisen many  
12 times."

13 So did you get an answer to that question as to  
14 whether there was a Treasury team you could engage with?

15 **A.** I don't think that I did. I think I may have put in my  
16 statement that I searched and was unable to find any  
17 answer. Or it may have been a slightly different email.  
18 But I don't think -- I don't believe I did.

19 **Q.** Moving away from this particular email, your general  
20 experience of that time when you were sitting on SPI-M-O  
21 as an academic scientist, did you ever find the answer  
22 to this question of: where was the economic modelling  
23 that you could look at to help understand your advice on  
24 policy change?

25 **A.** No, I did not.

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1 **A.** So I think there are some similarities. So in terms of  
2 some of the points that are noted, and it is difficult  
3 to read here, but they comment on an increasing fatality  
4 rate once hospitals are overwhelmed, which wasn't  
5 a common feature of the models at the time.

6 Then the actual plots that are there, they have  
7 some -- they have some similarities, some features that  
8 are quite similar to the way I presented my results.

9 On a log scale, the seeding -- the way that you  
10 start the epidemic if you use a log scale means that you  
11 get a down and then an up on that left-hand side, so  
12 both of those curves are a down and up. And then  
13 actually on the mitigation, the second curve on the  
14 whiteboard there, you can see it's two straight lines  
15 joined by a curve, which is -- that's what an epidemic  
16 on a log scale looks like. So there's -- and then  
17 I think in the bottom right that kind of looks like  
18 a discussion of how an epidemic is progressing up  
19 against some thresholds.

20 So -- and I -- and I do want to also add that during  
21 that week there were many voices within -- I'm sure some  
22 within government and certainly many voices outside of  
23 government which were making very similar points, with  
24 excellent clarity. There was lots of input that week.

25 **Q.** Yes. Yours wasn't a lone voice, certainly, as that week

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1 developed.

2 The other part of the narrative that we should

3 perhaps make clear is that Dominic Cummings was at that

4 SAGE meeting where your paper was discussed a few days

5 earlier.

6 **A.** I think I checked the minutes and a member of his team,

7 Ben Warner, was at that meeting. I don't know if

8 Dominic Cummings --

9 **Q.** Sorry, you're right, that was it, it was Mr Warner.

10 Thank you, we can take that down.

11 Then lastly for the moment before we have a break,

12 Professor, I want to ask you about a report that was

13 published by the Imperial College response team the

14 next week, so after your report was circulated, after

15 Friday, the 13th, after that whiteboard, the next week

16 there was a report published known as Report 9, and we

17 can see from the top that Professor Ferguson's name is

18 the first name on the list of authors, and was he the

19 principal author of this document?

20 **A.** Yes. Yes, he was.

21 **Q.** We do see your name, the penultimate name on the list.

22 **A.** That's right.

23 **Q.** So you were also involved?

24 **A.** That's right.

25 **Q.** I'm not going to ask you about this document in any

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1 of course, as we see in the report, had been saying from

2 your email to Professor Medley, and then in the report,

3 that NHS overwhelm was a reason for moving to

4 suppression. You had been saying that for a couple

5 of weeks. And indeed the Inquiry has heard

6 Professor Woolhouse saying he was worried about the NHS

7 being overwhelmed from the end of January, and

8 Professor Medley saying that everyone became aware that

9 the NHS would be overwhelmed during February at least.

10 So is it right, in your view, that this conclusion was

11 only drawn just a few days before this report?

12 **A.** No. And I have checked back through my files, I did

13 comment kind of heavily on a version of this. The

14 version I commented on didn't contain this paragraph,

15 but I did receive a copy prior to publication, so I did

16 see this before it went out and, you know -- so perhaps

17 I missed this at the time, but I don't agree with that

18 characterisation of how the evidence changed.

19 **Q.** In fact if we go to page 20 of your statement,

20 paragraph 5.1, you expressed the view, perhaps

21 unsurprisingly in light of the documents we've been

22 looking at, that the first national period of -- you've

23 allowed yourself to use the word "lockdown" there,

24 "should have been introduced on or around 9 March". Is

25 that still your view?

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1 detail, Professor, because we will be dealing with it

2 with Professor Ferguson, but I did just want to ask you

3 about the last two or three perhaps.

4 So if we can go to page 16, please.

5 So just in summary, the penultimate paragraph, there

6 is a striking sentence:

7 "We therefore conclude that epidemic suppression is

8 the only viable strategy at the current time."

9 So we saw those emails the week before where

10 Professor Ferguson had been resisting your suggestion of

11 a pivot towards suppression, but by the time of this

12 report he has himself changed his mind and is advocating

13 for that policy; is that right?

14 **A.** That's correct.

15 **Q.** In the paragraph that's at the top of that section we

16 can see why he is now saying that suppression is

17 the right policy, and that is because of the NHS

18 overwhelm problem --

19 **A.** Yes.

20 **Q.** -- in summary.

21 Then this, the paragraph between those two:

22 "In the UK, this conclusion has only been reached in

23 the last few days, with the refinement of estimates of

24 likely ICU demand due to COVID-19 ..."

25 I want to ask your view about that paragraph. You

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1 **A.** Yes. I felt -- and I do remember having discussions at

2 the time and certainly thinking this, that once we had

3 lab-confirmed deaths in ICU with no travel history, no

4 obvious connections to any out-of-country social

5 networks, even a handful of those would indicate that we

6 were -- we would be rapidly progressing in our epidemic.

7 I think -- yeah.

8 **Q.** Just to be clear, on the basis of the answer you've just

9 given, and of course the documents, this view that

10 you're expressing here is one that you had at the time,

11 not just with hindsight?

12 **A.** That's correct. I mean, the -- I think the introduction

13 to the note circulated on the 10th kind of captures

14 this, even if it's not stated explicitly.

15 **Q.** Yes.

16 Lastly, Professor, on this, your view, please: if

17 a lockdown had been implemented two or so weeks earlier,

18 what can you say about the different effect that might

19 have taken place?

20 **A.** So we've got a lot of data about how social mixing

21 changed over this period, and actually the -- on or

22 around 16 March seems to be when everybody did start to

23 change their behaviour. So I think the best way to talk

24 about this is to say: had we achieved that rapid

25 reduction in mixing earlier than the 16th, then the peak

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1 height would have been lower and the area under  
 2 the curve for the first wave would have been less, and  
 3 potentially quite a bit less, and the area under  
 4 the curve is proportional to the number of deaths, in  
 5 a very kind of crude but useful way.

6 **MR O'CONNOR:** Yes. Thank you.  
 7 My Lady, would that be a convenient moment?

8 **LADY HALLETT:** Can you remind me of the date of the report  
 9 that said "this conclusion has only just been reached in  
 10 the last few days"?

11 **MR O'CONNOR:** Yes, sorry, Report 9. Is it the 16th?

12 **LADY HALLETT:** 16th, thank you.

13 **MR O'CONNOR:** I suspect we'll hear more about that report,  
 14 my Lady.

15 **LADY HALLETT:** I thought we might, but I just wanted to make  
 16 a note there.  
 17 11.40, please.

18 **(11.23 am)**  
 19 **(A short break)**  
 20 **(11.40 am)**

21 **LADY HALLETT:** Mr O'Connor.  
 22 **MR O'CONNOR:** I'm grateful, my Lady.  
 23 Professor Riley, I'm going to move now away from  
 24 the chronology of events during the pandemic and ask you  
 25 finally a series of questions about the way in which

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1 bottleneck"?

2 **A.** So my understanding of the process is that onwards from  
 3 SAGE it is primarily the CMO and GCSA who take that  
 4 forward. I think Stuart Wainwright described this in  
 5 his testimony, there is written minuting of SAGE and  
 6 then the oral communication of CMO and GCSA going  
 7 forwards. So what I'm -- my comment here is that,  
 8 looking at the volume and complexity of the scientific  
 9 information that was funneling into that SAGE process,  
 10 I -- the fact that it went forward through such  
 11 a restricted mechanism to the most senior levels of  
 12 decision-makers does seem like a bottleneck.

13 I acknowledge there will be working-level  
 14 relationships all around SAGE as well, but I think  
 15 the formal structure is also important in addition to  
 16 those working level contacts that will also propagate  
 17 information.

18 **Q.** And do you -- if you're right, what you say has obvious  
 19 sense about it, do you have any ideas as to how that  
 20 bottleneck might be removed?

21 **A.** I think there are examples in other countries where they  
 22 have broader panels meeting directly with ministers in  
 23 a more formal way, and I would again emphasise there's  
 24 lots of informal communication that will be going on  
 25 around this process, so at a very basic level something

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1 the structure for providing scientific advice to  
 2 government worked during the pandemic, and following up  
 3 on some observations you've made in that regard in your  
 4 statement.

5 I'd like to turn first to paragraph 2.4 of your  
 6 statement, which is on page 4, and here you comment on  
 7 that part of the system whereby the advice of  
 8 the subcommittees or the evidence from the subcommittees  
 9 is passed up to SAGE, SAGE is chaired by the Chief  
 10 Medical Officer and the Government Chief Scientific  
 11 Adviser, and then it's they who act, to use a word  
 12 you've used, as the bridge for providing that advice on  
 13 to policymakers within government.

14 You say here that that aspect of the system had  
 15 strengths and weaknesses. You emphasise that the two  
 16 people who held those roles during the pandemic were  
 17 highly effective in digesting and synthesising evidence,  
 18 and therefore, as you say, the process by which they  
 19 acted as a bridge was a strength, because they could  
 20 ensure quality and coherence of the scientific evidence.

21 "However [you say], regardless of the capabilities  
 22 of individuals, it is my view that they must also have  
 23 acted as a slightly unrealistic bottleneck if their role  
 24 was to be the primary arbiter of scientific opinion."  
 25 What do you mean by "slightly unrealistic"

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1 that has more people involved in the formal  
 2 communication, because it just seems like two isn't --  
 3 it's an enormous load on two individuals.

4 **Q.** As you say, the system as it stands, you have the debate  
 5 at SAGE amongst that broad group of people, fed into by  
 6 the subcommittees, and debate above that at the policy  
 7 level, but just those two people acting as the link  
 8 between the two, and if one was to have some sort of  
 9 larger organisation where policymakers and scientists,  
 10 more than just those two, could communicate about  
 11 the scientific advice, that might be a better approach?

12 **A.** I think it might be, yes.

13 **Q.** Moving on, Professor, in fact on the same page of your  
 14 statement, paragraph 2.6, you refer to a lack of  
 15 diversity amongst SAGE and its subgroups, illustrated --  
 16 sorry, during the early months of the pandemic, and you  
 17 say that's illustrated by the under-representation of  
 18 women on SAGE and its subgroups during that period,  
 19 although you go on to say that that was corrected as the  
 20 pandemic progressed.

21 What about diversity in terms of representation of  
 22 other ethnic groups?

23 **A.** So, just to comment, I've not reviewed data on this.  
 24 This is a topic where, you know, looking at the number  
 25 of people attending meetings and their diversity

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1 characteristics is a very valuable exercise. I have not  
2 done that, so I'm commenting from my impression, and  
3 that's actually what I was doing here in the statement.  
4 And I'm suggesting that looking at gender was a --  
5 illustrated the overall lack of diversity, not -- I'm  
6 not saying that's the only important aspect of  
7 diversity.

8 **Q.** No.

9 **A.** And from recollection, with -- you know, in a series --  
10 you know, I would -- there is very little ethnic  
11 diversity that I'm aware of within the system. So yes,  
12 I'd imagine that is an issue that should be addressed as  
13 well.

14 **Q.** Do you think that that lack of ethnic diversity within  
15 the SAGE and its subgroups, and I take it that it's fair  
16 for you to say that that's just a sort of observation,  
17 it's nothing sort of scientific about that observation,  
18 but taking that as read, do you think that that may have  
19 had any actual substantive impact on the way in which  
20 scientific advice was provided, bearing in mind  
21 of course what turned out to be the disproportionate  
22 impact of the pandemic on certain ethnic groups in this  
23 country?

24 **A.** I think it's entirely possible that it did have  
25 an impact, yes.

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1 time, I'm not sure it's even remunerated, but there is  
2 a recruitment process that would be similar to any other  
3 position, whereas some other committees do not. And  
4 what I'm really saying here is, even if you're not  
5 invited to every meeting, there may be benefits in  
6 considering that for SAGE. I can imagine there are  
7 some -- you know, there may be drawbacks with that as  
8 well, but given the impact that the committee may have  
9 during key times, then that may be something to  
10 consider.

11 **Q.** Yes, thank you.

12 Moving on to a different topic, this is at 5.3 of  
13 your statement, page 21. The issue here is what you  
14 refer to as groupthink, and you describe a particular  
15 moment during the pandemic, in fact during that period  
16 that we were talking about before the break, when you  
17 were trying to gain an audience for your paper, where  
18 you were taken aside and privately assured that you were  
19 being listened to, even if perhaps it didn't feel like  
20 that. But you at that point describe raising the  
21 question of red teaming, perhaps a fairly well known  
22 phrase, whether there was a sort of challenge process  
23 built into the structure.

24 Tell us more about that issue.

25 **A.** Yeah, so it was at the end of the meeting on the 11th

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1 **Q.** And that would obviously be another reason why that  
2 aspect needs to be looked at and corrected as soon as  
3 possible?

4 **A.** Yes. It's a common theme across lots of technical  
5 disciplines, that historically there has not been  
6 sufficient diversity. It would apply to many  
7 organisations, certainly beyond SAGE. It's a difficult  
8 problem to address but it is an important problem.

9 **Q.** Just sticking with the question of diversity for  
10 a moment, if we could move to page 38 of your statement,  
11 paragraph 11.2, you pick up this theme again later in  
12 your statement, Professor.

13 We should bear in mind, of course, shouldn't we,  
14 that you were not an attendee of SAGE other than those  
15 few occasions where you attended it after you joined  
16 the UKHSA, but with that in mind you say that you  
17 understand that SAGE is an ad hoc committee and is  
18 shaped to respond to specific outbreaks, but you say it  
19 can be so influential and therefore you float the idea  
20 of there being some kind of what I take it to mean  
21 a more formal recruitment process than exists at  
22 present; is that what you're driving at?

23 **A.** Yes, I might contrast -- so NERVTAG I believe has  
24 an open recruitment process. I think they advertise,  
25 people apply, and even though it's only a proportion of

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1 that I'd attended in person and in discussions  
2 afterwards I raised the possibility of groupthink, and  
3 then -- and used the term "red team" to just ask whether  
4 anywhere else in government they had a bunch of people  
5 in a room trying to figure out if there was a better way  
6 to be doing -- to be thinking about the stuff that we  
7 were doing.

8 And it was -- I was very tired, I was quite  
9 frustrated, and I was kind of -- I was flailing a little  
10 bit, but, you know, that was a thought that occurred to  
11 me then: given the stakes here, I hoped at that time  
12 that there might be people I didn't -- that we weren't  
13 aware of who were actively considering the same issues.

14 **Q.** We certainly haven't seen any evidence of management  
15 consultants being brought in to SAGE during  
16 the pandemic. I take it that nothing came of your  
17 suggestion at the time?

18 **A.** I'm not aware of -- no feedback was given to me, and,  
19 you know, I wouldn't have expected it. This was  
20 an informal conversation after a long meeting.

21 **Q.** But looking back on it now, and in particular with the  
22 extra perspective you've gained from UKHSA, do you think  
23 there is a weakness in the system here? Do you think  
24 that the system would benefit from having some form of  
25 formal internal challenge mechanism?

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1 **A.** I think effectively that was addressed very quickly.  
 2 I'm not sure it was ever -- so, yeah, I'm not sure it  
 3 was ever referred to as a red team existing that hadn't  
 4 existed before, but if you look at the structures across  
 5 government that were -- sprung up immediately following  
 6 March, and certainly by the time I could observe them in  
 7 October 2021, effectively there were numerous red teams  
 8 that were capable of providing advice.

9 So I don't feel that's something that was  
 10 overlooked, beyond that moment I mention there.

11 **Q.** I'm going to move on, just two more topics left. The  
 12 first is transparency and for these purposes if we look  
 13 at paragraph 11.1 of your statement on page 38, please.

14 You here refer to the suggestion that  
 15 the government, the UK Government, "did not see  
 16 transparency of evidence as an integral part of managing  
 17 the Covid-19" question, and you say that in your  
 18 experience that was a fair criticism, at least in the  
 19 early stages, but that, perhaps a little bit like the  
 20 red teaming, the position improved later on in the  
 21 pandemic.

22 Why do you say it was a fair criticism early in the  
 23 pandemic?

24 **A.** So I think the details -- you know, the details of  
 25 the SAGE considerations weren't made public initially.

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1 week, stating:

2 "... that it was a 'massive failure' of the  
 3 government not to share the economic evidence or to  
 4 explain how this evidence informed its decision-making."

5 And you say you agree with that agreement.

6 Is there a contrast to be drawn between  
 7 the transparency which came to be adopted in regard to  
 8 the sort of more infection-based materials on the one  
 9 hand and the economic evidence on the other?

10 **A.** Yeah, I think there is an interesting contrast between  
 11 those two areas of analysis.

12 **Q.** Your view, you seem to agree with Professor --

13 **A.** Yes, so I think we mentioned it before, I -- my view is  
 14 that there was -- I was -- I never -- there was  
 15 insufficient public evidence about the potential  
 16 economic trade-offs with some of the -- with many of the  
 17 policies that were considered.

18 **Q.** On a similar theme, if we could look, please, at  
 19 page 42, 12.14 of your statement, you again come back to  
 20 the question of transparency and public scrutiny, here  
 21 in the context of modelling, and I think what you're  
 22 saying here is that perhaps the whole -- and this is  
 23 a broad topic which we will have to cover very quickly,  
 24 but the headline is that government could do more to  
 25 explain or could explain better the whole modelling

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1 The membership was not kind of -- I remember a lot of  
 2 debate about the membership at SAGE. So issues like  
 3 that I think reduce the transparency.

4 However, again, you know, my view, even when I was  
 5 outside of government, is that the level of commitment  
 6 and resource that was employed after this time was very,  
 7 very high, and even compared to many other places around  
 8 the world. So I think that -- I think this was a --  
 9 moving onwards from, you know, April 2020, this was  
 10 an incredibly strong aspect of the UK response. And  
 11 just to mention the REACT Study, that was -- we were  
 12 funded by government, worked closely with DHSC and  
 13 Ipsos MORI, we'd had extreme -- we'd had very, very good  
 14 data, we wrote our reports, we published our reports.  
 15 So I think that's an example of something that was very  
 16 transparent to the public.

17 **Q.** So, so far you've described, if I can say, maybe the  
 18 epidemiological, the infection side of the story, SAGE  
 19 minutes and papers, not published to begin with but  
 20 within a few months --

21 **A.** Yeah.

22 **Q.** -- that was all made very public.

23 **A.** Yep.

24 **Q.** If we can go down, please, to paragraph 11.3, you refer  
 25 there to Professor Edmunds, who is coming later in the

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1 process and how that advice feeds into decision-making?

2 **A.** This -- yeah. Briefly, this reflects perhaps my own  
 3 kind of professional bias. I try to be very careful,  
 4 using a phrase "the model says". I would rather give my  
 5 view, which is sometimes very heavily informed by  
 6 a model, other times draws on lots of other evidence.  
 7 But I think that phrase "What does the model say? The  
 8 model says this" is sometimes not helpful.

9 **Q.** Yes. Another lesson that could be learnt for the  
 10 future.

11 Then just finally, Professor, I want to ask you  
 12 a few questions about the need, from a scientific point  
 13 of view, for defined policy objectives against which to  
 14 set scientific advice. It's a subject that some of  
 15 the earlier witnesses have touched on already.

16 Could I ask you to look, please, at paragraph 11.5  
 17 of your statement on page 39. It's another one of these  
 18 parts of your statement where you have been asked to  
 19 address an observation made by the Institute for  
 20 Government, here about chaotic decision-making.

21 Picking it up about five lines down, you say you  
 22 have no comment on whether lack of clarity delayed  
 23 decisions or made it harder for scientific advisers to  
 24 provide useful advice, but you go on:

25 "... on reflection and with hindsight, it may be

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1 possible to define objectives that would drive  
 2 government strategies for some specific scenarios."  
 3 Could you explain what you mean by that.  
 4 **A.** Yes, so -- and here I am thinking about viral  
 5 respiratory pandemics to some degree, that we should be  
 6 able to decide in advance what those objectives would  
 7 be. And, you know, a particular scenario is where there  
 8 is a reasonable expectation of a vaccine, and where the  
 9 way we behave, our social mixing, affects the speed of  
 10 transmission. That's a reasonable future scenario. And  
 11 we -- I think it would be good to try to agree  
 12 collectively what the objectives should be.  
 13 **Q.** That's what you explain in the rest of this paragraph,  
 14 and it's striking, the objective that you propose, just  
 15 as an example, to:  
 16 "... maximise the number of at-risk individuals who  
 17 receive an effective vaccine prior to being infected  
 18 naturally, while minimising any indirect harms of  
 19 the interventions that [you] employ ..."  
 20 It's still at fairly high level, but you think that  
 21 even that sort of policy objective would help as  
 22 a structure for scientific advice?  
 23 **A.** Yes, yeah, I think that it would, and I think many of  
 24 the other witnesses have commented on how difficult it  
 25 was to scope the scientific advice in the absence of

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1 **Q.** Are they being taken?  
 2 **A.** There is -- there are -- I think as Professor Keeling  
 3 commented on, there are a number of groups that are  
 4 looking at exactly these economic questions, and there  
 5 is -- I think there is a lot of work going on in this  
 6 area, some of which I may not be aware of. I'm still  
 7 not aware of a kind of definitive description of what  
 8 the appropriate counterfactuals could have been or  
 9 should have been during kind of March 2020, but they may  
 10 exist and I'm not aware of them.

11 **MR O'CONNOR:** All right.

12 My Lady, those are all the questions.

13 **LADY HALLETT:** Can I just ask about that?

14 I'm a simple soul at heart, Professor. Surely if  
 15 I were a minister and I was asked to provide my  
 16 objectives, I would say my objectives are: minimise  
 17 deaths, minimise infections, because people have  
 18 long-term sequelae, minimise the impact on the economy,  
 19 minimise the impact on societal wellbeing, mental  
 20 health, educational opportunities and the like.  
 21 Wouldn't I just give you a whole range of  
 22 extraordinarily high-level objectives, and you might  
 23 say, "But they're not compatible, they don't go  
 24 together"? How would they help you?

25 **A.** So if you gave us a very long list of everything that

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1 that kind of framework.

2 **Q.** So without getting into specifics, even that type of  
 3 high-level objective was missing in the early stages of  
 4 the pandemic; is that a fair point to make?

5 **A.** Yes.

6 **Q.** Then very lastly, Professor, and you've already  
 7 mentioned that these objectives could be at least  
 8 debated now, if we could go to paragraph 12.15 of your  
 9 report, please, it's actually the last paragraph, and  
 10 you come back to the point about the economic trade-offs  
 11 of these measures, and the need for co-working. But you  
 12 say:

13 "At the very least, with the benefit of hindsight,  
 14 it should be possible for different disciplines to agree  
 15 on how they could have better assessed trade-offs  
 16 between the economy and health at key moments of the  
 17 acute phase of the ... pandemic."

18 **And:**

19 "If this work were public, it could inspire  
 20 substantial progress in academic collaborations between  
 21 health scientists and economists."

22 At the beginning of the paragraph you make the point  
 23 that there is no reason these steps shouldn't be taken  
 24 now?

25 **A.** That's right.

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1 you could be worried about, that probably wouldn't help.  
 2 I think even narrowing it down and saying, "I'm going to  
 3 describe our objectives in one or two or three ways",  
 4 that would be a start. And then I think that if you --  
 5 if from that there was a discussion and you start to put  
 6 a little bit of qualitative trading off between those  
 7 objectives, then that would help even further.

8 So you're right, if you just list everything you're  
 9 worried about, that wouldn't help, but being -- picking  
 10 two or three things and exactly how you express it, and  
 11 then perhaps moving on from there, I think could be very  
 12 helpful.

13 **LADY HALLETT:** But if I excluded from the list I just gave  
 14 you, for example, minimise the infection, then I'd be  
 15 accused, as the minister, of not taking into account  
 16 those who suffered Long Covid. If I didn't include  
 17 educational prospects, I would be accused of not taking  
 18 into account children. So how do I address all those  
 19 concerns when I'm making my decision or setting my  
 20 objectives?

21 **A.** I mean, it's really difficult, and I say in a number of  
 22 places that ministers were presented with the most  
 23 difficult possible decisions. But if ministers don't  
 24 choose a framework then they're leaving it to everyone  
 25 else to create their implicit separate frameworks, and

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1 we end up with over-emphasising deaths, which is,  
2 you know, one criticism of the response, or completely  
3 missing some aspects. So it's -- I'm not for a moment  
4 suggesting that it's easy. I'm suggesting it's  
5 a process that's better gone through in advance for  
6 scenarios that you can reasonably expect to arise.

7 **LADY HALLETT:** I'm glad I'm not the one having to set those  
8 objectives, Professor.

9 Thank you very much indeed, you've been extremely  
10 helpful. And I think looking back on it, you probably  
11 feel you were right to send your report. I don't think  
12 you would have forgiven yourself if you hadn't. So  
13 I appreciate it must have been a very stressful time for  
14 all of you, so thank you very much for your help and all  
15 you tried to do. Thank you.

16 **MR O'CONNOR:** My Lady, I have finished, but in fact --

17 **LADY HALLETT:** I'm so sorry.

18 Ms Morris, cutting you off, I'm so sorry.

#### 19 Questions from MS MORRIS KC

20 **MS MORRIS:** Thank you, my Lady.

21 Good afternoon, Professor Riley. I ask questions on  
22 behalf of the Covid Bereaved Families for Justice, and  
23 I have just one topic, please, to ask you about, and  
24 that's the use of face masks in the community,  
25 a question that's not only important to the Inquiry but

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1 was no obvious reason why surgical face masks couldn't  
2 be used in closed community settings, for example buses,  
3 public transport and shops, based on the limitations  
4 you'd observed from the widespread use of face coverings  
5 in other countries which had been considered useful and  
6 successful in containing Covid-19?

7 **A.** So I just want to give what I perceive to be the key  
8 points of the report, because there was a reason I was  
9 asked to do that and it's because I had looked at some  
10 of the evidence from influenza, studies of influenza.

11 **Q.** Yes. Pre-pandemic studies?

12 **A.** Yes, so I went back to look at those, and the key point  
13 that I thought I was making in the report was, even  
14 though those studies suggested quite low effectiveness  
15 of face masks for influenza, there were a number of  
16 issues around the design and interpretation of those  
17 that said maybe it could actually be better and we  
18 shouldn't necessarily rely too heavily on those as  
19 negative results.

20 **Q.** That's helpful, thank you.

21 **A.** Then if we just come to your question, you asked quite  
22 a specific list of things about use in other countries.  
23 I don't know whether I commented on those in the report.

24 **Q.** At that time, had you looked at, for example, other  
25 East Asian countries and their use of face masks?

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1 also to the bereaved families.

2 You mention it at paragraph 4.9 of your witness  
3 statement, it's a side note, an illustration of a paper  
4 that you've written and a provision of advice that goes  
5 forward. I just want to ask you about the specifics, if  
6 I may.

7 I'm not going to ask you to look at the paper,  
8 hopefully you've got a good recollection of it.

9 **A.** I do.

10 **Q.** It's dated 20 April 2020, it's called "*Potential impact  
11 of face covering on the transmissibility of SARS-CoV-2  
12 in the UK*", and just for the transcript reference, it's  
13 at INQ000236296.

14 Was this a report that was commissioned by SAGE?

15 **A.** Yes. So, Professor -- the co-chairs of SPI-M-O asked me  
16 to write a report.

17 **Q.** Thank you. I think we can see from the minutes of SAGE  
18 on 21 April, that's SAGE 27 -- again, I'm not going to  
19 ask you to look at it, but it's INQ000062295 -- that  
20 they did in fact discuss the impact of face coverings,  
21 and Graham Medley from SPI-M-O was at that meeting.

22 Thank you.

23 So you've produced a paper in April 2020 on the use  
24 of face masks in the community for asymptomatic members  
25 of the public. Is it a fair summary to say that there

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1 **A.** So I don't recall commenting on that explicitly in the  
2 report, so I'm not sure that I did.

3 **Q.** Okay. You've just touched upon the literature review  
4 you did about the influenza use of face masks, so you're  
5 doing this review in April 2020?

6 **A.** Yeah.

7 **Q.** Is it fair to say that if that review had been done in  
8 February 2020, of that pre-pandemic literature,  
9 the results would have been the same, had you done it in  
10 February?

11 **A.** I think they would have been quite similar. And  
12 I believe WHO have commissioned a relatively recent  
13 study of face masks for influenza that I think probably  
14 was quite similar.

15 **Q.** Okay, thank you.

16 So was it your conclusion that now would be quite  
17 a good time to gather more evidence about the efficacy  
18 of face masks?

19 **A.** Yes, I think that's -- yep.

20 **Q.** For example by combining it with digital contact  
21 tracing?

22 **A.** I believe I do mention that as an opportunity in  
23 the report, yes.

24 **Q.** Yes. So this is the advice you're giving in April?

25 **A.** Yep.

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1 Q. There may be utility to using surgical face masks in  
 2 closed community settings?  
 3 A. Yes.  
 4 Q. Thank you.  
 5 How did you expect that paper to be used by  
 6 policymakers? Was it just for SAGE or did you expect it  
 7 to have any wider impact?  
 8 A. So it was commissioned as a rapid review over just one  
 9 weekend, a rapid review to support the discussion at  
 10 SAGE, and I could see from the SAGE minutes that there  
 11 was an extensive discussion of face masks and there were  
 12 clearly many other points raised -- I was not there --  
 13 there were clearly many other points raised in that  
 14 meeting in addition to the material that I provided in  
 15 that report.  
 16 Q. But from your report, was there any scientific, as  
 17 opposed to resource, reason not to advise the public to  
 18 use surgical face masks in closed community settings in  
 19 April 2020?  
 20 A. I did not find a reason in the work that I did, no.  
 21 MS MORRIS: I'm grateful, thank you very much indeed.  
 22 Thank you, Professor.  
 23 Thank you, my Lady.  
 24 LADY HALLETT: Thank you very much, Ms Morris.  
 25 MR O'CONNOR: That does bring this witness's evidence to

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1 A. Mm-hm.  
 2 Q. -- Centre for Global Infectious Disease Analysis?  
 3 A. Well, I handed over that responsibility a few months  
 4 ago. I'm now director of the School of Public Health at  
 5 Imperial College.  
 6 Q. All right. The MRC Centre for Global Infectious Disease  
 7 Analysis is at Imperial, is it not?  
 8 A. It is.  
 9 Q. And you were the director for a number of years. As you  
 10 say, you are part also of the Department of Infectious  
 11 Disease Epidemiology, the School of Public Health, you  
 12 have also been a director of the Health Protection  
 13 Research Unit in Modelling and Health Economics, and you  
 14 hold a number of prestigious fellowships, awards and  
 15 professional qualifications?  
 16 A. I do.  
 17 Q. During the pandemic, you participated in a number of  
 18 important aspects of the country's response to the  
 19 pandemic, because you were, having served many years in  
 20 fact on SAGE, a member of SAGE. You also participated  
 21 in SPI-M-O, NERVTAG and another subgroup, EMG, as well  
 22 as a number of ad hoc task and finish groups?  
 23 A. Indeed.  
 24 Q. Was your contribution to this country's response to  
 25 the pandemic offered by way of your personal

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1 a close.  
 2 LADY HALLETT: Thank you, Mr O'Connor. Sorry, I'd missed  
 3 the one sheet.  
 4 Thank you very much again, Professor, really  
 5 grateful to you.  
 6 (The witness withdrew)  
 7 MR O'CONNOR: My Lady, the next witness is  
 8 Professor Ferguson.  
 9 LADY HALLETT: Thank you.  
 10 PROFESSOR NEIL FERGUSON (affirmed)  
 11 Questions from LEAD COUNSEL TO THE INQUIRY  
 12 MR KEITH: Good morning.  
 13 Could you commence your evidence, please, by  
 14 providing your full name?  
 15 A. Neil Ferguson.  
 16 Q. You are, Professor Ferguson, a mathematical  
 17 epidemiologist, and you have worked on the subject of  
 18 emerging infectious disease outbreaks for many years.  
 19 A. Yes.  
 20 Q. Much of your research has focused on using statistical  
 21 and mathematical models to understand infectious disease  
 22 dynamics and control; is that correct?  
 23 A. That's correct.  
 24 Q. As a world-leading specialist in this field, you are the  
 25 director of the MRC -- is that Medical Research Council?

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1 contribution as Professor Ferguson or as part of the  
 2 Imperial College team?  
 3 A. I think more in the latter. Clearly there were some  
 4 aspects of the former at times.  
 5 Q. It's very plain from the evidence that over time you  
 6 contributed very extensively to the body of scientific  
 7 advice that was provided to the government, and also  
 8 the Imperial College COVID-19 Response Team contributed  
 9 by way of the provision of a multitude of reports and  
 10 papers and pieces of learning to aid the government in  
 11 its hour of crisis.  
 12 In your statement, we needn't put it up, at  
 13 paragraph 13 -- and I should say you've very helpfully  
 14 provided the Inquiry with three statements, the first of  
 15 which is a powerful and lengthy piece of work,  
 16 Professor, weighing in at over, I think, 150 pages.  
 17 You say this:  
 18 "I believe that scientists have a key role to play  
 19 in advising policymakers on the potential impacts of  
 20 different policy choices in a crisis, but that they  
 21 should not use the public platform offered to them by  
 22 that role to campaign or advocate for specific  
 23 policies."  
 24 I want to start your examination, please, by asking  
 25 you for your views, in a general sense, on the role of

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1 scientists, in particular in relation to this pandemic.

2 What is the basis for your belief that scientists  
3 should not use a public platform to campaign or advocate  
4 for specific policies?

5 **A.** I mean, it's a personal view, and I have plenty of  
6 colleagues and -- who might take a different view. My  
7 view is that, I mean, we have expertise to give to  
8 inform policy responses, but we are just citizens in  
9 society, and for something as consequential as  
10 a pandemic, where everybody will be affected by the  
11 decisions made, fundamentally, it is for kind of  
12 policymakers to make those decisions, not for  
13 scientists.

14 So I'm quite happy to inform policy, but not,  
15 certainly in the -- as a member, for instance, of SAGE  
16 or NERVTAG, to advocate for a policy.

17 **Q.** In reality, in practice, was that an easy path to tread?

18 **A.** No. As I outline in my statement, there were many --  
19 well, many -- there were a number of occasions where  
20 those lines got blurred. And clearly we are all human  
21 beings and we're experts on infectious diseases, so we  
22 had more sense than many of what was about to happen,  
23 both in the spring of 2020 and in the autumn of 2020,  
24 and there were occasions where, you know, frustration  
25 built up, let's say, at the apparent slowness of

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1 you'll be aware from the evidence I've given in my  
2 statement and the statement of others, the reality was  
3 a lot more complex.

4 I was -- I don't think I stepped over that line to  
5 say, "We need to do this now". What I tried to do was,  
6 at times, which was stepping outside the scientific  
7 advisory role, to try to focus people's minds on what  
8 was going to happen and the consequences of current  
9 trends.

10 **Q.** Is it, in your view, possible, realistic, to have those  
11 scientists who are providing advice to government not  
12 engage in substantive debate about the right policy,  
13 the right strategy, and to communicate that view to  
14 government?

15 **A.** I mean, I think that brings one to something I talk  
16 about at some length at the conclusions of my first  
17 statement, namely I did feel there was a role that, if  
18 we had been more integrated into the operational  
19 response, we could have contributed more. And that has  
20 happened in the past. That's a different thing from  
21 saying we should be advising or advocating for a policy.  
22 It means that if you have more sight of the objectives  
23 and constraints under which policy has to be made, you  
24 can give more informative advice.

25 **Q.** The emails which the Inquiry has, as you are aware,

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1 decision-making.

2 **Q.** You yourself were not averse to appearing in the press.  
3 I think you appeared on perhaps the Today programme, in  
4 April 2020, you gave a number of interviews. In  
5 reality, was that self-imposed purdah difficult to  
6 apply?

7 **A.** I mean, certainly in giving media interviews, for  
8 instance, I always try to take the line that it was for,  
9 you know, scientists to advise on policies and for  
10 policymakers to decide upon them.

11 **Q.** Is the basis of your decision in part that you believe  
12 that, as a scientist, it's your role to advise and you  
13 have, therefore, no greater right than anybody else to  
14 determine policy?

15 **A.** Indeed.

16 **Q.** We will be coming back to the specific position of SAGE  
17 later, and we want your views as to how that system of  
18 advisory -- scientific advisory/government policy  
19 interface can be made to work perhaps better.

20 But in a general sense, do you feel that you did  
21 confine yourself to the provision of scientific advice,  
22 or did you become, despite your best endeavours,  
23 irrevocably involved in the determination of policy?

24 **A.** It's a difficult question to answer. I know I'm  
25 associated very much with a particular policy, but as

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1 Professor, show that on a multitude of occasions you  
2 expressed views about the government's policy, whether,  
3 for example, there was a distinct lack of urgency,  
4 concerns about whether or not it was over-wedded to  
5 a mitigation strategy. You told Professor Steven Riley,  
6 your colleague, he says that "we", meaning you and  
7 others, "were currently driving UK preparedness and  
8 planning", and you express on multiple occasions views  
9 about the economic impact of -- we're going to use the  
10 word, Professor -- lockdown.

11 That rather suggests that it is impossible for  
12 a scientist in your position and the position of your  
13 colleagues, who were providing this vital line of  
14 advice, not to become engaged, themselves, in expressing  
15 views on strategy, on policy, bluntly, what  
16 the government should be doing.

17 **A.** I would distinguish between exchanges with fellow  
18 scientists, particularly within the Imperial College  
19 team, where there was clearly a diversity of views, and  
20 we are -- we all had our views -- and then how you  
21 express oneself in interactions on committees such as  
22 SAGE.

23 **Q.** You expressed yourself in very forthright terms about  
24 the economic impact of lockdown. You informed your  
25 colleague, Professor Riley, that you'd spoken to,

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1 for example, a US federal interest committee about  
2 the economic consequences of lockdown. You expressed  
3 views about whether or not there was a clear-cut best  
4 strategy and whether the government was following it.

5 My point to you is: should one just not recognise  
6 the reality, which is that scientists are placed in  
7 an impossible position if they are expected to and they  
8 self-impose an obligation not to express clear views on  
9 policy outcomes and strategic options and what should be  
10 done?

11 **A.** I think there's a better balance that can be struck in  
12 that regard than was struck at certain times in  
13 the pandemic. I mean, I read carefully Chris Whitty and  
14 Patrick Vallance's statement and they express some of  
15 the same concerns as I do about that disconnect. Do  
16 I have a perfect model for it? No.

17 **Q.** Do you believe that, in drawing that very difficult  
18 balance between providing advice and intruding into  
19 policy decision-making, you personally kept to that  
20 line?

21 **A.** I do. Clearly I've thought in retrospect of whether  
22 I should have been more forceful at times. I think  
23 where I was comfortable intruding across that line was  
24 where I didn't see evidence of, let's say, the sort of  
25 preparedness to make a, you know, policy option

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1 **A.** I mean, in previous -- previous SAGE -- previous events  
2 where I've sat on SAGE, SAGE has been asked to do that.  
3 We weren't asked to do it for the pandemic. So -- and  
4 reading Sir Patrick's statement, it appears that that  
5 was, you know, the responsibility partly of himself and  
6 Chris Whitty and partly of DHSC and the Cabinet Office,  
7 presenting the policy options.

8 We were asked much more narrow questions about  
9 the likely impact of individual interventions and  
10 clarifying the science and the epidemiology. So at no  
11 point prior to, I would say, April 2020 were we asked,  
12 you know, what are the strategic options which  
13 the government could consider?

14 **LADY HALLETT:** And do you have a scientific-only based  
15 recommended option?

16 **A.** Well, that comes to another issue, that the recommended  
17 option will depend on the policy objectives and/or  
18 red lines the government wants to set. That's where,  
19 you know --

20 **LADY HALLETT:** That's where the needing to know  
21 the objectives comes in.

22 **A.** Yes.

23 **LADY HALLETT:** I follow, thank you.

24 **MR KEITH:** Professor, you were asked relatively narrow  
25 questions as a member of SAGE about the likely impact of

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1 viable -- let's put it that way -- rather than saying,  
2 you know, "This is the alternative policy which should  
3 be adopted".

4 **Q.** Now, you are, by training, a mathematical  
5 epidemiologist, and so it's important that we gain from  
6 you a sufficient understanding of the complexities of  
7 modelling.

8 **LADY HALLETT:** Just before you do, Mr Keith, can I just  
9 pursue the process by which you give advice to  
10 ministers?

11 I --

12 **A.** Can I --

13 **LADY HALLETT:** Sorry.

14 **A.** I never gave advice to ministers.

15 **LADY HALLETT:** No, so you didn't directly, sorry, advice is  
16 given to ministers.

17 As somebody who has given advice that is then given  
18 to ministers, I've seen a lot of papers over the years  
19 from civil servants that set out the various options,  
20 with the pros and cons, and then a recommended option.  
21 That wasn't the format that SAGE advice took, it seems  
22 to have had a consensus statement.

23 **A.** Yes.

24 **LADY HALLETT:** What's wrong with setting out the options and  
25 making recommendations?

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1 individual interventions, but to a very considerable  
2 extent you and your colleagues had no option but to  
3 answer those narrow questions rather more widely; is  
4 that a fair summary?

5 **A.** In some cases, yes.

6 **Q.** Is that why, as we will see in a moment, in March in  
7 particular, you became involved so intimately in  
8 the debate about the strategic options open to  
9 the government, the likely course of events, what their  
10 best strategy might be, what might happen, that were way  
11 beyond a narrow technical, epidemiological,  
12 mathematical, modelling answer?

13 **A.** Yes. I mean, that was really not on SAGE, it was  
14 the SPI-M group, which then -- and had discussed it  
15 before informally. I mean, clearly we did discuss --  
16 and we were reviewing what was happening in other  
17 countries, we did discuss the policy options and  
18 strategies available. But rarely as part of  
19 the official business of the group, more as informal  
20 conversations between, you know, fellow scientists.

21 **Q.** That, therefore, leads one to this conclusion, does it  
22 not, that there is something wrong with the system when  
23 the formal requests made of SAGE and, to a lesser  
24 extent, SPI-M-O, are framed in relatively narrow,  
25 technical, commissioned questions: what is your

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1 scientific view on X?  
 2 Whereas at the same time the email strings between  
 3 you and your Imperial colleagues, Chris Whitty,  
 4 Patrick Vallance, Ben Warner (special adviser in  
 5 Number 10), show that you were engaging much more  
 6 significantly in the overall policy debate.  
 7 **A.** Engage I think is fair. I mean, I was certainly aware  
 8 of the policy debate and I was aware that we needed to  
 9 have a policy which was actually able to be implemented.  
 10 **Q.** Professor Ferguson, your emails show, do they not, that  
 11 you expressed forthright views at various times on lack  
 12 of urgency, on caution on the part of government  
 13 officials, on whether or not the strategies adopted by  
 14 the government were leading us, effectively, to ruin?  
 15 You didn't hold back in those views.  
 16 **A.** No, I mean, I had, certainly, concerns.  
 17 **Q.** Why were they not communicated as part of the formal  
 18 SAGE process, of which you were an important member?  
 19 **A.** I mean, I think because the formal SAGE agenda was --  
 20 I mean, the meetings were relatively formal, with  
 21 a formal process for considering evidence and providing  
 22 advice. They were not -- until much later -- generally  
 23 open debates about -- certainly about policy strategy.  
 24 **Q.** The SAGE minutes, of course, are consensual minutes.  
 25 They reflect --

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1 was there not a problem here, that whilst SAGE openly  
 2 debated these vital issues and was of course constituted  
 3 to publicly, by way of publication of its documents,  
 4 give the government advice, you and your colleagues were  
 5 prone to emailing around each other and emailing the CMO  
 6 and the Government Chief Scientific Adviser and  
 7 Number 10 officials and other officials in the working  
 8 parts of the government your own rather more candid  
 9 views?  
 10 **A.** On -- I mean, I tried not to do it very much, but there  
 11 were times where that felt necessary to do.  
 12 Can I just correct, I mean, my perception of SAGE is  
 13 it's a committee convened to advise the Government Chief  
 14 Scientific Adviser and, in this case, the Chief Medical  
 15 Officer to allow them to provide the best scientific  
 16 advice to government. SAGE itself goes through that  
 17 conduit.  
 18 **Q.** Indeed. But the use of personal email to speak to  
 19 individuals in government outwith the SAGE and then  
 20 the CMO/CSA funnel was a process that had no visibility  
 21 to it, and of course those emails were not published in  
 22 the way that the SAGE materials were published?  
 23 **A.** Yes, and I believe both Chris Whitty and  
 24 Patrick Vallance engaged -- you know, had email  
 25 exchanges and conversations with many, many scientists

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1 **A.** Can I just?  
 2 **Q.** Yes.  
 3 **A.** I mean, they weren't minutes, so --  
 4 **Q.** No, I've called them minutes because that is how they  
 5 are referred to, but they were documents drawn up to  
 6 reflect a consensus position reached by the group; is  
 7 that a fair summary?  
 8 **A.** I think I would agree with how Patrick Vallance has  
 9 stated it in his evidence, namely they were a central  
 10 position rather than always a consensus position.  
 11 **Q.** Some of the meetings were -- I think perhaps can  
 12 reasonably be described as fairly tense, quite heated.  
 13 The 13 March SAGE meeting in particular, the heat of  
 14 the --  
 15 **A.** And I think in the September and October as well, but  
 16 yes.  
 17 **Q.** All right. But the flow of the debate and the range of  
 18 opinions was never really properly reflected in those  
 19 consensus documents, were they?  
 20 **A.** No. I mean, I think if you want to see a better  
 21 indication of I think how I would like to see such  
 22 minutes be prepared in future, then the NERVTAG minutes  
 23 are much more informative.  
 24 **Q.** In terms of transparency, in terms of having a good  
 25 visibility on what advice the government was receiving,

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1 across the course of the pandemic outside SAGE.  
 2 **Q.** You say, "I tried not to do it very much". Is that  
 3 an expression of -- well, perhaps of hope rather than  
 4 expectation? You did send quite a lot of emails,  
 5 Professor, did you not?  
 6 **A.** Yes, I did. I mean, a lot of them were about  
 7 the science itself, about the changing, you know,  
 8 situation, our understanding of Alpha, Delta, of  
 9 the infection fatality ratio, they were pure science.  
 10 There was a much smaller number which related to policy.  
 11 **Q.** There was still a considerable number relating to  
 12 the government's position, the policy, the strategy that  
 13 was being applied, and your own views on all of that?  
 14 **A.** There were a number, yeah.  
 15 **Q.** Coming to modelling, could you, in one sentence -- I say  
 16 this more in hope than anticipation or expectation,  
 17 Professor -- summarise the aim of epidemiological  
 18 analysis and modelling? What is its purpose? What does  
 19 it seek to achieve?  
 20 **A.** It aims to quantitatively understand patterns of  
 21 transmission of an infectious disease in the population,  
 22 the heterogeneities, the variability in that, and use  
 23 that insight to inform control policy planning and  
 24 understanding of epidemic trajectories.  
 25 **Q.** Yes. Professor, is the primary aim of modelling to

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1 understand, in the most basic lay terms, the spread of  
 2 the disease, of the pathogen?  
 3 **A.** It's to understand the patterns of spread but also to  
 4 estimate certain key quantities which relate to that,  
 5 such as the incubation period of transmissibility and  
 6 things.  
 7 **Q.** Those are all facets, are they not, of the disease?  
 8 **A.** Yes.  
 9 **Q.** A second aim of epidemiological analysis and modelling  
 10 is to work out prospectively, in the future, what might  
 11 be the impact of measures taken by the government. So  
 12 it's not an analysis so much as the painting of  
 13 a scenario: what might happen if this is done or this is  
 14 not done. Is that a fair summary?  
 15 **A.** Yes, the examination of a range of what are technically  
 16 called kind of counterfactual scenarios about  
 17 the potential impact of different policy options or  
 18 other interventions like vaccines and treatment on -- on  
 19 a disease.  
 20 **Q.** Could you give, please, the Inquiry a feel for how --  
 21 and as you answer, could you please try to keep your  
 22 voice up, it's been a bit hard to hear you.  
 23 **A.** Yeah.  
 24 **Q.** Could you give the Inquiry a feel for how great, wide  
 25 a field this field, this science of modelling is?

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1 Organisation, a meeting across multiple countries  
 2 earlier this year, including low-income countries, Kenya  
 3 for instance, and every country represented had some  
 4 degree of modelling applied to inform its pandemic  
 5 response.  
 6 **Q.** The role of modelling in the United Kingdom was plainly  
 7 a vital one. It's obvious from Professor Riley's  
 8 reports of early March, your own and the ICL report,  
 9 Report 9 of the middle of March, that the mathematical  
 10 modelling work product played a vital role.  
 11 What about Far East and Asian countries? So it's  
 12 well known and common ground, if you like, that  
 13 South Korea developed a diagnostic test around about  
 14 the same time as the United Kingdom. They of course  
 15 were aware of the incipient outbreak, as we were, and  
 16 they -- the evidence shows -- put into place rapidly  
 17 a very sophisticated test, trace, contact, isolate,  
 18 support system to keep control of the virus.  
 19 Do you know to what extent those governmental  
 20 choices made in South Korea were determined by  
 21 mathematical modelling?  
 22 **A.** I think mathematical modelling was one input into it.  
 23 I think a larger input was their experience of the MERS  
 24 coronavirus outbreak in -- which was very disruptive,  
 25 a few years before the pandemic. And that led them to

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1 The Inquiry has seen a great deal many reports and  
 2 papers prepared by yourself and your colleagues. Is  
 3 modelling or has modelling been driven by the well known  
 4 rapid expansion in computer science, for example, which  
 5 has enabled you to produce much more complicated and  
 6 complex work than hitherto?  
 7 **A.** So I prefer kind of lumping analysis and modelling  
 8 together, because most of what we did in the pandemic,  
 9 frankly, was epidemiological analysis rather than  
 10 modelling interventions.  
 11 You're completely right, the field has grown  
 12 dramatically in the last 20 years. It's less about  
 13 being able to use more complex models, more about  
 14 a revolution in what's called Bayesian inference, the  
 15 ability to calibrate models against epidemiological data  
 16 in a way which allows them to be used in a more  
 17 predictive sense -- and I use "predictive" in a --  
 18 I don't mean literal predictions in that sort of  
 19 scenario analysis sense -- than was possible in the  
 20 past.  
 21 **Q.** By and large, do all governments in the face of  
 22 an epidemic rely upon modelling scenarios? How  
 23 widespread is its utility and use?  
 24 **A.** So the UK has been in the lead in its use, throughout my  
 25 career, but I co-hosted, with the World Health

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1 implement legal measures to allow a sort of contact  
 2 tracing which we never got close to being able to  
 3 employ. I mean, using -- tracking individuals' mobile  
 4 phones, government having real-time access to all  
 5 banking transactions.  
 6 So I would -- I'm happy to talk about how Korea  
 7 achieved what they did, but it's not just as -- I mean,  
 8 it wasn't simple kind of boots on the ground contact  
 9 tracing.  
 10 **Q.** But to what extent, and you may only be able to answer  
 11 quite generally, to what extent were those practical  
 12 steps taken by government? And they were practical  
 13 steps, they were non-pharmaceutical measures.  
 14 **A.** Yeah.  
 15 **Q.** Non-pharmaceutical interventional measures.  
 16 To what extent was the decision to take those steps,  
 17 to put those measures into place, being driven by  
 18 the conclusions, the demands of epidemiological  
 19 mathematical modelling?  
 20 **A.** I mean, I can't answer specifically for South Korea, but  
 21 in many places, Hong Kong might be another example,  
 22 Singapore, where I know more about it, mathematical  
 23 modelling was certainly an input in terms of projecting  
 24 likely trajectory of the epidemic and hospital demand.  
 25 **Q.** Putting it perhaps unfairly and a little bluntly,

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1 Professor, you don't need mathematical modelling if  
 2 you're a government to know that if the virus spreads to  
 3 your land and is out of control and cannot be contained,  
 4 you're going to have a very serious problem indeed?  
 5 **A.** I mean, once you know what the infection fatality ratio  
 6 and the reproduction number of the virus is, you can get  
 7 away with, I would say, very simple models, and as you  
 8 say, maybe for -- you know, intuition to some degree  
 9 about what the consequences would be. You still need  
 10 that epidemiological analysis, though.  
 11 **Q.** You mentioned there the need to know the infection  
 12 fatality ratio. We'll come back to that in a little  
 13 detail later. But that infection fatality rate, that is  
 14 to say the knowledge of the number of people -- the  
 15 ratio of the number of people in the population who will  
 16 die amongst those who have become infected, was an issue  
 17 which you, particularly with ICL, were looking at  
 18 alongside the infection hospitalisation rate throughout  
 19 the second half of February and the early part of March?  
 20 **A.** Yes.  
 21 **Q.** That was a separate workstream, if you like, from  
 22 the pure epidemiological mathematical modelling?  
 23 **A.** Yes. The two are very -- obviously very tightly linked.  
 24 **Q.** In general terms again, we'll come back to the detail  
 25 later, you became aware by mid-February, 10 February in  
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1 certain key quantities are particularly important. So,  
 2 basic quantities are things like the reproduction number  
 3 and the infection fatality ratio, but also understanding  
 4 which subgroups in the population are most at risk of  
 5 either infection or severe consequences.  
 6 **Q.** By contrast to working out more bluntly and more broadly  
 7 the number of people who are likely to die amongst  
 8 an infected population, modelling of how a virus  
 9 transmits through that population requires information  
 10 to be understood on how that infection works, so how  
 11 an infection progresses in a person and how variable it  
 12 might be; correct?  
 13 **A.** Yes.  
 14 **Q.** So that would require you to know something about  
 15 the latent period, the infection period, the incubation  
 16 period, symptoms and the like.  
 17 You also need to know quite a lot, don't you, about  
 18 the consequences of infection, so clinical severity, how  
 19 many people are going to require hospitalisation or  
 20 an intensive care unit bed?  
 21 **A.** Yes, and we worked on all of those things you've just  
 22 listed.  
 23 **Q.** You need to know the reproduction rate, how rapidly  
 24 the virus spreads, you need to know about viral loads,  
 25 how easy transmission is, whether there are people who  
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1 fact, which is when you produced or Imperial College  
 2 London produced its first report on the infection  
 3 fatality rate, you became aware of a broad understanding  
 4 of what the number of deaths amongst those infected  
 5 could be, even though you were unable for many weeks  
 6 later to bottom out exactly what it would be?  
 7 **A.** Yes. We had our first estimates at around that time.  
 8 Indeed, I gave a Today programme interview where  
 9 I explained the consequences of that.  
 10 **Q.** Indeed.  
 11 So you didn't need epidemiological mathematical  
 12 modelling in mid-February to know that the number of  
 13 deaths amongst an infected population was potentially  
 14 very high indeed?  
 15 **A.** No.  
 16 **Q.** No.  
 17 Modelling, epidemiological modelling, is of course  
 18 complex. Does it depend upon a number of different  
 19 pieces of information or variables in order to enable  
 20 the system to produce a sensible and workable product at  
 21 the end of it?  
 22 **A.** Yes. I mean, mathematical models, even the most  
 23 sophisticated models of epidemics, are highly simplified  
 24 representation option of much more complex phenomena,  
 25 of course, but over many years we've learned that  
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1 superspread; you need to know about the demography, age  
 2 distribution, health, how it all impacts upon  
 3 a population; and you need to know something about  
 4 likely population behaviour, how will people respond to  
 5 being infected, and living in a country that is --  
 6 **A.** Yes, the latter we know very little about in any sort of  
 7 predictive sense, and I should say, whilst everything  
 8 you list there is correct, in reality if you're doing  
 9 this in real time, that information builds up slowly.  
 10 So one tends to take data from related diseases --  
 11 and here we used a mixture of SARS, MERS and influenza  
 12 data -- before -- you know, parameter estimates, and  
 13 applied them to Covid, before having all of those  
 14 available estimates, otherwise it would be the end of  
 15 the epidemic by the time you knew everything.  
 16 **Q.** You also need to know about what the effectiveness is  
 17 likely to be of intervention, so you need to work out  
 18 what the impact will be of antiviral treatment,  
 19 for example, I don't know, dexamethasone, which was  
 20 a UK-invented brilliant treatment. You need to know  
 21 about the impact of vaccines. You need to know the  
 22 impact of non-pharmaceutical interventions. You need to  
 23 know the impact of immunological aspects; you know, once  
 24 you get infected might you be reinfected? And you need  
 25 to know about viral genetics: will the virus change?  
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1 So putting all that together, a system of government  
2 response that rests upon and waits for answers to be  
3 given by mathematical modelling is likely to be a fairly  
4 drawn-out and, you used the word yourself, slow process?

5 **A.** Well, I don't think that's necessarily the case.  
6 You ... everything you list is important, but not all  
7 equally important and not equally important at the same  
8 time for decision-making. I mean, I see modelling more  
9 as a tool for synthesising different sorts of  
10 information together, to draw conclusions. And, yes,  
11 initially you're doing that on the basis of very little  
12 data. If you're referring to: do we need to have  
13 a playbook before we have very much information,  
14 a policy playbook which is automatically enacted?  
15 I wouldn't disagree with that, and clearly in that  
16 respect Korea and the UK differed markedly in what their  
17 policy playbook was.

18 **Q.** The issue of whether the government had a playbook, so  
19 a list of strategies or policies that would be  
20 automatically introduced if a red line was crossed or if  
21 certain trigger events happened, is another debate.

22 I want you, please, to focus on what you believe was  
23 the impact in terms of the government's overall response  
24 of waiting for the outcome of such modelling.

25 You are aware that on 28 January at SAGE SPI-M was  
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1 **A.** Not entirely. I mean, I think the more general question  
2 was around how long you wait to clarify, have  
3 uncertainties around the new threat reduce before making  
4 a decision. So it was a broader issue about  
5 the certainty with which we could characterise this new  
6 threat which I think played a bigger role.

7 Now, modelling clearly played a part of that, but  
8 I don't believe it was the most significant issue.

9 **Q.** But it's clear, isn't it, that the modelling process had  
10 to await a great deal more information, which was  
11 information that became gradually apparent through  
12 the beginning of February, the rest of February and  
13 the beginning of March, to be able to produce the  
14 worked-up scenarios, the thinking about what the impact  
15 would be of the various options the government might  
16 have had at its disposal, for example?

17 **A.** Yes, there was kind of certainly lots of iteration of  
18 those scenarios, I would agree.

19 **Q.** You are aware that a number of other scientists have  
20 questioned the reliance upon modelling as part of  
21 the government's response?

22 **A.** I am.

23 **Q.** What do you say to what Professor Woolhouse has said,  
24 for example, by way of the over-reliance upon modelling  
25 and the fact that you don't need modelling or  
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1 directed to provide assistance and advice as to how, in  
2 general terms, the government could respond to  
3 the virus, whether it could control it, what it would  
4 do.

5 The point I want to make to you is: by directing  
6 quite a relatively large or quite a relatively important  
7 part of its response upon the outcome of the modelling,  
8 we built into this response system a delay, because you  
9 didn't have the information, you didn't know enough  
10 about the virus, you didn't know enough about NPIs,  
11 the genetics, the behavioural aspects, to be able to  
12 produce work product for a while?

13 **A.** Yes, 28 January, but I would also comment that  
14 28 January we didn't have an estimate of the infection  
15 fatality ratio either.

16 **Q.** No, indeed not. You didn't start to investigate that or  
17 be able to understand the likely parameters of  
18 the infection fatality ratio until 10 --

19 **A.** Well, that's when we -- we were working on it throughout  
20 January, but ...

21 **Q.** We'll come to that a little later.

22 Do you agree, though, with the proposition that by  
23 waiting for the product of mathematical modelling there  
24 was then baked into, built into the response system  
25 a delay?  
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1 epidemiological modelling, certainly not mathematical  
2 modelling, to be able to understand that you have to try  
3 to control a virus and put practical measures in place  
4 to stop it?

5 **A.** I mean, I would agree with that last quote, certainly.  
6 I think modelling gives some benefits in terms of  
7 understanding the likely absolute magnitude of  
8 the impact of different interventions, which in its  
9 absence you are rather guessing at.

10 **Q.** Can we just now debate the scope of the modelling.  
11 You've referred to the fact that the mathematical  
12 modelling produced answers in relation to what  
13 the impact might be of non-pharmaceutical interventions.  
14 To what degree of detail or specificity could those  
15 models go or did they go? For example, a number of  
16 the core participants ask in their Rule 10 questions  
17 about the degree to which models focused on the impact  
18 of shielding methods, on the impact of  
19 non-pharmaceutical interventions on ethnic minorities,  
20 and on the elderly. Was it a necessary part of  
21 the modelling that all these sectors of the population  
22 were considered and the impact upon them understood?

23 **A.** So, to explain, rarely do you actually include in  
24 a model the operational details of how a policy is  
25 implemented. So, typically, if we were modelling, for  
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1 instance, shielding, then it is modelled as a reduction  
2 in contact rates in a certain subsection of the  
3 population, for instance the elderly, by a certain  
4 amount, and you might look at how much that varies. How  
5 you translate that operationally into policy is really  
6 for public health specialists.

7 So we certainly looked at age and shielding.  
8 I don't think any of the models, up until quite late in  
9 the pandemic, stratified by any other, you know,  
10 sociodemographic, you know, category, other than age,  
11 and we can get into why that was, but there were  
12 a number of reasons, mostly around data and  
13 computational feasibility.

14 But just to put -- it's -- they're not in some sense  
15 Sim City simulations of people walking around, I mean,  
16 they're much, much higher level than that.

17 **Q.** So the answer is there was a general understanding  
18 of course of the likely impact of whatever intervention  
19 you were modelling upon such sectors, but there were no  
20 models specifically designed to look at in detail what  
21 the impact would be?

22 **A.** I mean, looking -- none of the models looked at the --  
23 let's say, the indirect consequences of interventions,  
24 they were all focused on the impacts, potential impacts  
25 on virus transmission and health consequences.

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1 behavioural change were the imposition and relaxation of  
2 government-imposed restrictions. What he states is that  
3 the modelling presumed that the only way in which future  
4 behaviour of the population would alter would be as  
5 a direct result of the government-imposed restrictions  
6 themselves, as opposed to being spontaneous. So,  
7 for example, the population changing its behaviour in  
8 advance of a lockdown because it can see the lie of the  
9 land.

10 Is there any basis for the belief that your models  
11 did not pay appropriate attention to spontaneous  
12 behavioural changes and relied exclusively instead upon  
13 behavioural change brought about by government  
14 restrictions themselves?

15 **A.** So, I mean, models don't distinguish between whether  
16 there is messaging to encourage the population to change  
17 behaviour and mandate to force them to do so.

18 Models model changes in contact rates in  
19 the population which suppress transmission, so there's  
20 no prior assumption made about whether something is  
21 an advisory measure or a mandatory measure.

22 With respect to spontaneous behaviour change, and  
23 which is a slightly different thing, there you're  
24 saying --

25 **Q.** Professor, I'm sorry to interrupt. Could you please try

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1 **Q.** That's because the primary aim, to come back to your  
2 earlier evidence, of modelling is to work out the spread  
3 of a virus, its transmission, how it works, how it  
4 operates, and the likely impact of whatever measures are  
5 taken in a broad sense to combat it, and that primarily  
6 concerns clinical aspects, or how many deaths, how many  
7 people are hospitalised?

8 **A.** Yes.

9 **Q.** Is that a fair summary?

10 **A.** Yes.

11 **MR KEITH:** Good.

12 My Lady, is that a convenient moment?

13 **LADY HALLETT:** Certainly. I'm sorry we have to break, but  
14 I think you were warned you would have to be here some  
15 time, Professor, so if you will forgive us, we will now  
16 break for lunch and I shall return at 1.55.

17 **(12.57 pm)**

**(The short adjournment)**

19 **(1.55 pm)**

20 **LADY HALLETT:** Mr Keith.

21 **MR KEITH:** Professor Ferguson, just a few more questions on  
22 modelling.

23 A further point or issue raised by  
24 Professor Woolhouse is his belief that there was  
25 a default assumption that the only drivers of

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1 to go a little slower. You're speeding up. It's my  
2 fault, but I must try to restrain you.

3 **A.** With respect to spontaneous behaviour change, that's  
4 a much more -- so how do populations respond to risk,  
5 a perceived risk in the population. There are no --  
6 well, there is lots of speculative modelling of how that  
7 might happen, but no validated models or no validated  
8 models, frankly, of that type of behaviour. I mean,  
9 this is something I highlighted all the way back in 2006  
10 in an essay in the Nature journal, but -- there is  
11 research under way but it's still in its infancy and  
12 it's actually a very difficult thing to predict.

13 So, no, the models didn't try to anticipate how  
14 populations would completely spontaneously respond.

15 **Q.** The modelling is designed to ascertain what might  
16 happen, and behavioural changes are a significant driver  
17 of what might happen. Does it therefore matter in  
18 modelling terms whether the behavioural change is  
19 spontaneous or mandated?

20 **A.** Not in terms of its effect on contact rates, no. But  
21 of course it's hard -- may be harder to predict what  
22 voluntary change will do in terms of the magnitude of  
23 change of those contact rates compared with mandatory  
24 changes.

25 **Q.** But whether a population spontaneously changes its

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1 behaviour is hugely relevant, isn't it, to the policy  
2 debate about whether a lockdown is therefore necessary?  
3 **A.** It is certainly very relevant to the debate around  
4 the extent to which mandatory versus voluntary measures  
5 are required, yes.

6 **Q.** I'm going to call it a lockdown. You call it mandatory,  
7 Professor, but we all know we're talking about  
8 a lockdown.

9 Now, just finally on the question of modelling,  
10 there are important passages in your witness statement  
11 in which you speak of the care that must be taken in  
12 assessing the consequences of or the value of scenario  
13 modelling.

14 Scenario modelling, what might happen if we do this,  
15 is not a direct or an accurate guide as to what will  
16 happen, because the outcome is entirely dependent on  
17 what steps you take to meet the eventuality.

18 **A.** Agreed. And beyond that, throughout the pandemic we  
19 never had a sufficiently precise understanding of  
20 the exact impact of any one intervention to be able to  
21 make firm predictions.

22 **Q.** In truth, Professor, it is a very complex but broad  
23 science.

24 **A.** Yes.

25 **Q.** It must be put into its proper place as a tool for

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1 typically a rather smaller number. Typically ourselves,  
2 the London School of Hygiene and Tropical Medicine, and  
3 Warwick University later in the pandemic.

4 **Q.** Is it therefore the position that there was never  
5 a single Imperial College model, there were a multitude  
6 of different types of models on different issues,  
7 addressing different eventualities produced by Imperial,  
8 and there were models, similar models, produced by  
9 a number of other bodies as well?

10 **A.** Indeed.

11 **Q.** I raise that, Professor, because of course the press and  
12 the public attention which has been focused upon  
13 the role of Imperial.

14 Now I'd like to ask you some questions, please,  
15 about the strategy or the approach to the pandemic for  
16 which you advocated in the early part of February.

17 The Inquiry has heard evidence that the government  
18 strategy had, prior to the pandemic, been based on  
19 a pandemic influenza strategy, in particular a document  
20 from 2011. On account of the focus on influenza  
21 pandemics, on the advent of the pandemic, had there been  
22 any modelling of long-term, large-scale  
23 non-pharmaceutical interventions such as stay at home  
24 orders, closure of workplace across the country,  
25 quarantining and the like? Or was the modelling in

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1 guiding governments to respond; would you agree with  
2 that proposition?

3 **A.** I would agree with it, yes.

4 **Q.** The way in which SPI-M-O looked at models and the way in  
5 which the government responded to models was dependent,  
6 wasn't it, upon a process of taking a number of models  
7 together? So if, for example, the government wanted  
8 a medium-term projection of what the outcome might be,  
9 the impact might be of, say, closing schools, did it  
10 seek a specific model from a particular research  
11 institute such as Imperial College London or did it rely  
12 upon an ensemble, an amalgamation of reports, models  
13 from the various institutes who provided them?

14 **A.** So just to clarify there, I mean, you're talking about  
15 two different things. The medium-term projections were  
16 things updated every week and they were as close as we  
17 got to forecasts. They weren't true forecasts, because  
18 we assumed things stayed the same. And there, upwards  
19 of 10, 12 different models were combined in a formal,  
20 statistical sense. The second aspect is the use of  
21 modelling for, let's say, scenario modelling of  
22 intervention options, and typically what happened during  
23 the pandemic there is that the question was posed to  
24 SAGE, to SPI-M, a request came in, and modelling groups  
25 which were capable of answering the request did. So

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1 existence relatively limited?

2 **A.** So there had been modelling of -- of the use of layered,  
3 as they were called, non-pharmaceutical interventions in  
4 relation to an influenza pandemic, which included  
5 things, for instance, like home working, but none of  
6 the modelling considered scenarios where those  
7 interventions would be used for the duration that they  
8 were used during the Covid pandemic.

9 **Q.** So may it be said that the strategic reliance upon a flu  
10 pandemic approach had an impact upon the availability of  
11 learning about the possible measures that might be  
12 deployed to meet a coronavirus?

13 **A.** I think one can exaggerate too much the idea that we  
14 were following a pandemic flu playbook, certainly on  
15 the scientific front. I worked on both SARS and MERS  
16 coronavirus extensively, we were quite aware of  
17 the biological and potentially epidemiological  
18 differences. But I would argue the single most  
19 important difference between Covid-19 and something like  
20 SARS-1 was that a high proportion of those infected have  
21 relatively mild symptoms, some no symptoms at all, which  
22 talks to the relative effectiveness of different types  
23 of control measures at controlling the community spread  
24 of the virus.

25 **Q.** I've not suggested to you that there was a flu playbook

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1 followed scientifically or by Imperial College London,  
 2 but the point is that, on account of the attention paid  
 3 to that Tier 1 risk of a pandemic influenza, very little  
 4 thought had been given, had it not, to how a policy of  
 5 containment, for example, that is to say shutting down  
 6 the arrival of the virus and the spread of the virus,  
 7 might work in theory or in practice?  
 8 **A.** I would agree with that.  
 9 **Q.** So in the beginning of February, would you say that  
 10 there was a general doubt expressed by you and others as  
 11 to whether or not containment would ever work to deal  
 12 with a coronavirus, the coronavirus that we faced,  
 13 because there was very little by way of learning or  
 14 structure to be able to contain the virus when it became  
 15 apparent that it was spreading?  
 16 **A.** I think it's more nuanced than that. I mean, so first  
 17 of all, obviously globally containment did not work.  
 18 The -- I ... I was more sceptical than some that  
 19 the measures adopted in China would be as successful as  
 20 they turned out to be. I was -- changed my view. That  
 21 scepticism was altered by the data on the ground  
 22 from ... the -- you would have to be more -- in terms of  
 23 the long-term suppression of the virus, I think you're  
 24 right in the fact that it hadn't been well studied, but  
 25 I don't think that necessarily affected our evaluation

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1 limited contact tracing capacity.  
 2 **Q.** Because there was no complete closure of the border,  
 3 because there was, in the early days, merely symptom  
 4 screening, and then restrictions imposed by reference to  
 5 the destination or, rather, the overseas country from  
 6 which the traveller was coming, and because there was no  
 7 scaled up or significant testing process, you're saying  
 8 containment, that is to say stopping the virus from  
 9 spreading round the United Kingdom, just didn't work?  
 10 **A.** Not using the measures which were adopted at the time,  
 11 no.  
 12 **Q.** When did it become apparent to you that containment was,  
 13 to use your words, never going to have a significant  
 14 chance of preventing infection entering the country or  
 15 significantly slowing its establishment?  
 16 **A.** I mean, almost as soon as I heard that measures were --  
 17 what the measures were and what was being done.  
 18 **Q.** Late January?  
 19 **A.** Yes.  
 20 **Q.** Why then did you -- or perhaps that's unfair. What did  
 21 you make, then, of the government's published strategy  
 22 a month and a bit later, on 3 March, to have a contain  
 23 and delay strategy?  
 24 **A.** I was always unsure quite what contain -- as described  
 25 in that strategy, what contain was intended to actually

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1 of necessarily feasibility. It did affect the extent to  
 2 which, for instance, Public Health England was equipped  
 3 to be able to implement containment measures.

4 **Q.** I ask because in your statement you say:  
 5 "I felt the Contain phase [and that's a reference,  
 6 is it not, to the government's Coronavirus action plan,  
 7 mandated contain, delay strategy] never had any  
 8 significant chance of preventing the infection entering  
 9 the country or even significantly slowing its  
 10 establishment here."

11 Then you go on to say it was further impaired by the  
 12 lack of testing capacity, which I'll come back to.

13 That would seem to suggest that, at a broad  
 14 strategic level, the efficacy or the success of  
 15 a containment policy was always in doubt in your mind?

16 **A.** I would distinguish there between the measures the UK  
 17 adopted and labelled as the contain policy, and what  
 18 other countries adopted, which was much more successful.  
 19 I mean, I'm happy to elaborate on the UK situation.

20 **Q.** Yes.

21 **A.** We implemented, which was limited by testing, very  
 22 limited border controls, and you may come along to that  
 23 evidence shortly, which were only ever going to prevent  
 24 a small fraction of, you know, infected people coming  
 25 into the country, had low sensitivity and then had very

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1 do.

2 I mean, that's why I felt we needed to accelerate  
 3 planning for other non-pharmaceutical interventions.  
 4 I would say just in retrospect as well, I mean, there  
 5 have been a number of studies of this, that community  
 6 transmission of this virus -- I mean Covid in the UK  
 7 probably started in late January, and that's been  
 8 estimated using quite comprehensive genetic analysis.  
 9 So, put in context, the effectiveness of the strategy.

10 **Q.** There was a SAGE meeting that you attended, it's the  
 11 second SAGE, on 28 January, where there is a reference  
 12 in the consensus document to control measures, ideally  
 13 infection control in healthcare settings and rapid  
 14 detection of cases.

15 Why did you not say "I doubt whether any form of  
 16 containment strategy will work, given the porous nature  
 17 of the border and the lack of any significant testing  
 18 capacity"?

19 **A.** Well, actually the example you gave of infection control  
 20 in hospitals and testing was something I did advocate  
 21 for. I strongly felt we needed to set up sentinel  
 22 surveillance for the virus within the country. I mean,  
 23 there was a period in February, January and February,  
 24 where it was always being reported publicly that,  
 25 you know, the UK has 20 cases, for instance, all of whom

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1 were travellers. Well, that was axiomatically true,  
 2 because we were testing nobody but travellers, but --  
 3 and I didn't feel it was informative of what the true  
 4 situation was.

5 **Q.** If containment outside the healthcare setting was never  
 6 likely to work, then why was the government producing  
 7 a strategy based on containment five weeks later?

8 **A.** You know, to be honest, I mean, I did not have prior  
 9 sight of that document and SAGE was not consulted about  
 10 it.

11 **Q.** Did you express views around that time, that's to say  
 12 the end of January, as to the degree or the likelihood  
 13 of control measures working or what sort of control  
 14 measures should be considered?

15 **A.** I might have to be more specific, but yes, I expressed  
 16 my view of the likely effectiveness of a variety of  
 17 border measures, and what proportion of cases coming  
 18 into the country might be detected, and there were  
 19 initial fairly general discussions about what types of  
 20 measures might slow spread within the UK.

21 **Q.** Could we have INQ000148974, please.  
 22 This is an email string, Professor, between yourself  
 23 and Professor Sir Chris Whitty, copied in to  
 24 Professor Sir Patrick Vallance and  
 25 Professor Sir Jonathan Van-Tam, who was then the Deputy  
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1 **A.** I mean, because the focus of Chris's email there was on  
 2 things we could do to delay the peak, and so the  
 3 evidence -- so there's, as you'll be aware, almost  
 4 certainly know, the formal evidence base around  
 5 different non-pharmaceutical interventions, because  
 6 they're rarely used, is quite limited. The one  
 7 intervention which has been used quite frequently for  
 8 respiratory virus outbreaks has been school closure.

9 **Q.** Where is the debate in this email, though, about: well,  
 10 this is not a flu pandemic, different measures may have  
 11 to be considered, depending on the spread of the virus  
 12 more drastic, stringent, whole-society interventions may  
 13 have to be considered, and might it be too late anyway  
 14 to stop the influx of the virus because of the  
 15 containment debate that you've already referred to?

16 **A.** So a couple of paragraphs down you'll see I discuss,  
 17 you know, how the different epidemiological  
 18 characteristics of the virus, whether it's SARS-like,  
 19 which we didn't know at the time, versus more flu-like,  
 20 ie much more mild disease, would influence the  
 21 effectiveness of the interventions.  
 22 I mean, I was addressing Chris Whitty's, who is  
 23 the Chief Medical Officer, direct question rather than  
 24 saying -- giving my view on potential strategy, I would  
 25 say.

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1 Chief Medical Officer.  
 2 You can see that the top of the page is a forwarding  
 3 of a lower email and more substantive debate to  
 4 the persons I've mentioned, and also Professor Edmunds.  
 5 In the middle of the page, you can see an email from  
 6 John Edmunds.  
 7 Over the page, on page 2, there is an email from you  
 8 dated 29 January, 11.12:  
 9 "... delaying arrival requires either stopping  
 10 travel from China or very intensive screening and  
 11 follow-up of travellers. We can provide some crude  
 12 estimates ...  
 13 "If you are more referring to delaying the peak of  
 14 the epidemic via public health interventions, it is  
 15 harder to produce predictions. There are two broad  
 16 classes of such interventions ... case based such as  
 17 isolation of cases and contact tracing; and ...  
 18 community level interventions -- principally school  
 19 closure."  
 20 Professor, in principle, there were, of course,  
 21 other measures which can be put into place to deal with  
 22 a spread of a disease with an outbreak of pandemic, not  
 23 just principally school closure.  
 24 Why did you not mention the possibility of other  
 25 perhaps more stringent whole society interventions?  
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1 **Q.** If we could have INQ000047654, this is an email three  
 2 days later. And if we could have page 5.  
 3 It's between the same, broadly the same  
 4 participants.  
 5 If you would just go back, I'm sorry, one page. It  
 6 may be that that last part is from Professor Sir  
 7 Chris Whitty. Yes, it is.  
 8 This is the email from you, on page 4, dated  
 9 2 February.  
 10 "... it is quite likely (but not certain) that there  
 11 have been a number of undetected importations into the  
 12 UK ... Detection rates are not going to be anywhere near  
 13 100%. This doesn't mean we shouldn't take the  
 14 optimistic view that it is still worth trying to prevent  
 15 more importations, but it does change the assessment of  
 16 the likely impact of the new measures and therefore the  
 17 cost-benefit of those measures."  
 18 What was that reference to "cost-benefit balance"  
 19 a reference to? What did you have in mind when you  
 20 referred to that balance?

21 **A.** I mean, in terms of the proportion of our Public Health  
 22 England, resources which should be dedicated to, for  
 23 instance, targeting travellers versus targeting  
 24 community surveillance, for instance.

25 **Q.** So are you saying that if you apply some sort of border  
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1 restrictions, you've got to consider, as a government,  
2 how effective they are, how irritating they are, what  
3 they'll cost travellers and the public, against how  
4 effective they will be in stopping the influx of  
5 the virus?

6 **A.** Yes.

7 **Q.** It does appear, Professor, there that you are engaging  
8 directly in the policy debate as to the imposition of  
9 a measure and therefore straying beyond the mathematical  
10 modelling or the epidemiological modelling side of  
11 things.

12 **A.** I was pointing out that, you know, what turns out to be  
13 true, the effectiveness of measures would depend on  
14 the epidemiological situation. I wasn't, I don't think,  
15 there expressing any value judgement as to what measures  
16 should be adopted.

17 **Q.** At the time of these emails, at the beginning of  
18 February, was there a general acceptance, Professor,  
19 that the virus was unstoppable, that it would inevitably  
20 infect the United Kingdom, and that very little could be  
21 done to stop it washing through the population?

22 **A.** I mean, again you've combined, you know, multiple  
23 different concepts there. I think we felt it would be  
24 extremely difficult to prevent it entering the UK.

25 You'll find reference in later SAGE minutes to  
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1 the risk that the virus would enter the United Kingdom,  
2 that it would essentially get out of control, and steps  
3 would have to be taken to control it? Where is  
4 the general debate at this stage of what sort of control  
5 measures, NPIs, might have to be considered?

6 **A.** I mean, I think the debate -- well, if there was  
7 a debate, it was occurring within government. There  
8 wasn't a debate in terms of -- well, I mean, my  
9 perception is it wasn't the role of SAGE to, you know,  
10 determine strategy, so there wasn't that debate. You'll  
11 see in all of these instances, and you have many  
12 instances, I addressed the questions being asked.

13 **Q.** But these are private non-SAGE emails where you're not  
14 bound by the self-imposed constraints of SAGE, you are  
15 discussing control measures, you refer to schools, why  
16 wasn't that debate being held in this alternative forum  
17 of your communications with your colleagues?

18 **A.** Well, it's more than just a colleague, if it involves  
19 the Chief Medical Officer and both Deputy Chief Medical  
20 Officers, it's a communication between me as  
21 an independent scientist and government employees.

22 **Q.** Professor, were these SAGE-related communications or  
23 were they emails between you, Professor Ferguson, and  
24 the CMO, the DCMO, and Professor Edmunds, Jenny Harries?  
25 Who was I think, or became, another DCMO, but  
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1 the potential benefits of more draconian border  
2 restrictions in terms of the delay which might be  
3 attained. I think at that time we were saying  
4 relatively little about -- you know, certainly nothing  
5 specific about the feasibility of stopping spread within  
6 the United Kingdom.

7 **Q.** To what extent did you and your colleagues, in  
8 particular Chris Whitty, Patrick Vallance,  
9 Jonathan Van-Tam, Jenny Harries, believe that the virus,  
10 if it spread through the United Kingdom, would result in  
11 a wave, a wave of infections, and that it would be  
12 practically very difficult, if not impossible, to stop  
13 that wave proceeding through at least a significant part  
14 of the population?

15 **A.** So I think I'm on record, I think I gave an interview  
16 even in late January, or certainly early February,  
17 saying that I felt the world was at the beginning of  
18 a global pandemic. If the question is did I anticipate  
19 the use of intensive non-pharmaceutical interventions to  
20 suppress transmission at that point, no, I didn't. Did  
21 I know that they were in theory able to be used? Yes,  
22 I mean, I'd studied the use of such interventions both  
23 for SARS but, probably more relevantly, in the 1918 flu  
24 pandemic in the United States.

25 **Q.** But it was apparent, was it not, you were addressing  
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1 Professor Edmunds was not, of course.

2 **A.** I mean, I viewed them as an extension of discussions at  
3 SAGE.

4 **Q.** In your statement, you say that one of the problems that  
5 was encountered at this time by yourself and your  
6 colleagues was that there appeared to be no systematic  
7 consideration of the costs of control measures or NPIs  
8 against the benefits and what the cost might be of  
9 inaction, and you've referred, of course, there to  
10 cost-benefit.

11 Did anybody take any steps to say, in the context of  
12 SAGE or to the government by one of these emails, "We  
13 need to have a structure put in place for working out  
14 the cost-benefit of the various measures which might,  
15 God forbid, have to be considered"?

16 **A.** I don't believe -- I mean, I can't think of an instance  
17 of that happening. I mean, there was some discussion of  
18 cost-benefit, but certainly it was -- I think we did  
19 not -- none of us evaluated properly the cost of  
20 inaction, let's say.

21 I have to say we did not have the capability of  
22 doing so. I mean, within the Imperial College group,  
23 that -- to be able to do that thoroughly would require,  
24 you know, a dedicated group.

25 **Q.** But these emails show, Professor, don't they, that  
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1 you're not engaging in a dry epidemiological  
 2 mathematical modelling debate, you are discussing  
 3 matters of policy here and cost-benefit and  
 4 the feasibility of particular measures?

5 **A.** Yes, of course. Yes, I mean, there's some discussion of  
 6 feasibility.

7 **Q.** You referred to your views on whether or not  
 8 the lockdown intervention in Wuhan was likely to be  
 9 effective, and again you've said that in January 2020,  
 10 in late January 2020, your view was you had concerns or  
 11 doubts as to whether it would be effective.

12 Some of your colleagues were more confident that it  
 13 would be effective. What was it that caused you to  
 14 change your mind about the efficacy of the Wuhan  
 15 lockdown?

16 **A.** I mean, the trends in reported cases and deaths coming  
 17 out of Wuhan.

18 **Q.** Was that information that was available to those other  
 19 colleagues who took a more confident view of the likely  
 20 outcome?

21 **A.** I mean, we shared all information internally.

22 **Q.** Were some of your colleagues quite strongly of the view  
 23 that containment had been -- was being tried in Wuhan  
 24 and was at least likely to work to the extent that it  
 25 was worth trying or investigating further in the

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1 To what extent do you think that that debate about  
 2 a planning tool prevented a more significant substantial  
 3 debate about the reality of policy responses and what  
 4 should be done on the ground to stop the spread of  
 5 the virus?

6 **A.** I mean, potentially significantly. I was always  
 7 uncomfortable with labelling what I felt was our central  
 8 estimate as being the reasonable worst case. Because  
 9 calling it the reasonable worst case, even if in theory  
 10 policymakers are meant to be planning to it, makes it  
 11 sound like it's an unlikely eventuality, whilst in my  
 12 view it was the most likely eventuality if nothing more  
 13 was done.

14 **Q.** I now want to look at, please, this issue of  
 15 the infection hospitalisation rate and the infection  
 16 fatality rate.

17 In your statement, you tell the Inquiry that  
 18 the Covid response team of Imperial College London, or  
 19 maybe Imperial College London, I don't know whether  
 20 the response team was already in operation at this time,  
 21 but in any event ICL produced two reports. They were  
 22 put the MRC, the Medical Research Council, GIDA website,  
 23 your website, on 17 and 22 January.

24 Those reports made extremely important points, did  
 25 they not, about the under-ascertainment of likely cases

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1 United Kingdom?

2 **A.** Yes, a minority of my colleagues, yes.

3 Maybe I should put it into context. I mean, we  
 4 rarely had discussions internally of strategy, but  
 5 of course it did come up, and there were a diversity of  
 6 opinions expressed by different colleagues.

7 **Q.** Another area, again in this theme of the broad  
 8 conceptual issues, in January and February that was  
 9 the subject of debate, and you've referred to it in your  
 10 witness statement, was the way in which the government  
 11 attempted to ascertain what the reasonable worst-case  
 12 scenario might be.

13 Why did that matter?

14 **A.** I mean, because the reasonable worst-case scenario is  
 15 the scenario which the government should be planning to  
 16 cope with, in theory at least, in any civil contingency,  
 17 any crisis.

18 **Q.** Is the reasonable worst-case scenario a planning tool,  
 19 if you like?

20 **A.** Indeed.

21 **Q.** There was a considerable debate, was there not, on  
 22 the subject of what the reasonable worst-case scenario  
 23 should be interpreted to mean and whether or not it was  
 24 likely that we would find ourselves in a position in  
 25 which we were in the reasonable worst-case scenario?

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1 in Wuhan? And you concluded, didn't you, that the  
 2 number of real cases was likely to be a multiple of  
 3 those cases which the press and the government  
 4 announcements in China had indicated?

5 Why was it so important to get to the bottom of what  
 6 the reality was of the outbreak in Wuhan?

7 **A.** I mean, it was important for two reasons. First, to  
 8 understand what the -- what stage of an epidemic we  
 9 potentially were at, how large it had reached and  
 10 therefore it was the risk of external export of cases.  
 11 And secondly because, at the time, it wasn't certain at  
 12 all whether there was human-to-human transmission going  
 13 on.

14 The speculated cause of the outbreak was, you know,  
 15 exposure of people to a zoonotic source, to an animal  
 16 source of virus. Now, history tells us that's plausible  
 17 if you have a dozen, maybe two dozen cases, but if  
 18 you're estimating thousands of human cases, it becomes  
 19 very implausible, much less plausible, that those were  
 20 all infected by zoonotic exposure, much more likely that  
 21 we're seeing human-to-human transmission.  
 22 Self-sustaining human-to-human transmission.

23 **Q.** The press and government organs in China were reporting  
 24 on deaths and the numbers of people who were  
 25 hospitalised, but did that give you any idea of

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1 the number of people who might have had the virus in  
 2 a mild way and were not, therefore, being reported on,  
 3 or who were asymptomatic, that is to say showing no  
 4 symptoms at all?

5 **A.** So those first two reports, no, because the basic  
 6 approach they took was to look at cases being detected  
 7 in third countries outside China through border  
 8 screening, and that border screening was typically for  
 9 symptomatic cases. Some countries like Japan and  
 10 Thailand especially implemented that border screening  
 11 very early, but those cases were symptomatic cases, and  
 12 in several cases were actually hospitalised with quite  
 13 severe symptoms. So even those analyses, why they  
 14 produced estimates of thousands of cases, were not  
 15 characterising the full picture of the scale of  
 16 the epidemic.

17 **Q.** When were you able to ascertain, estimate that there  
 18 were very large numbers of infected persons who were  
 19 suffering from the virus, either in a mild way, not  
 20 requiring hospitalisation, and of course not dying, or  
 21 who were asymptomatic?

22 **A.** So with respect to Chinese -- China, that data came from  
 23 repatriation flights of non-Chinese citizens back to  
 24 their home countries, and for many of those flights  
 25 everybody on board was screened with a PCR test

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1 and to SAGE that if a large proportion, 35%, one-third  
 2 roughly, of infected persons were asymptomatic, that  
 3 there was a very great risk that the virus would spread,  
 4 because if people are asymptomatic you just can't tell  
 5 whether they've got it, in the absence of testing, and  
 6 there was no real testing, was there, either at the  
 7 border of the United Kingdom or in the community, as  
 8 you've described?

9 So why, at the beginning of February, was SAGE and  
 10 your own professional colleagues in Imperial College not  
 11 telling the world as clearly as could be done:  
 12 the nature of this virus and the nature of the disease  
 13 is it is almost certain to reach us and in very large  
 14 numbers?

15 **A.** I mean, I think I -- I mean, I've referred, I think my  
 16 12 February Today programme interview, where I said we  
 17 were in the early stages of a pandemic, that it was  
 18 going to be, you know, a global pandemic and that up to  
 19 80% of the -- if we did nothing, up to 80% of the UK  
 20 population would get infected in the following few  
 21 months, and that up to 1% of them might die. I mean,  
 22 I think that's quite a clear ...

23 **Q.** But where is that warning, Professor, in your own  
 24 private emails to your professional colleagues outwith  
 25 SAGE, and in the SAGE minutes and the SAGE consensus

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1 irrespective of whether they had symptoms or not. That  
 2 was a bit akin to the later ONS infection survey, it  
 3 gave us a measure of infection prevalence at one point  
 4 in time. And using that, making some assumptions, one  
 5 could calibrate the scale of the epidemic, the true  
 6 scale of the epidemic in Wuhan.

7 **Q.** As a result of this very clever analysis, and you relied  
 8 in part upon working out how many flights had left Wuhan  
 9 and how many people had spread and therefore how many  
 10 people were likely to be infected, did you and -- by you  
 11 I mean ICL -- did ICL and SAGE apply a working  
 12 presumption from the beginning of February that  
 13 one-third of infections could be asymptomatic and that  
 14 asymptomatic cases would be around one-third less  
 15 infectious than symptomatic cases?

16 **A.** Yes. The first was a reasonable assumption based on  
 17 data. The second, that there would be less -- I mean,  
 18 less infectious, was a working assumption, we had no  
 19 direct data for it, but it was consistent with patterns  
 20 in other respiratory viruses.

21 **Q.** And later research and data throughout the course of  
 22 2020 and in fact 2021 showed that your estimates were  
 23 actually pretty accurate?

24 **A.** Yes.

25 **Q.** So from early February it must have been apparent to you

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1 documents --

2 **A.** I mean, they're buried in the planning assumptions of  
 3 the SAGE documents, but those estimates were discussed  
 4 at length within SAGE meetings.

5 **Q.** In the context of planning debate, in the context of --

6 **A.** I mean, I would agree if -- if your implication is there  
 7 was perhaps too much focus on refining estimates and  
 8 reducing uncertainty, and not enough on, let's say,  
 9 operational planning -- which of course we did not have  
 10 visibility of in SAGE -- then that might be true.

11 **Q.** So you agree that there was too much focus on perhaps  
 12 the scientific or the data issues, rather than pointing  
 13 out what must have been apparent, which is a major  
 14 pandemic was inevitable?

15 **A.** I mean, I think that's maybe slightly unfair. I mean,  
 16 we had already a planning -- planning scenario which  
 17 NHS England, PHE, DHSC were meant to be producing,  
 18 you know, a policy response to, which was in my view  
 19 fairly catastrophic. I mean, the role of SAGE was to  
 20 provide scientific evidence into that process, not to  
 21 come up with policy.

22 **Q.** But you, Professor, were, as we've seen from these  
 23 emails, engaging in policy debate?

24 **A.** I was engaging in debate about the likely effectiveness  
 25 of different policy options.

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- 1 **Q.** Having understood that the virus had a very large  
2 percentage, 35%, that was asymptomatic, and that there  
3 were, in practice -- there was very little that could be  
4 done by way of containment or control, why was it  
5 important to then work out the percentage of people who  
6 might die or would die from the infection level? Why  
7 did that matter?
- 8 **A.** Because with a highly transmissible respiratory virus  
9 like Covid, and we were estimating an R number of  
10 between 2.5 and 3.5, then some basic epidemic theory  
11 would tell you that if that virus spread uncontrolled in  
12 a population, then over the first, you know, six months  
13 or so you would get a very high proportion of the  
14 population infected. Not everybody, but somewhere  
15 between 60% and 80%. And therefore knowing what  
16 proportion of that very large number of people were at  
17 risk of dying from the virus was critical to evaluating  
18 the public health impact, and also, by implication, what  
19 the level of proportionate response should be for the  
20 government.
- 21 **Q.** And presumably you would also say, under that heading of  
22 the public health impact, what the figures were for  
23 the number of persons who might be hospitalised?
- 24 **A.** Yes, I mean, that took somewhat longer to develop.
- 25 **Q.** When did ICL first estimate the likely infection

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- 1 would be likely to die. Probably matched by the IHR  
2 figure, working out how many people would require to be  
3 hospitalised.
- 4 Was there any basis for challenging Imperial College  
5 and its estimates on the basis of your professional  
6 provenance?
- 7 **A.** No, but there was challenge on the basis that we were  
8 basing it on very limited data from -- scraped from  
9 Chinese websites at the time, and a limited number of  
10 data points on what the infection prevalence was, and  
11 so -- I mean, SAGE grades, in some sense, evidence and  
12 estimates and it was, you know, viewed as being  
13 uncertain. I mean, I found that personally somewhat  
14 frustrating, but then, you know, I was partly  
15 responsible for generating the estimate, but if you look  
16 at the minute -- as you say, it took several weeks for  
17 SAGE and SPI-M to accept the estimate.
- 18 **Q.** You were personally frustrated?
- 19 **A.** Yes.
- 20 **Q.** You were frustrated because this was vital information  
21 which went directly to the government's ability to  
22 respond and to decide what that response might consist  
23 of?
- 24 **A.** Yes. And so I was pleased when it was finally accepted  
25 as a reasonable worst-case scenario. But, as you're

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- 1 fatality rate for this virus, an estimate that turned  
2 out to be, in fact, extremely accurate?
- 3 **A.** I mean, the first estimate which wasn't stratified by  
4 age, though we did know about the age distribution of  
5 deaths, was 12 February. That was highly uncertain, and  
6 then we had a much more refined estimate by, I would  
7 say, the first week in March.
- 8 **Q.** Why was it necessary, why did in fact, we can see from  
9 the dates, four to five weeks elapse before that vital  
10 figure, how many people would die, could be bottomed  
11 out, could be certified as being, "This is our final  
12 position and this is the figure we can rely upon"?
- 13 **A.** There was a hesitancy for -- by SAGE to rely on any  
14 single piece of evidence, and particularly coming from  
15 a single group, and therefore there was a desire to have  
16 it confirmed by other sources, which is what the London  
17 School of Hygiene and Tropical Medicine did to a degree  
18 in terms of the analysis of the Diamond Princess data.  
19 Then there was a desire to then translate that infection  
20 fatality ratio estimate into estimates of the impact on  
21 the health service.
- 22 If you're asking why did it take so long, I mean,  
23 I was somewhat frustrated as well.
- 24 **Q.** The figure, the IFR figure, was the single most  
25 important figure in terms of working out how many people

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- 1 aware, that took some weeks longer.
- 2 **Q.** It was only in fact at the beginning of March that your  
3 figures for infection fatality rate, a value of around  
4 about 1%, were accepted for use as an NHS planning  
5 assumption. I think it was formally accepted on  
6 26 February. But there then had to be a meeting, which  
7 there was on 1 March, to discuss the accuracy; yes?
- 8 **A.** Not quite. The meeting on 1 March was less about  
9 discussing the accuracy of the IFR figure, but involved  
10 clinical colleagues with expertise in respiratory  
11 viruses and with intensive care to translate that figure  
12 into estimates of healthcare demand. So the proportion  
13 of people being hospitalised, the proportion needing  
14 intensive care unit, the estimate of how many days they  
15 would be in each of those settings.
- 16 **Q.** And broadly speaking, who attended that 1 March meeting  
17 which debated the likely --
- 18 **A.** We hosted it in my office.
- 19 **Q.** Who attended it?
- 20 **A.** It was attended by Peter Horby, I think maybe remotely,  
21 John Edmunds, Stephen Powis I think dialled in to it,  
22 some NHS planners. I mean, I've provided the full list,  
23 I don't have it immediately to hand.
- 24 **Q.** Around about the same time, these figures for  
25 the infection fatality rate and the infection

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1 hospitalisation rate were put before SAGE, were they  
2 not?

3 **A.** Yes.

4 **Q.** So they were debated in fact in the SAGE meeting of  
5 27 February. SAGE was attended, of course, by not just  
6 the academic groups but by representatives of  
7 the government, of the NHS, Public Health England, and  
8 so on and so forth. It must have been apparent to  
9 everybody at that 1 March meeting, and at the SAGE  
10 meeting on 27 February, that given the fatality rate and  
11 given the hospitalisation rate and given the number of  
12 people in our population, the number of deaths and  
13 hospitalisations would be enormous?

14 **A.** Yes. And more than that, we generated, I mean, model  
15 output on that day, spreadsheets, which were provided to  
16 NHS England, of the expected trajectory of the epidemic.

17 I should say those estimates of hospital demand were  
18 refined considerably over the following two weeks,  
19 because the original estimates were basically based on  
20 best clinical judgement rather than data, and it was  
21 only -- it took -- they didn't change qualitatively but  
22 they did change quantitatively in that time.

23 **Q.** Some of the greatest brains in the land, Professor,  
24 the world experts on epidemiology, virology, pandemic  
25 response, were debating these figures. They weren't

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1 all previous planning around lethal pandemics.

2 **Q.** So, what, those deaths would take place,  
3 the hospitalisations would occur and the system would be  
4 overwhelmed?

5 **A.** The thing that meeting did not -- all that meeting  
6 considered what an unmitigated pandemic would look like.  
7 So if the government did absolutely nothing. I mean,  
8 that was the reasonable worst-case scenario. I think  
9 a lot of the work in the following week or two was  
10 around the extent to which that could be modified and  
11 how.

12 **Q.** These were self-evidently matters of life and death.  
13 The government did not start contemplating  
14 the possibility of the top control measure,  
15 the lockdown, mandatory NPIs, until around about  
16 the 13th, we'll put it in a broad way, the 13th to the  
17 16 March?

18 **A.** I wasn't actually aware of what the government was  
19 considering and wasn't considering at the time. I mean,  
20 in terms of what was going on within COBR, I had no  
21 visibility of COBR.

22 **Q.** But you had hitherto not been averse to emailing your  
23 thoughts on policy matters to the CMO, the GCSA,  
24 Professor Edmunds?

25 **A.** I mean, the CMO and GCSA, there was a complete Chinese

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1 going to go down by a multiple of 2 or 3, were they,  
2 thereafter? They weren't going to go down to 1%, or  
3 0.1%? You had correctly identified, broadly, the levels  
4 of death and hospitalisation --

5 **A.** Yes.

6 **Q.** -- that would inevitably ensue?

7 **A.** I mean, as I say, in a qualitative sense, I would agree.

8 I mean, they did adjust by about two-fold in terms of  
9 hospital demand, but that wasn't a qualitatively  
10 important amount.

11 **Q.** So as at the end of February, the beginning of March,  
12 why was no one at that meeting saying, or at SAGE,  
13 "Well, hold on, with these sorts of figures for deaths  
14 and hospitalisation, it is plain as a pikestaff our  
15 system is going to be rapidly overwhelmed"?

16 **A.** I mean, I would say two things there. First of all,  
17 before the pandemic, the UK basic pandemic plan for  
18 dealing with these particularly extreme events, lethal  
19 pandemics, allowed for the fact that health -- you know,  
20 healthcare demand would exceed the ability of the health  
21 system to cope, that emergency measures, surge measures  
22 and triage might need to be adopted. So there wasn't --  
23 you're right that I think everybody at that meeting  
24 recognised that the levels of demand were well in excess  
25 of standard capacity, but that wasn't out of line with

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1 wall between SAGE and COBR, so it was not as if SAGE  
2 meetings started with a readout from COBR about what  
3 the government were thinking and planning to do. We had  
4 almost no visibility of that. In terms of operational  
5 planning.

6 It wasn't clear, for instance, that exceeding  
7 healthcare demand, NHS capacity, was an absolute red  
8 line, really until, I would argue, 14 March. In terms  
9 of what we -- had been communicated to us as independent  
10 members of SAGE.

11 **Q.** But that elapse of time from the end of February to  
12 14 March is a passage of time which plainly can't be got  
13 back, but it was plainly not desirable, it was not  
14 inevitable -- you describe in your statement your regret  
15 at the fact that it took five weeks to get these figures  
16 bottomed out -- and then there is another two-week gap  
17 or delay before practical measures are started to be  
18 contemplated. How can that possibly have happened?

19 **A.** I mean, I think I may put it in my recommendations for  
20 learning lessons for the future. The artificial divide  
21 between scientific advice and then operational planning  
22 and response was a hindrance. We had very little  
23 visibility of what was going on in terms of preparedness  
24 within government. I would occasionally, at the,  
25 you know, margins of SAGE meetings, hear a little, but

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1 nothing definitive. I think even more so was the lack  
 2 of visibility of what government red lines were, what  
 3 were the absolute constraints that policies had to  
 4 adhere to, you know, never -- I mean, red lines is one  
 5 way of putting it. Objectives would have been nice as  
 6 well.

7 **Q.** Why, as an expert professor in mathematical modelling  
 8 and epidemiology, why -- if you'll allow me to say so --  
 9 as a plainly intelligent human being, why, as a human  
 10 being, do you need to wait for the government to tell  
 11 you what its red lines are before you raise the alarm in  
 12 the greatest way you possibly can?

13 **A.** It depends what -- I mean, what do you mean by raise  
 14 the -- I mean, I think I was clear in communicating  
 15 the magnitude of the threat, in public pronouncements  
 16 and private pronouncements. But it may be --

17 **Q.** Well --

18 **A.** You elaborate.

19 **Q.** At the 5 March meeting of SAGE, at which you were  
 20 a participant, there was a debate about whether there  
 21 were scientific grounds to move away from containment  
 22 efforts in the United Kingdom, there was a debate about  
 23 large gatherings. SAGE concluded there was no evidence  
 24 to suggest that banning large gatherings would reduce  
 25 transmission. There was a debate about what the figures

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1 **A.** Yes. So the issue is about what proportion of time --  
 2 maybe I'll start again. So mass gatherings I think  
 3 intuitively sound like risky things, because you might  
 4 have 10,000 people together, but for a virus which  
 5 transmits through close contact, in fact if you have  
 6 only one infected person they're no more likely to  
 7 generate large numbers of infections than they would be,  
 8 for instance -- in a pub, for instance, or a theatre.

9 **LADY HALLETT:** So they're going to infect the people around  
 10 them?

11 **A.** Around them.

12 So the question there is about proportionality.  
 13 There is a tendency to target football matches, for  
 14 instance, but in fact that's outside, generally, the  
 15 transmission risk is low.

16 If you look at an analysis of where people spend  
 17 their time, the venues where that sort of transmission  
 18 is much more likely to occur are hospitality venues, for  
 19 instance. I mean, this is a point I make, you have it  
 20 on record in an email exchange with Chris Whitty. So in  
 21 assessing the generic -- in some, sense a busy pub has  
 22 a hundred people in it, it is a mass gathering, indoor  
 23 mass gathering, people very close together for many  
 24 hours. It was my view that posed much more of a risk  
 25 than occasional outdoor sporting venues, because many

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1 were, the IFR, the IHR, the CFR, but there doesn't  
 2 appear to be the clearest of messages to the government  
 3 saying: our figures now show that the number of deaths  
 4 and hospitalisations are so massive that the NHS and the  
 5 healthcare system will be overrun.

6 **A.** I mean, that was about the same. It is not minuted,  
 7 you're completely right, but that was about the time  
 8 where both John Edmunds and myself got concerned about  
 9 the slight air of unreality of some of the discussions  
 10 and did start talking in the margins of -- to members --  
 11 well, let's say government attendees at SAGE, saying,  
 12 you know, "Do you know what this is going to be like?"  
 13 I mean ...

14 **Q.** So are you saying there was this debate but it wasn't  
 15 minuted? In which case, my next question will be --

16 **A.** There was a --

17 **Q.** -- how -- how -- Professor, could something of such  
 18 import not be minuted?

19 **A.** I mean, I am not the person to ask.

20 **LADY HALLETT:** Can I just ask, Mr Keith put to you that one  
 21 of the matters that was debated was whether banning mass  
 22 gatherings would reduce transmission. As a layperson,  
 23 it seems to be a rather simple question: if you stop  
 24 people getting together then they're not going to get  
 25 infected. Can you remember what the debate was?

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1 more people attend pubs than attend football matches.

2 **LADY HALLETT:** Thank you.

3 **MR KEITH:** I think, Professor, the government was much vexed  
 4 about the issue of mass gatherings and it repeatedly  
 5 asked SAGE for its commissioned advice, did it not?

6 **A.** Yes.

7 **Q.** So this issue was visited by, was discussed by SAGE  
 8 twice in late February and then again, as I've said, on  
 9 5 March. On 27 February you said this:

10 "I now believe it is more than 95% certain that  
 11 transmission is already established here, so from that  
 12 perspective holding the Six Nations matches will make no  
 13 difference."

14 Is that because --

15 **A.** So it's in the context that the major concern was around  
 16 people, you know, travelling between different  
 17 countries. And also, to put it into context,  
 18 250,000 people fly into the UK every day, so it is  
 19 a matter of degree rather than ... there are lots of  
 20 public health measures which will have a small impact,  
 21 and the tendency is to say, well, we should do  
 22 everything, but in reality you want to target the  
 23 measures which are going to be effective.

24 **Q.** It's like throwing, you would say, a lit match upon  
 25 a fire. If the virus is already established in

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1 the United Kingdom, it doesn't make any difference in  
2 general terms whether or not there is a single  
3 gathering?

4 **A.** Yes.

5 **Q.** But what about, and this is I think what lay behind,  
6 perhaps, if I might suggest, my Lady's question, what  
7 about the precautionary principle? You, around about  
8 that time, made the very valid point that, on  
9 a precautionary basis, closing schools would be  
10 justified, because even if you couldn't show a direct  
11 epidemiological link to a reduction in spread and  
12 a break in the chain of transmission, it looks good, it  
13 looks right, it shows you're serious about trying to  
14 stop the transmission. Wouldn't that approach apply  
15 equally to mass gatherings?

16 **A.** Not to the same degree. It's not to say there would be  
17 no impact of it, but our best estimates of the impact  
18 would be it would be much lower than, for instance,  
19 closing schools.

20 **Q.** Well, that's a relative answer, isn't it? I'm asking  
21 you in absolute terms: why wasn't the precautionary  
22 principle applied to this same issue of mass gatherings  
23 as it was to the closing of schools?

24 **A.** I would say that the question we were asked was what  
25 the likely effectiveness of the measure would be. So if  
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1 emergencies I've been involved in, I saw less evidence  
2 of, let's say, behind-the-scenes government planning.

3 **Q.** So I was asking you about the SAGE meeting of 5 March.  
4 At that stage, in early March, was SAGE still advising  
5 a mitigation as opposed to a suppression strategy?

6 **A.** I mean, SAGE was still considering a mitigation rather  
7 than a suppression strategy, yes. I mean, that was  
8 the ... the government strategy laid out in the 3 March  
9 Covid plan was one effectively of mitigation.

10 **Q.** What sort of mitigation measures did you or SAGE have in  
11 mind on 5 March as being effective in support of  
12 the mitigation strategy?

13 **A.** So the first one was -- we didn't have testing,  
14 of course, but isolation of symptomatic cases and  
15 the households of symptomatic cases.

16 **Q.** So just pause there. Telling the population that if you  
17 show symptoms you self-isolate?

18 **A.** Yes.

19 **Q.** And your family?

20 **A.** And your family self-isolate.

21 **Q.** All right. So that's a --

22 **A.** I mean, that was -- and that was indeed the first policy  
23 actually announced. Other measures we considered were  
24 reducing social contacts and workplace contacts. School  
25 closure has already been mentioned. There was  
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1 you're asking about effectiveness, I mean, I've given  
2 you an answer that on its own -- as part of a suite of  
3 measures of course, these things add up, but on its own,  
4 as a single measure, it would have a very small impact  
5 on the trajectory of the pandemic.

6 **Q.** As we've seen from the emails, you weren't averse to  
7 going beyond, quite understandably, a narrow issue of  
8 what would be the epidemiological answer to questions of  
9 policy and measures and efficacy and breaking  
10 transmission. Why did you not say --

11 **A.** Well, I would say that is part of the -- there's --  
12 talking about efficacy and talking about effectiveness  
13 and relative effectiveness is, I think, well within my  
14 area of expertise. Talking about should the government  
15 therefore do something, is something different.

16 **Q.** But you do agree, don't you, that there are plenty of  
17 examples where you do say the government should do  
18 something?

19 **A.** I mean, plenty of -- I mean, the examples I can think of  
20 most in those early days was about just ramping up  
21 testing and getting some decent surveillance into place  
22 so we knew what was going on.

23 **Q.** And control measures and cost-benefit analysis and  
24 economic considerations, all the stuff of policy?

25 **A.** I mean, yes. I mean, I would have -- compared with past  
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1 an extensive debate around that time about measures  
2 which were particularly targeted around shielding  
3 the elderly, because it was known that that age group  
4 was most at risk. Those were the measures being  
5 modelled.

6 There was also discussion within SAGE as to  
7 the particular risk associated with care homes and the  
8 need to improve infection control in that setting.

9 **Q.** But there was no recommendation made in early March  
10 about care homes, was there?

11 **A.** I mean, the risk from care home -- of care homes was  
12 discussed in -- I mean, I raised -- actually I can't  
13 remember the precise date, I think it was all the way  
14 back in February, the risk of care homes, because there  
15 was early evidence of outbreak in care homes from the  
16 United States, I think Seattle in the first instance.

17 **Q.** You did raise the issue of infection in care homes, and  
18 also the issue of nosocomial infection in hospitals, and  
19 the evidence shows, doesn't it, that a large percentage  
20 of the deaths suffered in the United Kingdom were in  
21 both those places.

22 **A.** Yeah.

23 **Q.** But at the beginning of March, although you've said you  
24 debated care homes, SAGE made no recommendations in fact  
25 for restrictions on care homes, other than the general  
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1 self-imposed obligation to isolate you and your family  
 2 members in the event of symptoms?  
 3 **A.** I mean, to be honest, I cannot -- I mean, I think it  
 4 was -- in relation to care homes, it was more  
 5 Chris Whitty and Patrick Vallance agreeing and  
 6 talking -- I think Jenny Harries had a responsibility --  
 7 within a SAGE meeting and saying that improving  
 8 infection control in care homes was a priority. Again,  
 9 I mean, the minutes may not reflect that.  
 10 **Q.** You weren't confident, were you, at the beginning of  
 11 March that these relatively limited measures, reflective  
 12 in fact of in terms of --  
 13 **A.** Flattening the curve, yes.  
 14 **Q.** Flattening the curve, but also having their genesis to  
 15 some extent in flu pandemic strategy, because you  
 16 weren't talking about lockdowns here or stay at home  
 17 orders or shutting of workplaces. Were you confident  
 18 that they would prevent the sorts of levels of death and  
 19 hospitalisation which you had indicated by the end of  
 20 February would otherwise inevitably occur?  
 21 **A.** The best we were able to achieve in -- I mean, in  
 22 modelling terms, but combining these interventions, in  
 23 a mitigation sense, was a -- about a halving of deaths,  
 24 mostly down to shielding, it's an open question how  
 25 successful that would have been as a policy, and maybe

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1 timeframe or longer, you know, where would the UK be  
 2 then, and that -- I mean, Chris Whitty in particular was  
 3 concerned about what would be happening in the autumn.  
 4 **Q.** So is this the position: there was a fear on the part of  
 5 SAGE and its constituent parts, its participants, that  
 6 if you suppressed, if you pushed R0 down below 1, if you  
 7 clamped down hard on the virus, it would re-emerge later  
 8 like an uncoiled spring in a vicious overwhelming second  
 9 wave?  
 10 **A.** I mean, that was the initial concern around those  
 11 measures.  
 12 **Q.** Why was it assumed that there would be a second wave, or  
 13 rather was consideration given to whether or not  
 14 measures might have been able to be taken in the  
 15 meantime in May, June, July, August, September, October,  
 16 November, to make sure there wouldn't be a second wave,  
 17 for example a developed test, trace, isolate and support  
 18 system?  
 19 **A.** I don't remember that being discussed but there wasn't  
 20 a lengthy discussion of suppression-type strategies in  
 21 SAGE until the middle of March.  
 22 **Q.** You say in your statement that:  
 23 "[You] did not strongly advise for a switch to  
 24 a suppression strategy prior to March 13th, in part  
 25 because of my belief that it isn't the role of

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1 a 70%, maybe slightly more if there was spontaneous  
 2 behaviour change, reduction in healthcare demand. The  
 3 challenge is that we were talking about levels of  
 4 healthcare demand which were more than ten-fold above  
 5 what the NHS could potentially cope with and therefore  
 6 a 70% reduction was not sufficient.  
 7 **Q.** So why did SAGE recommend and why did you throw your own  
 8 personal authority behind a recommendation that was, in  
 9 effect, a half measure?  
 10 **A.** I mean, say -- I would say SAGE was working to the --  
 11 what we understood was the government policy of wanting  
 12 to do its best to mitigate the epidemic but not risk  
 13 a second wave in the autumn.  
 14 **Q.** But the primary objective was surely to prevent death  
 15 and to stop the transmission of the virus. Why were you  
 16 waiting for clarity to come about the government's own  
 17 strategy? Why did you need to know what its red lines  
 18 were before you made a perfectly sensible  
 19 recommendation, "Half measures mitigation are just not  
 20 going to work we need suppression"?  
 21 **A.** So the challenge with suppression is what does it lead  
 22 to. It delays matters at enormous -- I mean,  
 23 enormous -- societal and economic cost, but what do you  
 24 do next? And so the SAGE discussions, such as they were  
 25 around this issue, were looking in the one-year

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1 scientific advisers to determine policy ... but also  
 2 because I was very conscious of the huge economic and  
 3 social costs which would be entailed by long-term and  
 4 intensive use of NPIs ..."  
 5 Why was it a concern of a mathematical  
 6 epidemiologist, no disrespect, to determine matters of  
 7 economic and social cost and to undertake this  
 8 cost-benefit analysis?  
 9 **A.** Well, I mean, first of all, I mean, public health, there  
 10 is a strong tradition within public health of looking at  
 11 cost-benefit in the way we operate our health system, in  
 12 the way we judge the proportionality of interventions.  
 13 I mean, cost is weighed against benefit, both economic  
 14 cost and other more, let's say, nebulous costs.  
 15 **Q.** Professor, where is the emergency call to the government  
 16 at the beginning of March, two weeks before the 13th  
 17 when it kicks off, where you say or SAGE says, "We have  
 18 to turn to a suppression strategy because of the risk of  
 19 the high levels of death and hospitalisation, but for  
 20 you, the government, you'll have to work out  
 21 the cost-benefit analysis, you'll have to work out  
 22 whether the cost of suppression is worth it"?  
 23 **A.** I mean, I think Chris and Patrick were at every SAGE  
 24 meeting and were very well aware of that. I wasn't  
 25 clear on what was being communicated to government or

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1 not, as some of the later emails you refer to make  
2 clear.

3 **Q.** I said where you or SAGE, not Sir Patrick or Sir Chris,  
4 where does SAGE say that, at the end of February and in  
5 the first week of March?

6 **A.** I mean, as I've said before, the role of SAGE is to  
7 answer the questions addressed to it.

8 **MR KEITH:** My Lady, is that a convenient moment?

9 **LADY HALLETT:** It is.

10 Sorry, it's time for another break, Professor, you  
11 might welcome one as well. 15 minutes, please.

12 (3.11 pm)  
13 (A short break)  
14 (3.25 pm)

15 **LADY HALLETT:** Mr Keith.

16 **MR KEITH:** So, Professor, we come to the beginning of  
17 March 2020, and the government, as you've correctly  
18 reminded us, publishes its *Coronavirus: action plan* in  
19 which the first stage is contain. And that wasn't  
20 something that you've told us was debated with SAGE.  
21 SAGE didn't know that the government was publishing that  
22 plan. You must have been quite surprised to see  
23 the promulgation of a new plan which contained as its  
24 first stage contain, when, as you've described very ably  
25 to us, you had very real doubts and had had very real

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1 member of that committee, and you take responsibility,  
2 as with all the members, for the documents and  
3 the minutes, the documents produced by your committee.  
4 What did it mean?

5 **LADY HALLETT:** Is that right?

6 **A.** No. I mean, we're not --

7 **LADY HALLETT:** If you get to approve the minutes -- did you  
8 get to approve them?

9 **A.** No, not from memory. We get circulated the summary, but  
10 we don't approve the minutes. It's not like NERVTAG  
11 where you edit the --

12 **MR KEITH:** Was this document circulated to you at any time  
13 before it was published and put into the public domain?

14 **A.** Oh, you always get copies of the summary.

15 **Q.** And when you saw this phrase -- did you see this phrase  
16 in the summary?

17 **A.** Yes.

18 **Q.** Right. When you saw that phrase in the summary, which  
19 was given to you, did you think to yourself, "Well,  
20 that's not a fair reflection of the debate"?

21 **A.** I thought it was a diplomatic form of words.

22 **Q.** To what extent was Sir Chris's discomfort at the idea  
23 that the United Kingdom would be the first country to  
24 abandon containment a driver of that conclusion?

25 **A.** I mean, I think it was probably the most significant

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1 duties for a matter of weeks as to whether contain could  
2 ever work.

3 **A.** Yes. It was one -- probably the only point of  
4 disagreement I had with Chris Whitty about the extension  
5 of the contain phase.

6 **Q.** A couple of days later, on 5 March, SAGE sat, met, and  
7 its consensus document concludes:  
8 "There are currently no scientific grounds to move  
9 away from containment efforts in the United Kingdom."  
10 What did that mean?

11 **A.** I mean, there was a debate around containment and Chris  
12 gave his view, which was, I think, largely around  
13 the fact that -- didn't want the UK to be the first  
14 country to move away from that. I mean, I -- from  
15 memory, I expressed the view which I've expressed  
16 previously, that I didn't feel contain was succeeding.  
17 To be honest, I don't know quite where that central  
18 opinion, let's say, of those minutes came from.

19 **Q.** Are you saying that because there was a disagreement as  
20 to the efficacy of containment, SAGE alighted upon that  
21 phrase "there are no scientific grounds to move away  
22 from it"?

23 **A.** I mean, you would have to ask the person who drafted it,  
24 but yes, that might be ...

25 **Q.** Professor, you were at the meeting, a most important

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1 driver.

2 **Q.** By 9 or 10 March, you were extremely concerned, were you  
3 not? You had had, for now a matter of four to  
4 five weeks, the basic figures in relation to infection  
5 fatality rate, infection hospitalisation rate. You  
6 could see that the containment policy didn't stand  
7 a chance, and the debate was still raging about whether  
8 or not suppression or mitigation was the right way to  
9 go.

10 **A.** I mean, I'm not sure that you would say the debate --  
11 there wasn't much debate of that on SAGE itself.  
12 I mean, the thing I was most frustrated by was there  
13 still seemed to be a residual, I don't know -- a sense  
14 I got that some in government hadn't really comprehended  
15 the figures or didn't think it was going to be as bad as  
16 it was going to be. A lack of a sense of urgency, let's  
17 put it that way.

18 There was also a second challenge, which was it was  
19 very difficult to get NHS England to actually state on  
20 the record that the health service would be overwhelmed  
21 and what their surge capacity was, and in fact the first  
22 time they did that was on 13 March.

23 **Q.** That was the first occasion on which, to use your words,  
24 they put that information on the record, and you  
25 challenged them quite strongly at that meeting. But you

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1 had known for a considerable time before that meeting,  
2 informally, what the impact would be of your figures on  
3 the NHS?

4 **A.** Depending on the level of -- obviously it wouldn't be  
5 the NHS as normal. I didn't know anything about what  
6 their surge capacity potentially was.

7 **Q.** Did you know weeks before they put it formally on  
8 the record that the number of deaths and hospital cases  
9 that you had estimated would result would likely  
10 overwhelm the NHS?

11 **A.** Yes, yes.

12 **Q.** Right. You emailed an official, an adviser in  
13 Downing Street called Ben Warner. I think you may have  
14 spoken to him on the phone to tell him that you were  
15 going to email him?

16 **A.** I don't honestly remember.

17 **Q.** All right.

18 Could we have, then, that email, INQ000196055.

19 If we go to the second page, please, we'll  
20 chronologically work backwards. We can see an email  
21 from you, director, of course, of the MRC Centre for  
22 Global Infectious Disease Analysis, and the body of the  
23 email:

24 "Thank you very much ..."

25 Talks about bed demand per day, daily deaths, the  
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1 suppression?

2 **A.** Yes.

3 **Q.** Complete control of -- or, I apologise, reducing  
4 the reproduction rate below 1?

5 **A.** Yeah.

6 **Q.** A lockdown in practice.

7 "We might still follow the currently planned  
8 measures for the next few weeks, but then much more  
9 intensive measures would need to be introduced. Which  
10 need to be thought about now."

11 At this stage, when you alerted Downing Street to  
12 your concerns, what was the thinking in relation to when  
13 that wave would likely peak?

14 **A.** I mean, when it would peak would depend on the measures.  
15 I mean, in retrospect, we didn't have a few weeks, as  
16 the next few days' data indicated, but we were --  
17 I mean, we'll come on to the topic of data streams,  
18 so ...

19 **Q.** I'm going to ask you about Colindale, never fear.

20 What was the thinking about the wave and when it  
21 would peak? At this stage, as you were raising --

22 **A.** I mean, from memory, May -- May-ish timescale, but  
23 obviously there's a significant build-up, I mean, to  
24 something which was six, seven times worse than what we  
25 actually saw in April.  
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1 peak. And you say this:

2 "As long as the PM and Cabinet accept and understand  
3 this is what is likely to happen and are still ahead to  
4 proceed with current plans, then there is a rational  
5 basis to that decision which I would say the science  
6 supports."

7 To what extent, Professor, did you regard yourself  
8 as obliged to step out of your SAGE role and express  
9 views about government policy and the workings of the PM  
10 and the Cabinet in this way?

11 **A.** I mean, it felt uncomfortable, but at the time it felt  
12 like it needed to be said, because, yes, as I said,  
13 I was increasingly concerned about this disconnect  
14 between the numbers we were actually presenting and  
15 the reality of what that would actually look like.

16 **Q.** In the last paragraph you say:

17 "But what would be the worst outcome -- in my  
18 opinion -- would be to go for mitigation ..."

19 And that of course was the current plan:

20 "... (the policy package currently being discussed)  
21 and for the health, social and political cost to be  
22 judged later to be unacceptable -- necessitating  
23 a policy pivot in the midst of what will already be  
24 a national crisis."

25 Did you mean by policy pivot a change to  
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1 **Q.** Was the reality that the wave peaked significantly  
2 earlier?

3 **A.** No, I mean, the wave peaked because of the suppression  
4 measures adopted. But the -- okay, I understand.

5 The epidemic, as we learned in the next few days,  
6 was at least two weeks further progressed than  
7 the surveillance data available at the time I wrote that  
8 email suggested.

9 **Q.** Was the reason for that (a), as you've already  
10 identified, the asymptomatic nature of a significant  
11 proportion of the virus meant that in the absence of  
12 testing it's difficult to trace where it's got to, and  
13 (b) the lack of understanding, because of the lack of  
14 testing, on the number of seedings, the number of places  
15 in the United Kingdom that the virus had already got to?

16 **A.** Yes, the epidemic was effectively hundreds of times  
17 larger than we had anticipated. Well, to be fair,  
18 probably about 30 to 40 times larger.

19 **Q.** In essence, because of a lack of a significant  
20 sophisticated surveillance and testing system?

21 **A.** Yes, which I would say that -- I mean, both  
22 Patrick Vallance, myself, John Edmunds and Jeremy Farrar  
23 had repeatedly commented on this multiple times in SAGE.

24 **Q.** Then if we could go, please, to the prior page, the  
25 previous page, page 1, you say at the bottom of the  
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1 page:  
 2 "Dear Ben,  
 3 "Good to talk today."  
 4 Which is why I suspect you might have called him.  
 5 **A.** That probably was on the side of -- on the SAGE  
 6 meeting --  
 7 **Q.** On the margins?  
 8 **A.** Margins, yes.  
 9 **Q.** Because he attended SAGE, did he not?  
 10 "Thank you for sending this over [he says].  
 11 "I think the point you make is very valid, important  
 12 and I will continue to raise it here."  
 13 Then you email subsequently about  
 14 the Prime Minister's press conference.  
 15 On 11 March there is also an email, INQ000149013,  
 16 this is an email to Professor Medley and a number of  
 17 individuals copied in, including Professor Woolhouse in  
 18 fact:  
 19 "See attached for edits. I think this is a little  
 20 more balanced -- especially with respect to  
 21 the international situation, given the original draft  
 22 was factually inaccurate in some respects ..."  
 23 What report was it that you were editing or had  
 24 edited?  
 25 **A.** This was a summary of the -- which frankly was generated  
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1 **Q.** Please.  
 2 **A.** So the issue of timing of policies is fundamentally  
 3 different between mitigation and suppression. So for  
 4 mitigation you're wanting to implement measures around  
 5 the peak of the epidemic to effectively squash the peak.  
 6 For suppression, on the other hand, you want to act as  
 7 early as possible, because the magnitude of -- the wave  
 8 will come down if those measures are successful, but if  
 9 an epidemic is doubling every four days, basically  
 10 a week's delay corresponds to four times more cases and  
 11 deaths.  
 12 **Q.** Because of the exponential nature of a virus. But in  
 13 reality, Professor, and in the event, it just didn't  
 14 matter, because measures had to be taken to stop the NHS  
 15 being overwhelmed in any event?  
 16 **A.** Yes, I mean, what became clear on the -- I think between  
 17 the -- particularly between the 12th and the 15th is  
 18 that, first of all, the NHS, you know, gave us  
 19 definitive figures, and secondly that I think -- this is  
 20 more from reading Chris and Patrick's statement -- that  
 21 it was clearly viewed as unacceptable to have the NHS  
 22 overwhelmed.  
 23 **Q.** To some extent, therefore, the whole debate about  
 24 suppression/mitigation was swept away by the realisation  
 25 that unless the maximum control measure was applied, and  
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1 spontaneously by SPI-M members, it wasn't commissioned,  
 2 of the relative both benefits and drawbacks of  
 3 suppression versus mitigation.  
 4 **Q.** It would appear that SPI-M had been discussing  
 5 the international situation, so it wasn't just  
 6 an epidemiological or mathematical exercise, they were  
 7 looking at the wider picture --  
 8 **A.** Can I interrupt?  
 9 **Q.** Yes.  
 10 **A.** I mean, we always looked at data. SPI-M was tracking  
 11 the epidemic everywhere, and we were reading the  
 12 scientific literature.  
 13 **Q.** You've seen the suggestion in a number of places that  
 14 SAGE and SPI-M failed to pay sufficient regard to  
 15 the position overseas and to overseas data, what was  
 16 happening in particular. Is there any basis for that --  
 17 **A.** No.  
 18 **Q.** -- suggestion? All right.  
 19 You then go on to say:  
 20 "With respect to 'wait and see'. We don't have  
 21 time. That is akin to a policy pivot when it is too  
 22 late."  
 23 Is that the same point you were making in your email  
 24 to Ben Warner?  
 25 **A.** Maybe can I elaborate?  
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1 lockdown, a mandatory order, the NHS would collapse?  
 2 **A.** I mean, I would slightly correct you there. I would say  
 3 there was -- other debates were got on to -- you know,  
 4 following -- after 16 March. I was actually -- the type  
 5 of measures we modelled in Report 9, which we'll get to,  
 6 is much more akin to what was announced on 16 and then  
 7 18 March than the mandatory lockdown. The issue around  
 8 the necessity of the 23 March announcement was around  
 9 quite how far progressed the epidemic had got by  
 10 the time measures were introduced. I think this is  
 11 a point that Mark Woolhouse has raised, that if you act  
 12 earlier you can act with slightly less intensive  
 13 measures. Still very disruptive, but not as intensive.  
 14 **Q.** Yes, I put the question on the basis that, in the event,  
 15 it was, of course, the need to avoid the collapse of  
 16 the NHS that led to mandatory measures being applied.  
 17 The SAGE meeting of 10 March was the first SAGE  
 18 meeting at which, as you've described earlier,  
 19 the potential risk to the care sector was debated  
 20 significantly.  
 21 **A.** I think to the level of being minuted.  
 22 **Q.** To the level of being minuted. And I think the position  
 23 is that there were no SPI-M-O models before 23 March  
 24 that explicitly modelled care homes or the impact on  
 25 the hospital sector?  
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1 **A.** I mean, that's true, we modelled -- all the models had  
 2 age-related risk in them, and we were looking at  
 3 shielding options for the elderly, but no models  
 4 explicitly represented the care sector.  
 5 They did represent hospitals, in some sense, but we  
 6 didn't represent nosocomial -- hospital-based  
 7 transmission.  
 8 **Q.** You say in your statement that you were so concerned by  
 9 the lack of data, and it was in the main a lack of data  
 10 which had led to you not being able to model  
 11 the specific sectors, that you sent members of your team  
 12 at the Imperial College COVID-19 Response Team to PHE's  
 13 offices in Colindale. Why did you do that?  
 14 **A.** Well, I should elaborate. I mean, it's -- we have  
 15 a close working relationship with what is now UKHSA, and  
 16 the Health Protection Research Unit you mentioned at the  
 17 start of this evidence session is a collaborative  
 18 initiative between Imperial College, London School of  
 19 Hygiene and Tropical Medicine and then Public Health  
 20 England. And so we were used to working together.  
 21 I just became aware that, at that time, there were --  
 22 the staff were overwhelmed at Colindale in trying to  
 23 pull the data together for both the central government,  
 24 for SAGE and SPI-M. I mean, I could tell that from the  
 25 fact that emails were coming through at, you know, past  
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1 that the country should lock down. He took a different  
 2 view of that kind of interface between science and  
 3 policy, and I accepted that.

4 So my -- I had some particular technical concerns  
 5 with the final report produced which you're referring  
 6 to, just in terms of the -- some of the assumptions  
 7 around, I mean, looking at how mitigation might fail but  
 8 not looking at, for instance, how suppression might  
 9 fail.

10 **Q.** Putting aside the technical changes and the editing, in  
 11 broad terms, you saw the reports as intruding  
 12 impermissibly into policy areas, did you not?

13 **A.** I had concerns at the way that they were written at  
 14 the time would be seen -- particularly if we put them  
 15 out as an Imperial College report, and I said he was  
 16 free -- I mean, absolutely, obviously, free to do what  
 17 he wanted with it, but if we put them out as an  
 18 Imperial College report it would be seen as almost  
 19 advocating on policy solution.

20 **Q.** But you had been advocating on policy in the press, to  
 21 Ben Warner, to the CMO, CSA?

22 **A.** I mean, what I had been doing is warning -- issuing  
 23 warnings about was the government aware of what their  
 24 policy was actually going to result in, I think.

25 **Q.** Did you debate publicly and with government officials  
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1 midnight. So I offered to provide some support in terms  
 2 of people who could help put in place hopefully a better  
 3 system.

4 **Q.** Then, as we heard earlier from Professor Steven Riley,  
 5 it's around that time that he produced the two papers  
 6 that he did -- he is, of course, a member of the  
 7 Imperial College team -- and the first of those papers  
 8 was considered by SPI-M-O on 11 March.

9 I think it's fair to say, Professor, that his  
 10 reports were not welcomed by you. You were, in your  
 11 response to him, quite critical of what you saw to be  
 12 the assumption that what he was recommending would be  
 13 adopted by the government. You said there will be no  
 14 appetite for the draconian -- such draconian measures.  
 15 But his approach was, putting aside the policy impact,  
 16 broadly correct, was it not?

17 **A.** I mean, it was an approach which ended up being adopted  
 18 in terms of suppression. I mean, the issue -- I mean,  
 19 as you're aware, there are multiple iterations of --

20 **Q.** Yes.

21 **A.** -- of that. The first iteration, on 1 March, was,  
 22 I mean -- and I said to him at the time we would include  
 23 containment options, which are much more similar to what  
 24 turned into Report 9. I felt there were certain -- so,  
 25 I mean, Steven believed passionately from very early on  
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1 the policy implications of the mathematical and  
 2 epidemiological advice that you were providing?

3 **A.** Sorry, what do you mean by publicly?

4 **Q.** Did you talk about the policy consequences of your  
 5 modelling in the press or in emails?

6 **A.** No. Not in that sense publicly.

7 **Q.** Did you communicate to Ben Warner in Downing Street --

8 **A.** Indeed.

9 **Q.** -- your concerns about the measures, whether it should  
 10 be suppression, mitigation, and what should be done?

11 **A.** Well, my -- you've just covered them, emails to  
 12 Ben Warner, which wasn't ... I did not view those emails  
 13 as being advocating for a change of policy, more as  
 14 saying: are you aware of what the current policy will  
 15 cause and, you know, clearly, is the Prime Minister  
 16 aware of that? It was a warning about the consequences.

17 **Q.** On 12 March -- could we have INQ000149061 -- you engaged  
 18 in email communication with Professor Edmunds and  
 19 Professor Farrar.

20 **A.** Yep.

21 **Q.** The email from you is at the bottom half of the page,  
 22 Friday, the 13th:

23 "I think the message got across."

24 What message was that? Was that the message at  
 25 the SAGE meeting on that day?  
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1 A. Yeah.

2 Q. "I still think part of the issue is Chris hoping it  
3 won't be as bad as we say."

4 You expressed that view to your colleagues,  
5 Messrs Farrar and Edmunds. Did you say to the CMO  
6 himself, "I'm concerned that you appear to have a degree  
7 of optimism bias that it won't be as bad as we all think  
8 it will be"?

9 A. Not in so many words. What I tried to do was reinforce  
10 the support for the estimates we were coming up with.  
11 I mean, I think Chris was naturally more, let's say,  
12 conservative at accepting -- and they were uncertain  
13 estimates.

14 Q. The email is obviously a conversation between yourself  
15 and Jeremy Farrar and John Edmunds. To what extent did  
16 you express these views openly in SAGE yourself on  
17 13 March?

18 A. So on 13 March what I refer to in the second sentence  
19 there is the fact that I actually, I mean, my ...  
20 I explicitly asked the question of Stephen Powis in  
21 the meeting of whether the, you know, what was the NHS  
22 surge capacity, which, in some sense, was outside  
23 the remit of SAGE, it's an operational consideration,  
24 but by doing so -- and then asked him, you know, could  
25 the NHS in any way cope with the current plan, you know,

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1 A. I mean, the difference between green and red in the  
2 previous table is the difference between mitigation and  
3 suppression.

4 Q. Does this email therefore stand as the point at which  
5 you yourself are converted to the merits of  
6 a suppression policy as opposed to a mitigation policy?

7 A. I think that's a very different and difficult judgement.  
8 I didn't -- I'm on record as saying that I didn't view  
9 any easy decisions here. I think it's the point at  
10 which it was clearly apparent that exceeding NHS  
11 capacity was a government red line they did not want to  
12 cross, and I was therefore saying these are the policies  
13 which need to be implemented.

14 Q. Around this time, you were engaged in drafting Report 9?

15 A. Yes.

16 Q. Which is the report of which we've heard earlier today  
17 from Professor Steven Riley. Could we have, please,  
18 INQ000270159.

19 There is a summary on page 1 which, in essence, is  
20 this right, states that the result of epidemiological  
21 modelling is that, whilst there are two fundamental  
22 strategies, mitigation and suppression, the optimal  
23 mitigation policy is that policy which you've identified  
24 in the email of a relatively stringent degree of measure  
25 but falling short of a lockdown?

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1 policy plans, and he said he would get back to me and  
2 did on the exact surge capacity but basically said no,  
3 there is no way the NHS would be able to cope.

4 Q. On 15 March, INQ000048089, page 2, you email Sir Chris  
5 and Sir Patrick.

6 A. I think it hasn't updated for me. Ah, okay.

7 Q. If we could go back, thank you, if you would just go  
8 back one page, please, we can see in the middle of the  
9 page, email 15 March, 2020, 3.37 am, to Sir Patrick and  
10 Sir Chris:

11 "... I need to sleep now."

12 Then, further down the page, figures, your thinking  
13 in relation to the impact upon NHS healthcare facilities  
14 and demand.

15 Then over the page, essentially, at the top of the  
16 page, you talk about what policy will need to be  
17 implemented in order to be able to avoid, as you saw it,  
18 and the figures supported you, the terrible consequences  
19 on the NHS of your figures of death and hospitalisation:

20 "The minimum policy will require: closing schools &  
21 universities, home isolation of cases, and large-scale  
22 intensive social distancing -- reducing all contacts  
23 outside the home and work by 75% ..."

24 Was that a mitigation policy or a suppression  
25 policy, Professor?

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1 A. Not quite. So the optimal mitigation policy could  
2 achieve maybe a two-thirds reduction in peak healthcare  
3 demand and the halving of deaths, which was the  
4 "mitigation". The suppression policy then went further  
5 and that's, you know, where you can avoid exceeding  
6 healthcare limits.

7 Q. Page 2, you say:

8 "The major challenge of suppression is that this  
9 type of intensive intervention package -- or something  
10 equivalently effective at reducing transmission -- will  
11 need to be maintained until a vaccine becomes  
12 available ..."

13 Did you consider the possibility that  
14 a sophisticated scaled-up test, trace and isolation  
15 measure could provide a degree of succour and support  
16 before vaccines were invented?

17 A. I mean, that is what was being referred to, or something  
18 equivalently effective at reducing transmission, in that  
19 sentence.

20 Q. Well, Professor, you make the point that whatever  
21 package it is has to be "maintained until a vaccine  
22 becomes available (potentially 18 months or more)".

23 A. And that's true whether you're using contact tracing or  
24 you're using -- irrespective of the type of  
25 non-pharmaceutical intervention one is using. No

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1 immunity is building up in -- or limited immunity is  
 2 building up in the population if suppression is working  
 3 and so the only way of exiting from that policy is when  
 4 a vaccine is available to generate immunity through that  
 5 route.  
 6 **Q.** Professor, in this document you were advocating  
 7 an intensive intervention package by way of reducing  
 8 contact in the workplace and at home, ensuring a degree  
 9 of isolation that breaks transmission chains, and you  
 10 say that package will need to be maintained until  
 11 a vaccine becomes available.

12 You're not there referring to testing. Testing is  
 13 not a package, is it, which is concerned with --

14 **A.** Maybe I'll read:

15 "The major challenge of suppression is that this  
 16 type of intensive intervention package -- or something  
 17 equivalently effective at reducing transmission -- will  
 18 need to be maintained until a vaccine becomes  
 19 available ..."

20 **Q.** All right. Why didn't you say, "The best way of being  
 21 able to return to life, something approaching normality,  
 22 after this package is -- intervention package is  
 23 introduced, is to develop, at speed, a rapid test, trace  
 24 and isolate system"?

25 **A.** I mean, I think -- well, we did a lot of work in  
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1 terms of intensive care unit demand. Qualitatively,  
 2 you're completely right, it didn't change  
 3 the conclusion, but in quantitative detail it did change  
 4 it significantly.

5 We didn't have, I should say, we had informal --  
 6 well, informal feedback from the NHS that it was highly  
 7 unlikely surge capacity would be available to meet  
 8 the likely demand, but we weren't given official  
 9 figures, let's say, for what that capacity was going to  
 10 be until 15 March, or 14 March.

11 **Q.** In the event, Professor, the government, as we all know,  
 12 imposed a lockdown. You make the point in your  
 13 statement that all interventions have a trade-off  
 14 between potential impact and cost, and also  
 15 effectiveness and practicality. A more practical  
 16 intervention may achieve a higher impact than a more  
 17 onerous intervention that is poorly adhered to.

18 **A.** Yep.

19 **Q.** In your view, if the goal was to prevent the collapse of  
 20 the NHS, was that lockdown necessary?

21 **A.** This is not a question we can definitively answer.  
 22 Without doubt the measures announced on 16 March had  
 23 some effect on transmission, and potentially accelerated  
 24 by spontaneous behaviour change, but we didn't have  
 25 the time to wait and collect the data which would allow  
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1 the following weeks on -- on that. It wasn't, at that  
 2 time, our top priority. We had a limited amount of time  
 3 to look at it and I did not want to be making statements  
 4 which I couldn't back up.

5 **Q.** All right. Page --

6 **A.** I don't disagree with the concept of having an effective  
 7 test and trace system and I'm on record at looking --  
 8 both stating that and looking at it in detail.

9 **Q.** Could we have page 16, please.

10 The middle of the page has the paragraph that we  
 11 looked at earlier:

12 "In the [United Kingdom], this conclusion has only  
 13 been reached in the last few days, with the refinement  
 14 of estimates of likely ICU demand due to COVID-19 based  
 15 on experience in Italy and the [United Kingdom] ... and  
 16 with the NHS providing increasing certainty around the  
 17 limits of hospital surge capacity."

18 Was it not the position that you had in fact for  
 19 a matter of weeks known what the IFR number was likely  
 20 to be, the hospitalisation number was going to be, you  
 21 had informal information about NHS capacity, and  
 22 obviously Professor Riley had produced his own report?

23 **A.** I mean, so I understand what you're saying, the IFR  
 24 didn't change, the hospital estimates did change, they  
 25 roughly doubled based on what was happening in Italy in  
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1 us to say, "Yes, they're sufficient", or, "No, they're  
 2 not".

3 **Q.** But you gave evidence, I can't go into for legal reasons  
 4 the evidence you gave, but you have spoken about what  
 5 the impact might have been if the intervention had been  
 6 introduced a week earlier.

7 **A.** So I was very careful when I made that statement to  
 8 the House of Commons select committee, which is --

9 **Q.** All right, I'm going to stop you there. For legal  
 10 reasons we can never debate in a court of law anything  
 11 that is said or done in Parliament. So I cannot ask you  
 12 questions about --

13 **A.** Okay.

14 **Q.** -- the merits --

15 **A.** I will refer instead to the paper we later published on  
 16 that.

17 **Q.** Thank you.

18 **A.** But I said the same at the time, which is moving all  
 19 interventions back a week. So returning to your point  
 20 of could things have acted -- moved faster in February  
 21 and March for whatever reason, more clarity on the data,  
 22 more clarity on NHS capacity, had we moved the 16 March  
 23 back to the 11th, the 23rd back to the 16th, that was  
 24 the scenario we were looking at.

25 **Q.** My question to you was: if the goal was to prevent  
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1 the collapse of the NHS, was that lockdown necessary?  
 2 From everything you've said, it must surely follow that  
 3 it was, because --

4 **A.** I mean --

5 **Q.** -- you were saying you've got to do it otherwise --

6 **A.** So I thought you were distinguishing between what was  
 7 announced on 16 March and what was announced on  
 8 23 March.

9 **Q.** No, the 23rd.

10 **A.** Okay. So I think -- you know, well, I think both were  
 11 warranted, but I cannot definitively say whether what  
 12 was announced on the 16th, maybe in combination with  
 13 what was defined -- announced on the 18th, would have  
 14 been sufficient in its own right, we just don't have the  
 15 data to answer that question.

16 **Q.** So what you're saying is we will never know the exact  
 17 nature of the number of deaths that would have been  
 18 saved if a lockdown had been a week earlier; equally  
 19 we'll never know whether or not the measures short of  
 20 a lockdown which were put in place around the 16th, or  
 21 the 13th in fact, whether they would have worked?

22 **A.** I'm specifically referring to the measures announced by  
 23 the Prime Minister on the 16th, which was mostly  
 24 an urging of people to work from home and to reduce  
 25 social contact. They weren't mandatory measures but

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1 that the more -- you can have a range of different  
 2 measures which will achieve suppression, but the rate --  
 3 the speed of doing so differs depending on how stringent  
 4 the measures are, and if you are concerned about  
 5 healthcare capacity being overwhelmed in the very short  
 6 term, you need to implement considerably more stringent  
 7 measures than if you act potentially earlier and can  
 8 then later refine measures.

9 **Q.** Does your conclusion, your view, depend at all upon  
 10 Professor Woolhouse's point, which you have already  
 11 addressed separately, that there was a failure to take  
 12 proper account of spontaneous changes in behaviour?

13 **A.** I mean, it's difficult. What we can do is observe. We  
 14 had that one week to observe spontaneous changes in  
 15 behaviour, because most -- nearly all the measures  
 16 announced on 16 March were recommendations, and there  
 17 was a significant reduction in mobility, in how other  
 18 measures have -- we weren't, at that point, measuring  
 19 contact rates but in proxy measures of contact rates.  
 20 Whether it would have been sufficient though we don't  
 21 have enough data to say.

22 **Q.** Now, very briefly, some of the high points and low  
 23 points of the chronology thereafter.

24 In relation to the May 2020 alert system, and  
 25 the government's approach to the relaxation from

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1 they did have an appreciable effect on population  
 2 contact rates and behaviour. And I know there's  
 3 a certain sector of society who are exercised about  
 4 the difference between mandatory and voluntary measures,  
 5 and my response was we will never know in the UK context  
 6 whether the measures announced on the 16th, and then  
 7 later with school closure, which is mandatory on  
 8 the 18th, would have been sufficient on their own. What  
 9 we can say is that the mandatory lockdown was more  
 10 effective at reducing contact rates, it had an even  
 11 higher effectiveness.

12 **Q.** How clear are you in that conclusion? Plainly there are  
 13 degrees of likelihood. If we had only had those  
 14 measures, the ones imposed on the 16th, how clear is it?

15 **A.** It isn't, and we didn't have time to wait for it to be  
 16 clear.

17 **Q.** Has there been any subsequent analysis done, any  
 18 counterfactual work done afterwards which shows whether  
 19 or not it was ever possible at all that those measures  
 20 would have sufficed on their own or are we in  
 21 the territory of, well, they might well have worked but  
 22 we'll never know?

23 **A.** Well, I mean, the policies we actually modelled in  
 24 Report 9 were considerably less stringent than  
 25 the lockdown of 23 March, but the reason for that is

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1 the then Covid restrictions, have you said in your  
 2 statement that the strategy failed to learn perhaps  
 3 the most important lesson from March 2020, namely that  
 4 acting early saves lives and costs no more economically  
 5 than acting late?

6 **A.** Mm-hm.

7 **Q.** That is of particular application, is it not, to  
 8 the debate about whether there should have been  
 9 a circuit breaker in September/October or an earlier  
 10 lockdown earlier than the date in November on which it  
 11 was actually imposed?

12 Did you produce models and documents in September on  
 13 behalf of ICL but also before SAGE making plain that at  
 14 various stages various levels of quite stringent NPIs  
 15 would be needed to slow or reverse the exponential  
 16 growth in the virus as you saw it to be?

17 **A.** Yes, I did. And I'd like to place it into context, that  
 18 first of all the efforts between April and September to,  
 19 in some sense, reduce transmission through other means,  
 20 through test and trace, through making environments  
 21 Covid-safe, did have a marked effect. So we were not  
 22 facing quite the same situation in September/October  
 23 that we were facing in March 2020. We were facing  
 24 a growth rate, a reproduction number of more like 1.4,  
 25 1.5 rather than one of nearly 3. But it -- as all the

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1 modelling we had done all the way back in April of exit  
 2 strategies and lockdown had indicated, it just wasn't  
 3 sufficient. So in that context of exponentially growing  
 4 levels of infection, hospitalisation in  
 5 September/October, yes, we undertook a lot -- well, we  
 6 undertook, first of all, for SPI-M, along with other  
 7 groups, modelling of likely scenarios going into  
 8 the winter and the potential impacts of control  
 9 policies, anticipating, indeed, even before Alpha was  
 10 announced, the likely necessity of a third lockdown in  
 11 January 2021. And -- but I also contributed, with  
 12 Matt Keeling and with John Edmunds, to a table of  
 13 potential non-pharmaceutical interventions which could  
 14 be considered by the government if they wanted to  
 15 escalate from what the current policy was.

16 **Q.** As had been foreseen in February/March, because it is  
 17 part of a viral epidemic, there was a second wave?  
 18 **A.** I mean, a catastrophic second wave.  
 19 **Q.** Even though there had been Covid-safe measures to some  
 20 degree put in place and even though there was longer  
 21 warning of the breaking of that wave, the number of  
 22 deaths in fact exceeded those in the first wave?  
 23 **A.** I mean, by two-fold, yes.  
 24 **Q.** And do you say in your statement, therefore, that  
 25 the policy of acting incrementally and as late as

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1 were draft documents prepared some time before the leak?  
 2 **A.** My concern with it is they weren't any sort of  
 3 prediction, they were a commission to develop in some  
 4 sense reasonably bad scenarios for the winter, before  
 5 the tier system had even been introduced, and they had  
 6 been superseded by, you know, more recent and calibrated  
 7 projections of what the epidemic was going to be. So it  
 8 felt like deliberately pessimistic figures were being  
 9 produced, and I felt that, you know, that wasn't the --  
 10 I mean, the more recent figures were also -- I think  
 11 could have made the point equally well.

12 **Q.** The position was that, together with the other research  
 13 groups, you had prepared documents for a specific  
 14 purpose, in fact to identify a particular reasonable  
 15 worst-case scenario, a very pessimistic scenario, and  
 16 you have had done so some weeks before --  
 17 **A.** Well, not very pessimistic, somewhat pessimistic.  
 18 **Q.** Somewhat pessimistic. But in the event those slides  
 19 came to be used --  
 20 **A.** Almost as if they were predictions, yes.  
 21 **Q.** All right. And there was a considerable press and  
 22 public turmoil concerning --  
 23 **A.** Yes.  
 24 **Q.** -- the production of those documents.  
 25 Finally, in relation to SAGE, which I said I would

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1 possible, in the end -- to prevent NHS capacity again  
 2 from being exceeded -- had a significant impact upon the  
 3 number of deaths?  
 4 **A.** Yes.  
 5 **Q.** The local tier system in October 2020 you criticise.  
 6 You make the point that SAGE and SPI-M-O were not  
 7 consulted about the introduction of the local tier  
 8 system, and you describe it as being flawed in its  
 9 implementation. Was it in essence a form of  
 10 epidemiological levelling up?  
 11 **A.** Mm.  
 12 **Q.** Everywhere would find itself inevitably in the highest  
 13 tier?  
 14 **A.** Eventually, yes. It was sort of delaying the  
 15 inevitable, and of course that has a public health,  
 16 a human consequence in terms of hospitalisations and  
 17 deaths.  
 18 **Q.** You state in your statement that you fully agreed with  
 19 the decision to introduce the second lockdown, that is  
 20 the lockdown in November 2020. There was an issue, was  
 21 there not, around about 31 October, when slides  
 22 developed in this ensemble process that you've  
 23 described, prepared by Imperial, Warwick, London School  
 24 of Hygiene and Tropical Medicine and Public Health  
 25 England, Cambridge, were leaked, were they slides which

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1 come back to, drawing together, and you address SAGE in  
 2 multiple places in your statement, would it be fair to  
 3 say that you have expressed a number of views about  
 4 particular aspects of the way in which SAGE operated?  
 5 **A.** Mm-hm.  
 6 **Q.** Firstly, in relation to its make-up, that is to say its  
 7 membership, do you have anything to say in relation to  
 8 whether or not it was dominated by epidemiologists,  
 9 modellers and behavioural scientists or whether it had  
 10 a sufficient number of pandemic management experts,  
 11 public health experts and experts outside your  
 12 particular field?  
 13 **A.** So I think it evolved over time. So in the very  
 14 earliest stages of the pandemic it was a small group.  
 15 I should say, there were typically always two members  
 16 of -- senior members of Public Health England present to  
 17 represent public health, so it wasn't that it was not  
 18 present, but in terms of independent expertise there  
 19 were a number of gaps. Many discussions around,  
 20 you know, why wasn't economics, more social science  
 21 represented. And I would have -- I mean, I think that  
 22 would have been to the good.  
 23 **Q.** You have, secondly, addressed this issue of the  
 24 commission basis upon which SAGE was approached. Would  
 25 you agree that a byproduct of that basis, that system by

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1 which the government approached SAGE and said "Could you  
2 please address the following specific issues", that SAGE  
3 did not feel able to raise issues of its own accord or  
4 proactively make recommendations to the extent it might  
5 otherwise have preferred?

6 **A.** Yes. I mean, I do.

7 I mean, I frame that in a broader context, that  
8 I think SAGE became almost the normative source of  
9 public health advice, certainly for the early months of  
10 the pandemic, and I don't think it was ever properly  
11 constituted to act in that role.

12 I mean, I think -- my own view is that most  
13 countries, not all, but most countries which handled the  
14 pandemic better had empowered public health agencies  
15 informed by independent scientific advice, but that is  
16 the appropriate body which should be informing  
17 government policy on something on the magnitude of  
18 a pandemic, not a professor from Imperial.

19 **Q.** Thirdly, you've described how there was a process of  
20 reaching consensus. Is it possible that that process of  
21 reaching consensus, which reached its fruition in  
22 the documents which were produced, may have perpetuated  
23 a status quo, it may have led to inaction, because the  
24 government, when reading those documents, would have  
25 been unaware of the range of views which were actually

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1 determined by what, you know, what policy objectives  
2 you're trying to achieve.

3 **Q.** The evidence shows multiple communications between  
4 yourself and the Chief Medical Officer and the  
5 Government Chief Scientific Adviser outwith the  
6 framework of SAGE. Does that indicate that the funnel  
7 by which SAGE's views were communicated to government  
8 through the CMO and the CSA personally were not working  
9 as effectively as they might?

10 **A.** I think it more indicates the fact that it's -- in many  
11 cases it was difficult to have a free-flowing discussion  
12 of technical points within SAGE meetings, in my  
13 experience. That was partly rectified, you know, from  
14 about April onwards by Patrick Vallance having informal,  
15 small-group meetings to talk things through, but most of  
16 those email exchanges are around, I mean, you know,  
17 Chris or Patrick bouncing ideas, wanting clarification.

18 I think, thinking more -- I think there are better  
19 ways of having structures which allow for that in a more  
20 formal way than emails, if that was your question.

21 **Q.** If you had been satisfied that your views were properly  
22 reflected in SAGE, and communicated to the government  
23 through the CMO and the CSA --

24 **A.** Yes --

25 **Q.** -- you would not have, yourself, written directly to

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1 expressed?

2 **A.** I think that was a risk, and I would certainly recommend  
3 that full -- I mean, more comprehensive minutes are  
4 produced in future, along with a -- then probably  
5 accompanied by a summary, but minutes could give -- true  
6 minutes give a much better sense of debate and  
7 discussion.

8 **Q.** You have described, Professor, how there were occasions  
9 when you did not -- and these are my words, not yours --  
10 speak out when you might have done so, because there was  
11 a lack of understanding as to what the government's aims  
12 were, what its objectives were, what it wanted.

13 **A.** I think that was true throughout 2020. 2021, it was  
14 much clearer.

15 **Q.** There's next then the issue of "following the science".  
16 Did you feel that the mantra of "following the science"  
17 blurred the boundaries between scientific advice and  
18 policy decision-making, and also perhaps lead to  
19 an unwanted pressure upon SAGE itself?

20 **A.** Yes, because there is no such thing as really "following  
21 the science". I mean, policy is there to achieve --  
22 I mean, science informs policy in the sense of saying  
23 what is possible, what the likely impacts of both  
24 the virus and policies will be, but it doesn't  
25 predetermine a single best strategy, that's obviously

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1 a Downing Street adviser, would you?

2 **A.** That is certainly true, yes.

3 **Q.** Then finally, what was your view on the diversity of  
4 SAGE? Would you agree, Professor, that, as one of the  
5 leading lights of one of the most powerful research  
6 groups, SAGE may have become too clubbable, too  
7 dominated by major teaching and research institutions?

8 **A.** Certainly there was a type. I mean, I think both gender  
9 diversity and minority ethnic group diversity could be  
10 better reflected in future crises.

11 As for -- I mean, to be honest, I'm sure both  
12 Chris Whitty and Patrick Vallance would say this, that  
13 you do want the leading experts in their respective  
14 fields to be represented on a committee like that, so  
15 there is always a preponderance of people from certain  
16 institutions.

17 **Q.** Lastly, Professor, it is of course well known that you  
18 resigned from SAGE on 6 May 2020 for personal reasons.  
19 Do you accept, putting aside some of the public  
20 reaction, fundamentally damage was done to public trust  
21 in government structures because you were seen, wrongly  
22 as it happened, to be part of the government and  
23 therefore there was a damaging effect on compliance  
24 and --

25 **A.** I mean, yes, I breached lockdown rules and I apologised

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1 for that and I apologise again, and I think that and  
2 later incidents certainly didn't help with public trust.  
3 And I think being -- yes, I wasn't a government servant,  
4 I wasn't a government employee, but I still recognise  
5 the consequence of those actions.

6 **MR KEITH:** Thank you, Professor.

7 My Lady, there are a number of Rule 10 questions.

8 **LADY HALLETT:** I am afraid it's not quite over yet,

9 Professor, I'm afraid.

10 Ms Morris, I think you have some questions.

11 **Questions from MS MORRIS KC**

12 **MS MORRIS:** Thank you, my Lady.

13 Professor Ferguson, I ask questions on behalf of  
14 the Covid Bereaved Families for Justice. I'm going to  
15 ask you on a single topic about restrictions on mass  
16 gatherings, which is important as members of the groups  
17 that I represent had families who attended those mass  
18 gatherings and contracted Covid-19 as a result.

19 Now, my Lady's already asked you a question about  
20 mass gatherings, and Mr Keith has taken you to  
21 the substance of your advice, and that developed by  
22 SAGE, and you have been asked directly why  
23 the precautionary principle was not applied in the same  
24 way that it was to schools. So my remaining question is  
25 about the process of the advice around mass gatherings.

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1 **Q.** Thank you.

2 Going back to page 1, if we may, and just to  
3 the beginning of that email, and just highlighting that  
4 first paragraph, please, this is the beginning of it:

5 "Do let me know if you are happy for me to send to  
6 DCMS, also please note that I have included the comments  
7 from academics/modellers but not sure how happy they  
8 will be that their *assumption heavy* views will be shared  
9 but have caveated that their opinions are not based on  
10 data."

11 My first question is: did you know that this view  
12 was being shared?

13 **A.** No.

14 **Q.** No. Have you later become aware that it was shared?

15 **A.** Yes.

16 **Q.** Roughly when, can you assist?

17 **A.** I mean, I think as part of this public inquiry.

18 **Q.** Okay, thank you, that's helpful.

19 Do you agree that your view was assumption-heavy, as  
20 the caveat indicates?

21 **A.** Given that -- at the time, yes.

22 **Q.** Thank you. Back to page 2, please, if we may, just  
23 before the summary of the modellers, it says in red:

24 "... please note that there is no data to support  
25 the following."

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1 I'd like you to look, please, at an email,

2 INQ000047898, please. Thank you.

3 Just looking at the first paragraph and the  
4 attendees in highlight, first, if we may. This is  
5 an email dated 27 February 2020. It's an email from  
6 Professor Sir Jonathan Van-Tam to, amongst others,  
7 Oliver Dowden -- it discusses a meeting between himself  
8 and Oliver Dowden, the then Secretary of State for  
9 Digital, Culture, Media and Sport, and it includes  
10 a summary of the meeting. It's a minute being  
11 circulated after with accompanying comments, you will  
12 see on page 2, from yourself.

13 Can you see there "Comments from modellers", and  
14 your name is the second in bold there.

15 Have you seen this email before, Professor?

16 **A.** I believe I have, yes.

17 **Q.** Thank you.

18 The meeting itself between Professor Sir  
19 Jonathan Van-Tam and Mr Dowden and others was about mass  
20 gatherings, and the summary of your views on page 2, we  
21 don't need to look at the substance of it, but do you  
22 agree there with the summary that's provided in  
23 the email?

24 **(Pause)**

25 **A.** Yes, it's a reasonable summary.

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1 Do you agree with that caveat?

2 **A.** No data directly for Covid. There was data for other  
3 diseases which have similar transmission patterns but  
4 not for Covid.

5 **Q.** Understood. In providing the view that is represented  
6 in this email, had you conferred with colleagues in  
7 South East Asia on the issue before providing this view  
8 in whatever context?

9 **A.** I mean, certainly we had -- I discussed with colleagues,  
10 not specifically because of this email or the request  
11 but the issue of restricting gatherings had been  
12 discussed in -- with colleagues around the world.

13 **Q.** Thank you.

14 **A.** I should maybe add that we have published analyses of  
15 the effect of restricting gatherings of different sizes.  
16 I mean, over the course of the pandemic, drawing on  
17 experience across multiple countries, and I'm happy to  
18 share those if it's helpful.

19 **Q.** Thank you, no, it's just simply the information that you  
20 were pulling together for this summary.

21 So my point really is that there was a SAGE meeting  
22 as well on that date, this is 27 February. We can go to  
23 the minutes if you like, but I think you can take it  
24 from me that there was a SAGE meeting --

25 **A.** Yes.

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- 1 Q. -- on that day, and both yourself and  
2 Professor Sir Jonathan were there. How comfortable are  
3 you with your individual views on a topic such as mass  
4 gatherings being shared via email as opposed to being  
5 shared within the consensus statement of the SAGE  
6 minutes?
- 7 A. My preference in all of these, it would have been better  
8 for a summary opinion from SAGE or SPI-M, probably  
9 including SPI-B, to be written. My understanding, and  
10 it is a long time ago, was that Jonathan Van-Tam wanted  
11 an urgent and quick opinion rather than having the time  
12 to go through the formal process. But I would agree  
13 a more considered and consensus view would be  
14 preferable, clearly.
- 15 Q. Particularly when the two things happen on the same day,  
16 is that fair?
- 17 A. Yes, yeah.
- 18 Q. The email is on the same day as the SAGE meeting?
- 19 A. I should say it wasn't unusual, that timescale of  
20 getting advice.
- 21 MS MORRIS: I see. That's helpful. Thank you, Professor.  
22 Thank you, my Lady.
- 23 LADY HALLETT: Thank you, Ms Morris.  
24 Ms Gowman.

**Questions from MS GOWMAN**

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- 1 paragraph 12 to be understood by the Prime Minister,  
2 that no regulations were imposed despite that identified  
3 risk. Can you see that?
- 4 A. Yes.
- 5 Q. To your knowledge, Professor, has there been any  
6 statistical analysis of the likely impact on mortality  
7 and healthcare burden in Wales of not implementing  
8 border controls between England and Wales specifically?
- 9 A. Specifically, no. I think there has been some  
10 consideration and analysis not by my own -- maybe even  
11 by my own group, but certainly by other groups, of the  
12 extent to which -- this is when Covid was endemic in  
13 the UK, as it is today, of how the extent to which  
14 infections get moved from area to area, so there is some  
15 analysis of that. I'm not completely familiar with it  
16 all.
- 17 Q. So when you said within your statement that there was no  
18 evidence to suggest that -- there was evidence to  
19 suggest that border controls would have little impact on  
20 the final mortality and healthcare burden, that was not  
21 specifically to Wales, and is it fair to say that you  
22 can't comment on the position in respect of Wales?
- 23 A. I think that would be fair. I was thinking of  
24 the international borders.
- 25 Q. Thank you, Professor.

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- 1 MS GOWMAN: Thank you, my Lady.  
2 Professor, I ask questions on behalf of Covid  
3 Bereaved Families for Justice Cymru. First, at  
4 paragraph 164 of your statement, you opine that border  
5 controls had little impact on the final mortality and  
6 healthcare burden. When you made that statement, were  
7 you aware of the First Minister for Wales' requests of  
8 the Prime Minister for enforceable restrictions to  
9 control the border between England and Wales?
- 10 A. I wasn't, no.
- 11 Q. For context, therefore, please can we display  
12 exhibit INQ000083851.  
13 These are the COBR meeting minutes from  
14 12 October 2020, and if we turn to page 7 of that  
15 document, and specifically turn to paragraph 11, we see  
16 an example of the First Minister highlighting his belief  
17 that cross-border travel between areas of England with  
18 high infection levels and Wales left people situated  
19 within low areas of infection in Wales susceptible to  
20 increased risk.
- 21 A. So maybe I'll -- so I thought in your original question  
22 was in relation to kind of international travel. Okay,  
23 it's a slightly different context, yes.
- 24 Q. We can see from that document that, despite the concern  
25 identified by the First Minister, and said at

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- 1 The second topic relates to paragraph 141 of your  
2 statement, and the working group meeting convened on  
3 1 March 2020, to analyse key clinical variables for  
4 reasonable worst case planning for the NHS, which you've  
5 already touched upon in your evidence.  
6 It's right, isn't it, that there were no academics  
7 or NHS clinical leaders from Wales on that working  
8 group?
- 9 A. Sorry, remind me of the date again? It's quite hard  
10 to --
- 11 Q. 1 March. And if it assists, this is --
- 12 A. You're correct. To my knowledge there were no  
13 representatives from Wales in that meeting.
- 14 Q. With this in mind, what steps, if any, were taken by  
15 the working group, or indeed SAGE, who had commissioned  
16 the working group, to engage academics and NHS clinical  
17 leaders in Wales to seek to agree a co-ordinated  
18 approach on these very important issues that were  
19 discussed at the meeting?
- 20 A. I wouldn't be able to answer for the Chief Medical --  
21 I mean, if anything happened it would be via the Chief  
22 Medical Officer's office.
- 23 Q. Similarly, what steps, to your knowledge, were taken  
24 after the meeting to promptly share the important  
25 outcomes of that meeting with academics, NHS clinical

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1 leaders and decision-makers in Wales?

2 **A.** Again, I mean, the sharing would have been through  
3 the four, you know, devolved administrations and CMOs --  
4 four nations CMO group, to my knowledge.

5 **Q.** But from your perspective you didn't raise the alarm  
6 with your counterparts, for example, in Wales?

7 **A.** No, I mean, all SAGE business at that time was official  
8 sensitive.

9 **Q.** In a similar vein, at paragraph 27 of your statement you  
10 state that the MRC Centre for Global Infectious Disease  
11 Analysis staff were seconded to the UK government  
12 departments. What steps, if any, were taken to share  
13 the expertise of MRC GIDA with the Welsh Government?

14 **A.** So no ... the Welsh -- I mean, the Welsh Government and  
15 all devolved administrations were represented on SPI-M,  
16 and I was party to a number -- I would have to go  
17 back -- a number of conversations which involved them,  
18 some of which touched specifically on Wales. We did  
19 generate estimates every week of Welsh healthcare  
20 demand, the trajectory of the epidemic in Wales and  
21 Scotland and in Northern Ireland, not just in England.  
22 We just had a limited capacity and we're based  
23 in London, so -- and we were working flat out, we  
24 couldn't do any more than we were doing.

25 **MS GOWMAN:** Thank you, Professor.  
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1 particularly as the pandemic went on and capacity ramped  
2 up, yes, we could have done.

3 **Q.** Specifically, to give an example, could SAGE have  
4 evaluated the social and psychological impacts of  
5 non-pharmaceutical interventions on children  
6 specifically and provided the government with advice as  
7 to their suitability?

8 **A.** So, I mean, this is going outside my area of expertise  
9 but I believe SPI-B, the behavioural science group of --  
10 or subgroup of SAGE, could have done that, and there  
11 were a number -- in fact there were quite a number of  
12 working groups around, let's say, the broad both public  
13 health and educational effect of non-pharmaceutical  
14 interventions on children which I partly participated  
15 in, which involved the Department of Education and  
16 members of SPI-B and clinicians. But undoubtedly it  
17 could be -- it wasn't done in the way which I was  
18 suggesting there as a kind of commission to look at  
19 different policy options, it was more evaluating the,  
20 you know, role of children in transmission.

21 **Q.** Thank you.

22 Secondly, page 69 of the same statement,  
23 paragraph 219(a), this is a subparagraph on children and  
24 modelling, and you observed that the role of children in  
25 transmitting Covid was a topic of much activity and  
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1 My Lady, those are my questions, thank you.

2 **LADY HALLETT:** Thank you very much, Ms Gowman.  
3 Is it Mr Menon?

4 **Questions from MR MENON KC**

5 **MR MENON:** Good afternoon, Professor Ferguson, I ask a few  
6 questions on behalf of some children's rights  
7 organisations.

8 Firstly, could we have your first Module 2 witness  
9 statement on the screen, please, the reference is  
10 INQ000249526, and in particular page 123, paragraph 406.  
11 Do you have that?

12 **A.** Yep.

13 **Q.** You say, Professor, in that paragraph, that SAGE was  
14 never explicitly asked to evaluate what policies would  
15 lead to minimum use of economically and socially  
16 disruptive non-pharmaceutical interventions, and that  
17 perhaps a more appropriate use of SAGE would have been  
18 to review a range of strategic policy options drawn up  
19 by the government and to provide scientific challenges  
20 to their suitability in meeting the stated policy goals.

21 My question is this: if the government had asked  
22 SAGE to conduct such reviews of a range of strategic  
23 policy options, could SAGE have potentially done so?

24 **A.** Yes. There's always a limit in terms of bandwidth and  
25 capacity but, I mean, I believe in broad terms, and  
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1 discussion in SAGE during 2020.

2 Was there any discussion or acknowledgement in SAGE  
3 as to the differential impacts of non-pharmaceutical  
4 interventions on children as compared to adults?

5 **A.** I think in the initial stages of the pandemic, limited,  
6 just because of due to time, I think. The -- to be  
7 fair, I think I remember Chris Whitty raising it as  
8 an issue all the way back in February 2020, but it  
9 wasn't considered in the formal way. I think SAGE  
10 became more focused on both inequity of impacts of the  
11 pandemic and of interventions as 2020 progressed, but  
12 again SAGE was responding mostly to, you know,  
13 commissions for scientific advice rather than  
14 proactively coming up with a work plan.

15 **Q.** Understood. So no modelling done as such; is that  
16 right?

17 **A.** So ... I'm not sure there are models which can --  
18 I mean, so the mathematical models we use to model  
19 an epidemic, I mean, model outcomes on health typically.  
20 I mean, we have now coupled those models to economic  
21 models to model the impacts on the economy. As for  
22 modelling impacts on mental health, we haven't attempted  
23 to do that as yet, and in some sense it -- impacts on  
24 education I think would be, I mean, difficult to model  
25 and maybe not impossible, but not something we were ever  
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1 asked to do.

2 **Q.** Thank you.

3 Thirdly, I assume you were aware at the time that  
4 there were social distancing exemptions for children in  
5 Scotland but not for children in England from about  
6 July 2020 onwards.

7 Are you aware of any modelling that was done as to  
8 the impact of such a relaxation of the rules?

9 **A.** Actually, I mean, when I nodded, I mean, I thought you  
10 were going to say something else. I don't think I was  
11 aware -- you'll have to elaborate about what the  
12 relaxation was in Scotland for me to comment.

13 **Q.** Well, I mean, there were a number of relaxations.

14 I mean, for example, in July 2020 the need for  
15 children under the age of 12 to distance physically from  
16 each other was removed, not in England.

17 In September 2020, children under the age of 12 were  
18 exempt from the rule of six when it was reintroduced in  
19 Scotland.

20 I mean, those are just two examples, but there are  
21 others.

22 **A.** So I am not aware of certainly SPI-M being asked to look  
23 at exempting children from social distancing  
24 restrictions in England. I'm not aware really of SAGE  
25 discussions of that. So I think the -- Patrick Vallance  
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1 because children have very high close contact rates and  
2 connect households together. So if you're wanting to  
3 break chains of transmission, it is an obvious measure  
4 to start, and was adopted by nearly all countries in the  
5 first few months of the pandemic to varying degrees.

6 A more nuanced understanding of the role of children in  
7 Covid transmission then developed.

8 **Q.** Subsequently?

9 **A.** Yeah.

10 **MR MENON:** Thank you.

11 **LADY HALLETT:** Thank you very much, Mr Menon.

12 Mr Dayle.

#### 13 Questions from MR DAYLE

14 **MR DAYLE:** Thank you, my Lady.

15 Professor Ferguson, I ask questions on behalf of  
16 FEHMO, the Federation of Ethnic Minority Healthcare  
17 Organisations. I have five short topics.

18 Firstly, in the period leading up to the pandemic  
19 and in the early stages, did the data sources and  
20 modelling you've referred to include ethnicity?

21 **A.** Do you mean prior to 2020?

22 **Q.** Perhaps more specifically in the period of January 2020  
23 up to March/April 2020.

24 **A.** So none -- at that time, period none of the data we were  
25 provided with on surveillance -- well, that's not  
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1 and Chris Whitty will be able to give you a definitive  
2 view, but I don't think it was significantly considered  
3 at SAGE.

4 **Q.** Finally, page 54, at paragraph 174 of the same  
5 statement, please. In this paragraph, Professor, you  
6 mention a meeting in February 2020 when school closures  
7 was discussed by SAGE as a possible non-pharmaceutical  
8 intervention.

9 Thinking back, I appreciate it's a long time ago,  
10 but was this discussion of school closures before SAGE  
11 ever considered, for example, other non-pharmaceutical  
12 interventions such as closing pubs and non-essential  
13 shops, requiring adults to work from home? Can you  
14 help?

15 **A.** Yes. I mean, so case isolation and, you know,  
16 quarantine had been discussed earlier, but this was the  
17 first community measure which was discussed. The reason  
18 being is it was already one of the most commonly --  
19 I mean, you'll be aware that countries in East Asia were  
20 already responding to the pandemic and nearly all of  
21 them shut schools, and so we were looking at what's  
22 going on in Singapore, Hong Kong and other countries.  
23 And there is a -- I appreciate the social and emotional  
24 and mental health cost and educational cost of closing  
25 schools, but there is a rationale to it in many cases,  
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1 completely true. A small portion of the data we were  
2 provided on surveillance had ethnicity. It was  
3 incomplete in many cases, and therefore of difficult --  
4 difficult to use, but most data sources did not provide  
5 any information on ethnicity. Neither, therefore, was  
6 ethnicity considered in the analysis we were doing at  
7 the time.

8 That situation changed quite substantially over the  
9 following, I would say, three to four months, such that  
10 we were more able to -- it wasn't a primary focus, but  
11 we were more able to look at ethnicity in detailed  
12 epidemiological analysis of the impact of a pandemic on  
13 different groups.

14 **Q.** Okay.

15 In light of that evidence, can I ask you to reflect  
16 on that state of affairs: do you agree that ethnicity  
17 should have been a part of the mix of data sources that  
18 were under study, and included in the work in modelling  
19 that was pursued?

20 **A.** Yes, and I should say gender as well, because there were  
21 differences by sex in outcomes as well.

22 **Q.** Okay, thank you.

23 Secondly, in your first witness statement -- and you  
24 perhaps don't have to refer to it -- you note that you  
25 were not aware of any mechanistic models representing  
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1 variation by ethnicity and/or deprivation. Presumably  
2 you're referring to economic deprivation. And you cited  
3 two possible reasons: one, complexity of modelling  
4 required to do so and, secondly, data gaps.

5 So my questions are: appreciating that you have  
6 indicated that this is an area of current research for  
7 you at ICCRT, can you share any insight at this time as  
8 to whether it would have been possible to carry out such  
9 modelling during the Covid pandemic?

10 **A.** I think it wouldn't have been possible in the first few  
11 months, if it had been made -- I mean, we just didn't  
12 have time and we didn't have the data sources. If it  
13 had been a priority, then certainly by the end of 2020  
14 it would have been possible if it had been a priority.

15 I think it isn't a trivial undertaking because it  
16 increases, for the reasons I explain in my statement,  
17 the computational complexity of models quite  
18 dramatically. But let me put it this way, it is  
19 something we're actively working on and in future  
20 epidemics -- I hope I don't see another pandemic -- but  
21 I would very much hope that it is one of the factors  
22 included.

23 I would also say, I think, as well as differential  
24 impacts by minority ethnic group, there were also very  
25 significant differential impacts by, as you say, level  
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1 accumulated".

2 What specific data are you referring to there?

3 **A.** So I'm talking about individual level both case data,  
4 hospitalisation data and mortality data. So that data  
5 was -- only really became available after the initial  
6 decision to lock down. I mean, you heard the discussion  
7 of the poor data streams. But once we -- by late March,  
8 early April, we were getting regular detailed lists of  
9 cases, hospitalisation -- well, hospitalisations were  
10 later; cases and deaths, my -- some colleagues within  
11 the Imperial group were working closely with clinical  
12 colleagues in northwest London on detailed health data,  
13 so we were able to then look at ethnicity as a risk  
14 factor for both exposure and hospitalisation and death.

15 **Q.** Do you --

16 **LADY HALLETT:** I think you've had your time, I'm afraid,  
17 Mr Dayle.

18 **MR DAYLE:** Very well.

19 **LADY HALLETT:** I'm also not clear where these questions are  
20 on the ones I approved.

21 **MR DAYLE:** My understanding is that they are just a slight  
22 rephrase of the ones --

23 **LADY HALLETT:** You have one more minute, Mr Dayle.

24 **MR DAYLE:** Very well. I am most obliged.

25 Do you recall any data indicating a trend towards  
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1 of economic deprivation which -- we would like to be  
2 able to capture both, because both pointed to the fact  
3 that the poorest in society had the least ability to  
4 comply with measures, to work from home, were most  
5 exposed to the virus in health settings, in service  
6 jobs, and I think that should be better reflected in  
7 analysis and modelling going forward.

8 **Q.** Thank you.

9 Putting aside issues of modelling complexity and  
10 data gaps, are there any other factors that would have  
11 precluded ethnicity being considered in the work leading  
12 up to the early stages of the pandemic?

13 **A.** I mean, I can't see of any reasons it wouldn't be  
14 considered beyond those two, but those are kind of quite  
15 major hurdles.

16 **Q.** Thirdly, at paragraph 3.42 of your first statement, you  
17 state that the potential for unequal impacts was  
18 appreciated by SAGE from February 2020 onwards, and that  
19 you believe this was discussed frequently at SPI-B, that  
20 you've referred to. You refer specifically to  
21 care homes, low income households and low income  
22 population groups as being discussed in March 2020.

23 Then you go on in paragraph 3.44 to state that  
24 differences in impact between ethnic groups "began to be  
25 recognised from early April, once sufficient data  
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1 potential disparate impacts between ethnic groups coming  
2 towards April of 2020?

3 **A.** Yes, I mean, we published some early analyses. Also it  
4 didn't come as any surprise to me. I mean, pandemics  
5 build on the pre-existing health inequity, and there is  
6 already health inequity between ethnic -- inequity  
7 between different ethnic groups in the United Kingdom.

8 **Q.** And had a better data capture system been in place from  
9 the onset, does it follow that the disparate impact on  
10 some ethnic groups would have been identified sooner?

11 **A.** Perhaps. I can't be definitive about that, because it  
12 also partly depends on how much data has been  
13 accumulated.

14 **Q.** The penultimate topic: you state at paragraph 3.44 of  
15 your first witness statement that, despite the ICCRT  
16 publishing analysis on 29 April that identified two  
17 times higher risk of death for black patients, you  
18 believe that SAGE didn't review or discuss the data on  
19 ethnic inequalities until late May, with the first  
20 comment not being issued until 4 June; the Ethnicity  
21 Subgroup of SAGE was not formed until September.

22 So two questions: can you share any insights as to  
23 why there was such delay in responsive action?

24 **A.** As I think I've referred to earlier, SAGE was being  
25 bombarded with requests for evidence from government and  
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1 it was government which largely determined the topics,  
 2 certainly at that point in time, that SAGE was  
 3 prioritising.  
 4 **Q.** And finally, in your second witness statement at  
 5 paragraph 22, you explain you have been asked to comment  
 6 on specific questions regarding considerations of  
 7 vulnerable groups in modelling. You do not appear to  
 8 have been instructed specifically to address ethnicity  
 9 as a vulnerability. However, you were asked to address  
 10 "whether the public health response was sufficiently  
 11 targeted at those who were most vulnerable". In your  
 12 answer you refer to the elderly and those required to  
 13 shield, but not specifically to ethnicity.

14 And my question is: do you consider that more could  
 15 and should have been done to target minority ethnic  
 16 communities as vulnerable groups for interventions?

17 **A.** I mean, I think the -- the data is complex. A lot of  
 18 the vulnerability of minority ethnic groups is  
 19 associated with either occupational exposure or the  
 20 higher prevalence of comorbid conditions, and so it  
 21 counts -- those conditions, diabetes for instance,  
 22 were -- meant that individuals with those conditions,  
 23 regardless of ethnicity, were prioritised as vulnerable  
 24 groups.

25 So I can't give a simple answer, but just being of  
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1 **LADY HALLETT:** Very well, Mr Keith.  
 2 Apologies to our stenographer.

3 **MR KEITH:** Indeed.

4 **LADY HALLETT:** And apologies to Professor --

5 **THE WITNESS:** It's fine.

6 **LADY HALLETT:** -- Ferguson.

7 **Further questions from LEAD COUNSEL TO THE INQUIRY**

8 **MR KEITH:** Professor Ferguson, were you aware of the fact of  
 9 long-term sequelae being likely to be produced, to  
 10 occur, from previous coronaviruses like SARS and MERS?

11 **A.** I mean, I was aware of -- I mean, a lot of viral  
 12 infections can have long-term sequelae, but the  
 13 magnitude of those sequelae and the severity associated  
 14 with the original strain, particularly of SARS-CoV-2,  
 15 I was -- I did not anticipate.

16 **Q.** Can you explain why in your modelling you did not model  
 17 for long-term sequelae?

18 **A.** I mean, in the early months it was -- we had almost no  
 19 data to do so. It took quite a long time thereafter.  
 20 In terms of modelling long-term sequelae, in some sense  
 21 it's a risk associated with each infection, and so the  
 22 outputs of the existing models can be used to estimate  
 23 the burden without the models necessarily being  
 24 dramatically changed.

25 **Q.** Would you agree that if you model for death or acute  
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1 a specific ethnicity, independent of either occupational  
 2 exposure or comorbidities, I'm not -- to my knowledge,  
 3 I'm not aware of intrinsic differences by ethnicity in  
 4 Covid vulnerability.

5 **MR DAYLE:** Thank you, Professor.

6 Thank you, my Lady.

7 **LADY HALLETT:** Mr Dayle, I apologise. We were both right.

8 You were right that you did have permission to ask the  
 9 questions, I missed a sheet, but I think I was right on  
 10 the timing. Maybe we have been a bit mean with the  
 11 timing. So thank you very much for your questions.

12 I'm sorry for interrupting so --

13 **MR DAYLE:** Very well, my Lady.

14 **MR KEITH:** My Lady, no one is more sorry than myself, other  
 15 than perhaps Professor Ferguson, at the fact that I have  
 16 to lengthen the process, or ask for your permission to  
 17 do so.

18 We were provided with some six or seven pages of  
 19 separate topics which we gave assurances to the CPs that  
 20 CTI would sweep up in the course of a lengthy  
 21 examination.

22 We have been prodded by Mr Metzger, quite properly,  
 23 on behalf of the Long Covid groups that there was  
 24 an area consisting of four short questions which I did  
 25 not put to Professor Ferguson.

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1 infections in relation to a viral pandemic without  
 2 modelling for long-term sequelae, a misleading  
 3 impression may be given?

4 **A.** You are certainly not capturing all the morbidity caused  
 5 by a pandemic. I would argue that the things we did  
 6 capture gave a fairly grim picture of the risk Covid  
 7 paid -- posed, rather. We just had no detailed -- it  
 8 took months for detailed data on long -- to be  
 9 collected.

10 **Q.** Would you agree that in future, modelling of infectious  
 11 diseases should include potential long-term sequelae  
 12 from the outset?

13 **A.** I think long-term sequelae have been -- I don't think  
 14 this is an issue about modelling, I think long-term  
 15 sequelae of viral infections have been an understudied  
 16 area more generally, partly because they are hard to  
 17 resolve. Covid provided a one-off, in some sense,  
 18 horrible experiment which highlighted how important they  
 19 were and is there -- has therefore heightened their  
 20 importance as a research topic.

21 **MR KEITH:** Thank you.

22 **LADY HALLETT:** Thank you very much indeed,  
 23 Professor Ferguson, that is it.

24 I note in your statement that you say:

25 "In all my experience of working on the pandemic  
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1 I didn't encounter a government official, fellow  
 2 scientist or clinical colleague who was not working flat  
 3 out."  
 4 I think we've seen the proof of that in the timing  
 5 of some of the emails. So thank you very much for all  
 6 the work that you did during the pandemic, and your  
 7 colleagues.

8 (The witness withdrew)

9 LADY HALLETT: 10 o'clock tomorrow, please.  
 10 (5.00 pm)

11 (The hearing adjourned until 10 am  
 12 on Wednesday, 18 October 2023)

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195/8 206/1	174/23 177/25 181/24	<b>write [1]</b> 78/16	64/12 65/11 65/25	191/13 191/16 203/20
<b>willing [1]</b> 36/4	182/18 204/14 206/13	<b>writing [2]</b> 22/15 41/3	66/4 66/23 67/11	204/12 206/15
<b>winter [2]</b> 185/8	208/18 210/4 210/11	<b>written [6]</b> 37/15 63/5	71/13 72/9 73/4 73/23	<b>you'd [5]</b> 1/25 41/14
187/4	217/6	78/4 171/13 191/25	74/5 78/15 79/11	45/22 79/4 88/25
<b>withdrew [2]</b> 82/6	<b>workable [1]</b> 102/20	197/9	79/12 80/19 80/23	<b>you'll [10]</b> 87/1 123/3
217/8	<b>worked [10]</b> 2/10	<b>wrong [3]</b> 36/21	80/24 81/3 82/19	123/16 125/25 127/10
<b>within [36]</b> 3/4 3/6	2/16 62/2 70/12 82/17	90/24 92/22	90/23 91/22 92/5	145/8 156/20 156/21
3/7 4/7 4/19 22/19	103/21 107/14 116/15	<b>wrongly [1]</b> 192/21	92/13 94/2 94/16	205/11 206/19
30/18 30/25 33/19	181/21 182/21	<b>wrote [2]</b> 70/14 164/7	95/23 96/6 96/25 97/8	<b>you're [70]</b> 1/12 9/7
42/2 46/3 47/5 56/21	<b>worked-up [1]</b>	<b>Wuhan [12]</b> 12/20	97/15 101/20 101/23	10/20 11/2 13/11 14/9
56/22 62/13 65/11	107/14	12/22 13/17 17/11	102/7 102/22 103/13	16/10 17/24 24/9 26/2
65/14 70/20 88/18	<b>working [36]</b> 4/8 8/3	129/8 129/14 129/17	103/21 104/6 105/10	27/5 30/9 30/21 30/24
120/22 121/20 126/5	8/3 8/4 8/11 29/12	129/23 132/1 132/6	106/13 107/17 110/8	31/9 31/13 32/13
127/7 128/22 136/4	29/17 63/13 63/16	134/6 134/8	110/10 113/5 113/24	32/14 32/18 35/14
143/20 144/24 150/13	74/11 95/7 103/6	<b>Y</b>	114/3 118/20 119/19	36/17 39/14 42/1 42/5
152/6 153/7 156/10	106/19 116/5 121/13	<b>yeah [51]</b> 6/15 6/19	121/15 124/7 125/6	51/11 51/16 53/18
191/12 197/5 198/19	128/13 134/8 134/11	9/21 11/25 12/19	126/21 129/5 129/5	57/9 60/10 63/18
199/17 211/10	134/18 138/25 139/2	13/13 13/25 15/6 17/4	130/2 130/2 134/16	66/22 67/4 71/21 76/8
<b>without [11]</b> 16/2	154/10 169/15 169/20	18/20 22/12 23/16	134/24 137/24 139/19	76/8 80/4 80/24 98/11
22/24 22/25 30/16	177/2 191/8 200/2	24/4 25/15 26/16 27/8	139/24 140/7 141/3	101/2 101/4 104/8
34/24 48/11 48/18	200/7 200/15 200/16	27/9 27/19 30/3 30/10	141/14 142/5 147/1	105/11 105/12 111/23
74/2 179/22 215/23	201/23 203/12 209/19	30/10 32/17 32/20	148/6 149/4 150/25	112/1 114/14 117/23
216/1	211/11 216/25 217/2	37/18 38/2 39/7 42/23	151/7 151/18 153/13	119/7 127/13 129/1
<b>witness [14]</b> 1/4 1/11	<b>working-level [1]</b>	44/20 45/6 46/2 46/6	158/3 158/24 159/17	132/18 138/22 139/25
2/8 47/15 78/2 82/6	63/13	46/6 48/13 49/6 53/13	161/11 161/11 162/12	142/23 146/7 149/13
82/7 113/10 130/10	<b>workings [3]</b> 8/5	60/7 67/25 69/2 70/21	163/2 164/16 164/21	150/1 167/4 170/19
202/8 208/23 212/15	49/10 162/9	71/10 72/2 73/23 80/6	165/8 166/9 167/16	171/5 176/23 176/24
213/4 217/8	<b>workplace [3]</b> 115/24	96/14 97/23 100/14	168/14 170/20 175/15	177/12 178/23 179/2
<b>witness's [1]</b> 81/25	151/24 177/8	152/22 163/5 173/1	180/1 184/17 185/5	181/16 191/2 200/12
<b>witnesses [3]</b> 1/25	<b>workplaces [1]</b>	197/17 207/9	185/23 186/4 186/14	207/2 209/2
72/15 73/24	153/17	<b>year [2]</b> 99/2 154/25	187/20 187/23 189/6	<b>you've [46]</b> 1/23 8/10
<b>woke [1]</b> 37/20	<b>works [2]</b> 103/10	<b>years [8]</b> 2/17 82/18	190/20 191/24 192/2	8/19 42/10 47/1 53/5
<b>women [1]</b> 64/18	110/3	83/9 83/19 90/18	192/25 193/3 194/16	55/22 59/22 60/8 62/3
<b>won't [3]</b> 15/18 173/3	<b>workstream [1]</b>	98/12 99/25 102/25	194/25 195/15 195/21	62/12 68/22 70/17
173/7	101/21	<b>yep [24]</b> 1/22 3/3	196/25 197/17 198/23	74/6 77/9 78/4 78/8
<b>Woolhouse [8]</b> 8/14	<b>world [9]</b> 21/19 31/7	3/25 4/5 8/21 16/9	199/4 202/24 203/2	78/23 80/3 84/13
14/7 53/19 59/6	70/8 82/24 98/25	24/19 26/24 30/10	206/15 208/20 212/3	103/21 108/11 123/15
107/23 110/24 165/17	126/17 135/11 141/24	31/6 38/10 38/12	<b>yesterday [3]</b> 8/14	125/1 125/22 128/9
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<b>Woolhouse's [1]</b>	<b>worried [3]</b> 59/6 76/1	46/25 52/3 53/9 70/23	<b>yet [2]</b> 193/8 204/23	152/23 157/17 157/20
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25/16 29/24 30/3 30/4	<b>worse [1]</b> 163/24	<b>yes [183]</b> 1/24 2/3 2/7	13/14 19/3 26/17	181/2 181/5 186/22
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<p><b>Y</b></p> <p><b>your [195]</b> 1/9 1/14  2/8 2/8 2/10 5/11 6/17  6/23 7/12 8/10 8/12  8/18 8/22 11/2 11/6  14/21 17/13 18/6  18/14 20/20 22/10  23/17 25/5 26/1 26/22  27/11 27/14 27/19  27/22 28/7 28/13  30/25 32/12 34/8  34/22 35/2 35/12  46/13 47/15 47/17  49/15 51/25 52/5  54/19 54/23 55/22  55/25 57/4 57/14  57/21 58/10 58/25  59/2 59/10 59/19  59/25 60/16 62/3 62/5  64/13 66/10 66/12  67/13 67/17 68/16  69/13 69/17 71/12  71/19 72/17 72/18  74/8 77/11 77/14 78/2  79/21 80/16 81/16  82/13 82/14 82/20  83/24 83/25 84/12  84/24 84/25 85/2  86/11 86/12 86/17  86/22 87/10 88/6  88/12 88/12 88/24  92/2 92/25 93/3 93/10  95/4 95/8 96/13 97/21  98/2 99/8 101/3 110/1  111/10 113/10 118/4  118/15 119/13 126/7  127/17 127/17 128/4  128/5 129/7 129/10  129/12 129/14 129/22  130/9 131/17 131/23  134/22 135/10 135/23  135/24 136/6 139/5  140/2 143/22 144/14  144/14 151/19 151/20  153/1 154/7 155/22  159/3 160/23 161/2  162/8 163/12 166/23  169/8 169/11 170/10  172/4 172/9 173/4  174/12 174/19 179/12  179/19 180/19 183/9  183/9 184/1 185/24  186/18 188/2 188/11  191/20 191/21 192/3  193/21 194/14 194/20  195/19 197/3 198/4  198/21 199/5 199/17  200/1 200/5 200/23  201/5 201/6 201/9  202/8 208/23 210/16  211/16 212/15 213/4  213/11 214/11 214/16  215/16 216/24 217/6</p>	<p><b>yours [4]</b> 16/6 48/10  56/25 190/9</p> <p><b>yourself [18]</b> 59/23  77/12 86/2 86/21  88/23 98/2 105/4  121/22 128/5 159/19  162/7 173/14 173/16  175/5 191/4 191/25  194/12 197/1</p> <hr/> <p><b>Z</b></p> <p><b>zoonotic [2]</b> 132/15  132/20</p>			
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