Witness Name: Dame Angela McLean

Statement No.: 1

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UK COVID-19 INQUIRY

WITNESS STATEMENT OF
PROFESSOR DAME ANGELA MCLEAN

I, Professor Dame Angela McLean, will say as follows:

INTRODUCTION

1. This witness statement is provided in relation to a Rule 9 request from the Inquiry, dated 5 September 2023. I have previously provided the Inquiry with a Questionnaire Response dated 3 August 2023, addressing a Rule 9 request dated 13 July 2023 [DAM/1 **INQ000232197**]. In the expectation that this statement will be treated as a standalone document, I quote or paraphrase the Questionnaire Response where appropriate. At points throughout this statement, I have also gratefully adopted the more detailed explanations of various issues given by my colleagues, and will indicate the points of agreement.

QUALIFICATIONS, CAREER AND PROFESSIONAL EXPERIENCE

2. On 3 April 2023, I became the UK Government Chief Scientific Adviser ("GCSA"), a position previously held by Sir Patrick Vallance. As Module 2 of the Inquiry focuses on the period from early January 2020 until February 2022, this statement also focuses on that period, and not my current role. The role of the GCSA is summarised in Dr Wainwright's third statement [DAM/2 **INQ000148407** – paragraph 14]; there has been no relevant change to that the role since my appointment.

3. Prior to becoming the GCSA, I was the Chief Scientific Adviser ("CSA") for the Ministry of Defence ("MoD") between 2019 and 2023. The role of the CSAs is set out in Dr Wainwright's third statement [DAM/2 **INQ000148407** – paragraphs 23-32]. This was a very broad role, for which I applied because I had always had an interest in science advisory roles; I previously had experience on the Science Advisory Councils of a number of different Whitehall departments, as an independent expert adviser.

4. During the period that the Scientific Advisory Group for Emergencies ("SAGE") was activated in respect of the Covid-19 pandemic, (see detail below), I acted as the deputy GCSA, from Spring 2020. This role included standing in for occasional press briefings and signing off some papers on behalf of SAGE.

5. Before my appointment to GCSA, I was also a Professor of Mathematical Biology in the Department of Zoology at Oxford University and a Fellow of All Souls College. My research interests and expertise lie in the use of mathematical models to aid our understanding of the evolution and spread of infectious diseases. I am also interested in the use of natural science evidence in formulating public policy and I co-developed the Oxford Martin School Restatements: an activity which restructures and presents the evidence underlying an issue of policy concern or controversy in a short, uncharged, intelligible form for non-technical audiences.

6. The below is a summary of my qualifications, career history and prizes:

Qualifications

1983-1986	PhD in Biomathematics, Imperial College London
1982-1983	Graduate Student, University of California
1979-1982	BA in Mathematics, Somerville College, University of Oxford

Career History

2023 - present	Government Chief Scientific Adviser
2019-2023	Chief Scientific Adviser for the MoD
2008-2023	Senior Research Fellow, All Souls College, University of Oxford
2000-2008	Professor of Mathematical Biology, University of Oxford and Fellow of St Catherine's College, Oxford
1990-1998	Royal Society University Research Fellow, Oxford (seconded 1994-98 to the Institut Pasteur, Paris)

Prizes

2009	Elected a Fellow of the Royal Society
2011	Royal Society Gabor Medal for work on the mathematical population biology of immunity
2018	Weldon Memorial Prize
2018	Received a damehood in the Queen's Birthday Honours List.

7. A full list of publications is available online [DAM/3 **INQ00031727**

SAGE AND SPI-M-O

8. By way of summary, I was a participant in SAGE from 11 February 2020 to 10 February 2022 and in SPI-M-O (the Scientific Pandemic Influenza Group on Modelling, Operational) from 27 March 2020 to 23 March 2022.

9. As the Inquiry has already heard from a number of witnesses, SAGE exists to provide independent science advice in civil emergencies to decision-makers in government. For an overview of SAGE, I adopt the description in Dr Wainwright's third statement [DAM/2 **INQ000148407** – paragraphs 44 – 50].

10. I was invited to join SAGE by its co-chair and the then GCSA Sir Patrick Vallance, and the first SAGE meeting I attended was SAGE 6 on 11 February 2020 [DAM/4 **INQ000061514**]. I attended 89 SAGE meetings between 11 February 2020 and 10 February 2022, and my presence is recorded in the SAGE minutes. My attendance was initially as the CSA for the MoD and then later also as SPI-M-O co-chair (discussed below).

11. My role on SAGE was to contribute to the development of the consensus advice SAGE formulated, and to present consensus statements and papers from SPI-M-O. Consensus positions on modelling were often established in SPI-M-O before being presented to SAGE for discussion. At each SAGE meeting, the extent of my participation depended on the expertise required for the issues under discussion.

12. SPI-M (the Scientific Pandemic Influenza Group on Modelling) is a modelling sub-group of the Scientific Pandemic Influenza Advisory Group ("SPI") within the Department of Health and Social Care ("DHSC"). In non-emergency periods, SPI-M provides expert advice to the government based on infectious disease analysis, modelling and epidemiology. The last meeting of SPI-M prior to the COVID-19 pandemic was in July 2019. I was not a member of SPI-M.

13. During a civil emergency, SPI-M-O can be stood up as a sub-group of SAGE to support the government's emergency response. As such, during the pandemic, SPI-M-O was a sub-group of SAGE, tasked with mathematically modelling the transmission of

CovidVID-19, as is recorded in the minutes of the first "full" SAGE meeting on 28 January 2020 [DAM/5 **INQ000061510** - paragraph 4].[1]

14. I was appointed as co-chair of SPI-M-O on 27 March 2020. Sir Patrick Vallance asked me to take up the role to replace Sir Jonathan Van-Tam, who I understand was needed elsewhere in government [DAM/6 **INQ000317531** [DAM/7 **INQ000317537** I was the executive co-chair, working alongside Professor Medley who was the academic co-chair. The first meeting I attended and co-chaired was on 30 March 2020 and I remained co-chair until SPI-M-O was stood down in the spring of 2022. During this period, I attended 81 SPI-M-O meetings.

15. As executive co-chair of SPI-M-O my main role was to act as the most senior link between SPI-M-O and government. My role as co-chair also included, but was not limited to, commissioning work and signing off consensus statements before they went to SAGE. Civil servants would contact me to ask questions about how to frame their commissions for modellers. This role drew on my experience in science advisory roles within government, and my interest in using data to support policy decision-making. From January 2021 onwards I frequently attended daily Cabinet Office-led Covid-19 Taskforce analysis meetings to answer questions on the latest epidemiology and modelling. From early 2021, I also arranged for Nick Davies and Louise Dyson, both participants of SPI-M-O, to join the Covid-19 Taskforce as part-time secondees to hear directly what questions were arising within the Cabinet Office, to facilitate a form of instant commissioning. This also increased SPI-M-O's exposure to government decision-making and built important relationships between modellers and government during the pandemic.

16. I am asked by the Inquiry the extent to which I consider that my appointment as executive co-chair improved interactions between SPI-M-O members and the government. As I was not a member of SPI-M-O until I was appointed as co-chair, I cannot speak to what interactions with government were like before I took on the role. In his statement, Professor Medley observes that my appointment "*was a very significant step and greatly improved the interactions between SP-M-O members and government. The principal improvements were better understanding of what modelling could and could not do within government, and the consequent improved efficiency of what SPI-M-O did"* [DAM/8 **INQ000260643** – paragraph 3.50]. As I discuss in more

[1] This meeting is generally referred to as SAGE 2. SAGE 1 was the precautionary SAGE meeting convened on 22 January 2020, before the first COBR (M) meeting.

detail below, in the early months of the pandemic a lot of work was done on improving commissioning across government. This work paid off, especially in early 2021 as Professor Medley observes in his statement [DAM/8 **INQ000260643** – paragraph 12.13].

17. As academic co-chair, Professor Medley took responsibility for presenting SPI-M-O work to SAGE, with me in a supporting role. I agreed the SPI-M-O work plan jointly with Professor Medley, where I would sense check tasking that he suggested, and we both gave some assistance in the drafting of the SPI-M-O consensus statements. Professor Medley had been the academic chair of SPI-M for almost three years beforehand, so had an established working relationship with the SPI-M secretariat. He brought an extensive knowledge of the modelling research community to his role, so advised on the membership of SPI-M-O, which he details in his statement [DAM/8 **INQ000260643** – paragraphs 3.18 – 3.19]. We had a close working relationship, with the benefit of having known each other from the earliest stages of our academic careers. Professor Medley sets out his duties as co-chair in his statement in more detail [DAM/8 **INQ000260643** – paragraph 3.44].

18. SPI-M-O produced consensus statements which were reported to SAGE, as discussed further below. Once it became practice to publish everything that went before SAGE, these consensus statements were published along with all the other papers presented to, and considered by, SAGE. SPI-M-O and other sub-groups produced most of the written evidence considered by SAGE. The role of SAGE was then to bring together the work of the sub-groups, and to facilitate an external, interdisciplinary critique of the evidence that those sub-groups presented to SAGE, and to formulate science advice informed by those discussions on a consensus basis. The CMO and GCSA then produced minutes of these discussions.

19. Effective working between sub-groups required good communication facilitated by co-membership and interconnection. For example, Professors Edmunds and Ferguson were both participants of NERVTAG and SPI-M-O; participants of other sub-groups such as SPI-B would come to SPI-M-O meetings to ask questions and understand the modelling; and participants of SPI-M-O did the same with other sub-groups like SPI-B, which I thought was a great benefit. I would recommend that co-membership between sub-groups is actively encouraged in any future emergency response. I refer the Inquiry to Professor Medley's considered thoughts on the relationship between SPI-M-O and other sub-groups [DAM/8 **INQ000260643** – paragraph 3.4], with which I agree.

20. The academic diversity of SAGE was very broad, and it constituted a range of scientific disciplines relevant to the pandemic. SAGE participants came from different stages in their respective careers, from mid-career onwards. Amongst the SAGE participants, gender diversity was quite high. SPI-M-O recruited a good proportion of the relevant academic expertise in the UK. It was a great strength of the sub-group that three large research groups that would have been competitors in 'peace-time' were represented and were very active contributors. This, along with the participation of multiple smaller research groups and individuals, led to a diverse, curious, driven collaboration that was able to maintain high engagement and output for the two years they were needed.

21. I am asked by the Inquiry if I consider there to have been a "*lack of definition of roles within SAGE"* and whether this impacted on its work during the pandemic. I do not consider that there was a lack of definition in roles and, more fundamentally, I do not consider it appropriate to view SAGE through an organisational lens. There was no 'membership' nor fixed participation, and there was not strict delineation of roles, which was intentional and appropriate. Individual experts participated, chairs of the sub-groups presented their work, and the CMO and GCSA as chairs oversaw the meetings. SAGE's aim was to facilitate broad, cross-disciplinary analysis and challenge of scientific evidence, which it achieved through a culture of robust but respectful discussion. This is a familiar environment amongst academics, and it was encouraged by the GCSA and CMO. I believe that participants felt they could ask any questions of those presenting evidence, and chairs of the sub-groups contributed to wider discussions outside of their discipline. The CMO and GCSA meaningfully participated in the discussions. I agree with Professor Edmunds' observations on this point in his statement where he states: "*As individual experts we were not designated a specific role within SAGE…this meant that we were free to contribute to discussions that may have been outside our specific areas of expertise…* [which] *represented an important function in the process of providing scientific advice"* [DAM9 **INQ000273553** – paragraph 6.3].

22. My experience of SPI-M-O and SAGE during the pandemic was that there was robust and appropriate debate and discussion of the evidence and matters we were considering. I have been asked to reflect on some issues relating to the style of such debate. Throughout my career I have come to recognise two very different cultures, within the civil service and within academia. Academics tend to focus on points of disagreement and can speak very directly and pointedly about their views, and can

challenge others' views or research in a similarly direct and impersonal manner. This can quite easily be misread as rude. By contrast, civil servants place greater emphasis on fostering shared visions and smooth relationships and more time is spent acknowledging points of agreement. A standard statement in a civil servants' meeting is "I agree with everything that's been said", under Professor Medley's leadership in SPI-M-O our mantra became "tell me why I'm wrong".

23. Fostering active and constructive engagement between civil servants and academics has been an important feature of my work within government, which requires understanding both styles. I have been asked by the Inquiry about an email I sent to Dr Ward, a civil servant working for the Joint Biosecurity Centre ("JBC"), where I apologised that he was made to feel uncomfortable during a SPI-M-O meeting [DAM/10 **INQ000215900**]. I recall that I had been notified by the head of JBC that Dr Ward had been unhappy following the meeting. I followed up with him personally in an email. He responded saying that he understood the frustrations of SPI-M-O members [DAM/11 **INQ000317533**

24. Participation in SAGE and SPI-M-O was voluntary and unpaid. Due to the prolonged length of the pandemic, some resources were made available to support academics for their time, mainly by authorising payments to universities to support the release of academics providing critical advice so that they could continue their participation, however, this was mostly quite small amounts and later in the pandemic response. On the whole, participation in SAGE and SPI-M-O relied on the goodwill of its participants, who recognised that these were extraordinary times and so extraordinary efforts were needed. Due to the volume of work required, involvement in SAGE and SPI-M-O often also came at a significant personal cost to attendees. This is also addressed by Professor Medley in his statement [DAM/8 **INQ000260643** – paragraphs 3.38 – 3.39].

25. In some ways, I think the fact that these groups ran on goodwill was a strength. I do not think that much more could have been done by those who participated, even if they had been paid. Many participants had spent their academic careers thinking about the emergence of a highly transmissible new virus, and had conducted significant research and received grant funding to consider this very eventuality. As such, they expected to be involved and have a voice. Nevertheless, I acknowledge the difficulties the duration of the pandemic in particular caused to many academics, particularly those in their early careers, and I refer the Inquiry to the statements of SPI-M-O participants who discuss this, for example [DAM/9 **INQ000273553** – paragraphs 16.30 – 16.31].

26. Given the necessity of providing timely research and advice, demands on everyone's time were acute; most of us did not take much or any time off in the early stages and we worked well beyond normal hours. That said, I believe that SPI-M-O participants knew from early 2020 that we were 'in it for the long haul' and by the summer of 2020 people did take holiday, and I encouraged them to do so. When we moved SPI-M-O main meetings from Mondays to Wednesdays, we hoped that people might be able to take some time off over the weekends. I was certainly guilty of asking people to do work, with not enough understanding of how long that might take, so was grateful when people pushed back on unrealistic deadlines and expectations. Looking to future pandemic responses, I think encouraging more openness to feedback on workload and expectations would assist, as would improving the commissioning process (discussed later in this statement).

27. Support from the civil service secretariats working with SAGE and SPI-M-O was exemplary. We could not have asked for more. In terms of wider support, on one occasion SAGE participants received a letter from the Prime Minister thanking us for our efforts, which was well-received. The GCSA attended SPI-M-O meetings to thank participants and that was very good for morale. I want to take this opportunity to pay tribute to the generous efforts of those participants of SPI-M-O and its secretariat whose contribution often came at significant personal and professional expense throughout what was already a long and challenging period for everyone. They were not alone in this respect; we owe so much to both the scientific community and those members of society more generally who lost their lives, or put their lives on hold, to help others.

OTHER WORK

Task and Finish Groups

28. As part of my role in SAGE, I also contributed to the following SAGE task and finish groups:

    a. Multidisciplinary Task and Finish Group on Mass Testing – 11 August 2020 to 24 August 2020;

b. Impact of Interventions Task and Finish Group – 1 November 2020 to 17 November 2020;

c. Vaccines Science Co—ordination Group (also known as the Vaccine Updates Group) – 18 December 2020 to 3 June 2021.

29. I was asked to join these groups at the request of Sir Patrick Vallance. These groups were established to answer particular questions, and it was necessary to produce work in a matter of days. These groups instantly focused everyone's minds to work together to iron out issues and help secure a common focus. Consensus reached from these groups was then scrutinised through SAGE. As independent advisory groups, they did not recommend specific policies.

Multi-disciplinary Task and Finish Group on Mass Testing ("TFMS")

30. TFMS was a multidisciplinary group established to examine from epidemiological, clinical and behavioural perspectives, the potential benefits and challenges of mass screening for Covid-19.

31. I was asked to join this group because I had knowledge in this area but no pre-conceptions about the correct approach to be taken. The first TFMS meeting I attended was on 11 August 2020, and I was chair from the second meeting onwards. I attended three meetings of this group.

32. Inputs from the teams were reviewed and a SAGE product was presented at SAGE 53 on 27 August 2020 [DAM/12 **INQ000061561**].

Impact of Interventions Task and Finish Group

33. In the autumn of 2020, all four nations of the UK faced a second wave in the numbers of people infected with Covid-19. SAGE 67 on 12 November 2020 [DAM/13 **INQ000061575**] considered the effect in the UK of the "tiering" system that had been introduced in England and the "firebreaks" introduced in Wales and Northern Ireland the previous month. As more work was required on understanding these interventions, I offered to examine this issue in more detail, which resulted in this group being set up to consider the following three questions by way of an observational study:

a. What interventions were made, where and when?
b. How fast did epidemics shrink or grow before and after those interventions?
c. What can we learn from autumn 2020's efforts to control the spread of Covid-19 in the UK?

34. I attended two meetings overall. The first meeting was on 16 November 2020. A paper "*The UK's 4 nations' autumn interventions"* was presented to SAGE on 19 November 2020 [DAM/14 **INQ000071856** and then an updated version (with the benefit of more data) was presented to the following SAGE on 26 November 2020 [DAM/15 **INQ000114473** The lessons learnt are summarised in the paper at page 14. The paper was well received [DAM/16 **INQ000317520**. I cannot comment on what role the paper played after it had been considered at SAGE.

Vaccines Science Co-ordination Group

35. This group, also known as the Vaccine Updates Group, was established to maintain an integrated view of science advice in the Covid-19 vaccines programme across a range of the groups and organisations involved.

36. The first group meeting I attended was on 18 December 2020. I attended five out of seven meetings of this group.

37. Two papers from the group were presented to SAGE. The first "*Considerations on when and how to update SARS-CoV-2 vaccines"* [DAM/17 **INQ000317504**, was presented at SAGE 83 on 11 March 2021 [DAM/18 **INQ000061591**] and the second "*Setting up medium-and long-term vaccine strain selection and immunity management for SARS-CoV-2"* [DAM/19 **INQ000317543** was presented at SAGE 99 on 5 May 2021 [DAM/20 **INQ000061607**].

No.10 led Covid-19 Government Press Conferences

38. I presented slides and data sets at eight government Covid-19 press conferences between 6 April 2020 and 18 November 2020. The slides and datasets can be found online [DAM/21 **INQ000325156**, as can all the recordings of the conferences [DAM/22 **INQ000317544**.

39. The slides and datasets I presented came from the No.10 press office and I believe that they would have arisen from the No.10 daily dashboards. I would have variable amounts of time to interrogate those slides and datasets in advance. I was asked to appear directly by No.10, and I appeared in my capacity as deputy CSA.

Background Technical Briefings

40. I provided 12 background technical briefings to journalists between 19 April 2020 and 12 July 2021. These were briefings to science and health correspondents, and gave them an opportunity to ask more technical, science-focused questions and to help inform the accuracy of their reporting on the current Covid-19 situation and the relevant underlying data. These briefings were non-attributable and not intended to be directly quoted. I was asked to assist with these briefings by Sir Patrick Vallance, often when reporting was based on modelling and the work of SPI-M-O. Several other SAGE participants volunteered their time to support these briefings.

House of Commons Science and Technology Select Committee

41. I appeared in front of the House of Commons Science and Technology Select Committee on 17 February 2021 to give evidence to their inquiry into Global Disease Outbreaks. The transcript of this session can be found online [DAM/23 **INQ000317554**

SCIENCE ADVICE AND DECISION-MAKING

Science advice

42. In my role as CSA for the MoD and later as SPI-M-O co-chair and deputy GCSA, I never attended COBR, Cabinet, COVID(S) meetings, or dashboard meetings with the Prime Minister. I attended a COVID(O) meeting on 15 December 2020 [DAM/24 **INQ000317532** I also contributed to Exercise Fairlight in September 2020 run by the Covid-19 Taskforce and the MoD [DAM/25 **INQ000317534** I attended a meeting with Dominic Cummings on 20 February 2020, but Covid-19 was not discussed. I also

attended a meeting on 29 December 2020 on modelling the impact of the new variant. From early 2021, I attended many daily Covid-19 Taskforce analysis meetings, where I would sometimes suggest edits for information and graphics the Cabinet Office were putting out. As such, I was involved in the 'science advice' stage, and not in decision making, nor did I directly provide science advice to decision-makers (with the exception of the meeting of 20 September 2020 discussed below). This meant I did not have cause for concern regarding the performance of specific individuals.

43. The formal output of SAGE discussion and consensus advice was its minutes. SAGE and each of its sub-groups reached a consensus amongst participants, whereby the advice that was written summarised the current state of scientific understanding. This is not the same as reaching a compromise view. In his statement, Sir Patrick Vallance clearly explains the concept of consensus advice, which I agree with [DAM/26 **INQ000238826** – paragraph 36]. Unsurprisingly, and appropriately, there were challenging discussions at SAGE, but I thought the GCSA and CMO listened to participants and the minutes were accurate reflections of the nature of the discussion in meetings.

44. All the SAGE minutes can be found online, organised by month. See for example all the SAGE minutes for February 2020, which are held in one online repository on the gov.uk website [DAM/27 **INQ000325155** The SAGE minutes are discussed in detail in Sir Patrick Vallance's statement [DAM/28 **INQ000147810** – paragraphs 35 – 39]. The draft minutes were circulated amongst SAGE participants to comment on. I occasionally had comments on the draft, but was otherwise not involved in their drafting. The minutes were finalised and provided to decision-makers, usually very shortly after the meeting. I understand that efforts were made to ensure publication and transparency of the SAGE minutes and papers, such that by May 2020, the minutes were published and freely available online.

45. In my view, the SAGE minutes were sufficiently detailed; any greater detail may have made them less accessible or useful to decision-makers. I cannot recall any instances where I disagreed with the consensus advice set out in the minutes. The degree of transparency of SAGE advice was appropriate. To my knowledge, no other advisory groups or bodies took similar steps to publish the advice they gave to government.

46. SPI-M-O produced consensus statements, which were also published along with all the SPI-M-O papers presented to SAGE. The consensus statements were carefully

drafted to reflect the range of views within the group, which was inevitable given that we had independent and distinct groups of modellers working on the same questions and scenarios. The consensus statements were drafted with care to point to sources and areas of uncertainty. Consensus statements were drafted by the secretariat immediately after the Wednesday SPI-M-O meeting, signed off by the co-chairs and then submitted to SAGE secretariat for the next day's SAGE meeting.

47. In my Questionnaire Response, I give an example of a SPI-M-O consensus statement explaining the evidential uncertainty inherent in its analysis: this relates to the SPI-M-O consensus view on the potential relaxing of social distancing measures from 4 May 2020 [DAM/29 **INQ000213253**]. It presents, on a single page, four different graphs from four distinct modelling groups (Imperial College London, the London School of Hygiene and Tropical Medicine, the University of Bristol and the University of Warwick) and explains the similarities and differences in their findings. The consensus document also lists some general conclusions that can be drawn from the work. This is typical of the output of SPI-M-O.

48. SPI-M-O consensus statements were provided to SAGE in advance of meetings and were then presented in SAGE meetings by Professor Medley. SPI-M-O evidence, once presented to SAGE, was frequently incorporated into SAGE advice.

49. In my Questionnaire Response, I observe that one important lesson to be learnt is the importance of reaching a consensus in modelling [DAM/1 **INQ000232197** - paragraph 54]. Early on in the pandemic, SPI-M-O naturally relied upon the work of Imperial College, who quickly produced the earliest models. My view is that the output of SPI-M-O was greatly improved once we had a number of independent research groups addressing the same policy questions with largely the same data. This is for the reasons given by Professor Medley in his statement, namely that having multiple models to address the same question meant that agreement between the models allowed for more confidence in the evidence, and disagreement gave us an opportunity to interrogate different assumptions and data [DAM/8 **INQ000260643** – paragraph 8.4]. This point is also made by Professor Edmunds in his statement [DAM/9 **INQ000273553** – paragraph 12.4].

50. In general, in the face of high degrees of uncertainty, which was the case particularly early on in the pandemic, consensus advice was important and useful. The process of reaching a consensus required us to think about where commonality was in our analysis, and where it differed, which prompted thought about why that was the case.

This made us think constructively and emphasised the value of having a range of independent thinkers coming together to address the same questions. As a result of this process, consensus advice had stronger roots in evidence. I cannot comment on whether advice being expressed as a consensus in this way increased the likelihood that it would not be followed, as I did not communicate that advice to decision-makers.

51. The consensus approach necessarily introduces delay, however throughout the pandemic both SPI-M-O's consensus statements and SAGE minutes were produced extremely quickly. The process was that papers from the modelling research groups would arrive on my desk by Tuesday evening, and I would read them overnight. SPI-M-O would then meet on Wednesday, where the academic work was subject to instant, robust peer review by experts. Then, the SPI-M-O consensus statement would be drafted by the SPI-M-O secretariat, then signed off by myself and Professor Medley, ready for the GCSA and CMO by 6am on Thursday morning. The consensus statements were then presented to SAGE, and discussed in the meetings. The SAGE minutes were then drafted and finalised by the CMO and GCSA usually in a day. The academic papers were published shortly afterwards. Therefore, any delay caused by formulating consensus advice is a matter of a day and a half at most, and in my view is worth it, for the reasons explained above.

52. The academic papers that informed the advice of SAGE and SPI-M-O were also published. SAGE always received the academic papers which informed SPI-M-O consensus statements and advice. These papers took longer to publish than the minutes or consensus statements, often because at the point at which they were discussed in SAGE/SPI-M-O meetings they were not finalised for publication. Those meetings amounted to an extremely high-quality level of external analysis and essentially acted as real-time expert peer review. On the day that a policy decision was announced, all the papers that informed that decision were in the public domain.

53. These was academic rigour in this process, despite it being done rapidly. The authors of the papers, along with the SPI-M-O secretariat, would meticulously comb through the papers for omissions, inconsistencies, or typographical errors. The authors of the papers then gave their permission for them to be published. There was further academic scrutiny of those papers once they were in the public domain, which the authors were willing to be subject to, as they were acutely aware of the significance of their work during this time.

54. I do not think there was 'group-think' on SPI-M-O. On the one hand, people who train together, often in a small set of institutions and work on the same subjects need to be aware of 'group-think'. On the other hand, scientific careers are set up to honour diversity of thought; and scepticism is central to the scientific method. On SPI-M-O we were acutely aware of this, and I think we did a good job to encourage constructive scepticism and guard against group-think. Hence our mantra "tell me why I'm wrong". This was helped by the fact that SPI-M-O had a lot of early career researchers who were thoughtfully and energetically critical. All modellers were required to explain their models and were prepared to defend them. There was plenty of healthy challenge. The same is true on SAGE, where there was often disagreement and challenge came from many different perspectives. Both groups could have benefitted from more international perspectives, but most foreign scientists were busy with their own domestic situation. Nevertheless, by making papers, data, minutes and consensus statements publicly available, we sought to ensure that the wider academic community and the public could effectively challenge the advice that was given.

55. The CMO and GCSA directly advised decision-makers, informed by our discussions and the minutes. I was not in the room when that advice was given, and the CMO and GCSA were careful to ensure that information flow was one-way, so I cannot comment on what their advice was exactly or how that advice was received by decision-makers. I do not doubt that they were effective in giving that advice. For the same reason, I cannot comment on the quality of decision-making or the performance of decision-makers other than by reference to outcomes.

Decision-making

56. Given the time it took for decisions on NPIs to be made throughout the pandemic, by inference I think that it is likely that many decision-makers lacked an intuitive grasp of two key concepts relevant to pandemics: the implications of fast exponential growth and lagged controls. If a situation you are dealing with is getting twice as bad every week, then you should not spend a week deliberating on what to do, and it is more effective to act earlier. Lagged control refers to the time which elapses between the introduction of a measure and the results of that measure being apparent. In the pandemic, the control available was to slow down the rate of infections. After a measure is taken to slow down the rate of infections, hospitalisations and death are

bound to carry on rising for several weeks, even if the measure in place to reduce rates of infections is very effective.

57. The difficulties in appreciating those two concepts seemed to cause a lack of appreciation that very quick decisions were needed, and that the approach of 'watch and wait' was, in itself, a decision capable of producing damaging consequences. From my perspective, this is an important lesson for the future as it represented what appears from my perspective to be the most significant shortcoming in decision-making-during the pandemic. This issue played out in the autumn of 2020, which I discuss later on in this statement. I do not believe that understanding these concepts and acting quickly required a 'scientific mindset'. For example, the Director General for Analysis in the Covid-19 Taskforce (an individual with a non-scientific background) was entirely able to grasp these concepts and worked most effectively to marry up scientific and policy thinking.

58. I am asked by the Inquiry to explain an email I sent to Professor Medley on 27 April 2020 [DAM/30 **INQ000215716].** I cannot recall what that email was about or find any emails to help contextualise it, so I cannot assist in explaining who or what it refers to.

59. In the early stages of the pandemic, SPI-M-O received a high volume of requests from different groups and departments in central government, some of which exposed some weaknesses in understanding of the purpose of epidemiological modelling. From mid-Autumn 2020, commissioning improved, which I address below.

60. While I did not present science advice or concepts to decision-makers directly, I often attended Friday press briefings to assist those members of the press who attended to understand the modelling. I thought that this was an effective, albeit indirect, conduit for assisting decision-makers who I knew took time to read journalism.

61. In late 2020, I also assisted the JBC with producing an MS Excel 'toy model' which was sent to policy-makers and decision-makers across key government departments. It was very basic; for example, it did not factor in age-dependent mixing. I arranged for the model to be externally reviewed by academic modellers, to ensure it was quality assured. The toy model was designed to be a pedagogical tool that could be played around with, so that the user could gain some kind of intuitive feel for how an epidemic worked through scenario analysis. For example, they might learn from modelling that delaying a decision to intervene by just one week could double the number of people admitted to hospital. When I was teaching, I would guide very diverse groups of

students to build such simple epidemic models in Excel, as I think learning by doing is effective. I also believed that this would improve SPI-M-O commissioning, as ideas for interventions that arose from using the toy model could then be explored in the more robust models available to SPI-M-O, thus creating a virtuous circle in which models helped decision-makers to formulate better questions to put to their advisers. I also thought it might improve understanding of how models worked at a very simple level, and what their limitations are. I understand it was used by senior members of government. See [DAM/31 **INQ000273551** [DAM/32 **INQ000317514**

62. I am asked about an email I sent on 25 January 2021, in which I expressed my concern to Ben Warner that Her Majesty's Treasury ("HMT") had amended the code of the toy model after it had been quality assured and had not sent it back for further review or repeat quality assurance [DAM/33 **INQ000196031**]. I was not told what HMT was changing in respect of this model, and I am not aware which individual or team had made the amendments. In the email I refer to a different Excel model which came from HMT and which I had previously reviewed and found to contain very substantial flaws. Since HMT had not spotted the significant errors in this previous model, I had no confidence that they could adapt the toy model in an appropriate or sensible way.

63. There were a number of ways by which I tried to ensure that the work of SPI-M-O was understood more generally by civil servants and by the public. I tried to act as a filter by helping to pro-actively identify what research could be of help to decision-makers, and I tried to pick up on instances where researchers had assumed knowledge of concepts that would not be obvious or accessible to non-scientists. SPI-M-O produced a number of 'explainers' to assist the civil service with understanding modelling, some examples of which include:

    a. At SAGE 35 on 12 May 2020 myself and the SPI-M-O secretariat were asked to provider a short explanatory note on the reproduction number ("R") for HMG communication experts [DAM/34 **INQ000061543**]. We produced a one-page explainer that was published [DAM/35 **INQ000317530**

    b. SPI-M-O produced "*The general principles and assumptions on transmission of SARS-CoV-2"* published on 16 April 2020 [DAM/36 **INQ000194018**

c. I helped write a document called "*Introduction to epidemiological modelling*" published in October 2021 [DAM/37 **INQ000236423**] This aimed to explain what models are, and importantly what they are not, and how they work.

d. SPI-M-O also produced a documented called "*Epidemiological Modelling Frequently Asked Questions*" published in December 2021 [DAM/38 **INQ000317505**]

64. I understand that the SPI-M-O secretariat produced a number of internal explanatory documents for officials, and we published explanatory text alongside R number and growth rate estimates.

65. We were mindful that the decision-making audience for material in the consensus statements needed to absorb large amounts of information very quickly. That made us careful not to introduce too many different kinds of graphs. However, when Professor Brooks Pollock (SPI-M-O participant) came up with the 'ready-reckoners' we could see that they were a useful way of representing many different outcomes in a single picture. Ready-reckoners were a new way to display how the R number would vary under multiple different interventions. For example, one early version showed variation in: (1) degree of mixing outside the home, (2) degree of school opening, (3) efficacy of contact tracing, and (4) efficacy of Covid-19 security [DAM/39 **INQ000148836**] The beauty of the ready-reckoners was that by characterising the impact of interventions through the R number, several different ways of reducing the transmission of infection could be compared on a single sheet of paper. Professor Brooks Pollock recognised that people within government understood enough about the R number that it was a useful shorthand for good outcomes and that a comparative approach helped decision-makers consider the impact of many different interventions at once. Ready-reckoners were first presented at SAGE 22 on 2 April 2020 [DAM/40 **INQ000061530**], were frequently incorporated into SPI-M-O consensus statements, and appeared in SAGE minutes. Ready-reckoners are also discussed in Professor Medley's statement [DAM/8 **INQ000260643** – paragraph 3.66].

66. The R number eventually became the subject of persistent focus and even a major target for strategy. I would observe that one lesson for the future is that decision-makers need to formulate a long-term plan and provide a clear strategic steer to advisers. A 'strategy' of keeping the R number at or below one does not determine how many infections you have each day; it just says the number of infections should

be flat or falling. You can both have lots of infections each day, or very few, and the R can remain at 1. If there had been an articulation of not just the desired R number, but also a maximum tolerable level of infections each day, it would have been easier to advise on what measures needed to be taken and when they needed to be implemented. It would have been possible to say "today you have this number of infections, the epidemic of infections is growing at this rate, so you will breach your target in this many days". As stated above, decision-making at speed was important, and I think that being able to set this out would have incentivised faster and more decisive action when it was needed. Through the Office for National Statistics' Coronavirus Infection Survey ("ONS CIS") we eventually had a good estimate of that number of daily infections, so it was directly observable, and it would have been crystal clear if a target had been breached. In his statement, Professor Medley also concludes that "*the management of the epidemic would have been better if there had been some target or goal against which the modelling could work*" [DAM/8 **INQ000260643** – paragraph 8.52].

67. I recall repeatedly requesting this number, but it was never provided. The lack of a longer-term strategy was raised by Professor Medley in an email to me on 28 March 2020 [DAM/41 **INQ000213187**]. In the absence of a number, over the course of April 2020, SPI-M-O through SAGE gave the government an alternative means of providing a strategic steer, through asking whether they wanted to run the epidemic 'hot' or 'cold', which I discuss later in this statement. Again, unfortunately we never received an answer. The consequence from my perspective appeared to be that less decisive action was taken than might otherwise have been possible, and with a clearer defined goal or level in mind, the epidemic might have been managed more effectively, i.e. resulting in fewer infections and less morbidity and mortality.

68. SPI-M-O members tried to illustrate the utility of setting a target or a goal in a series of documents which include the "*SAGE Mathematical Modelling Strategy*" [DAM/42 **INQ000148837**] and a paper from 14 April 2020 discussed below [DAM/43 **INQ000216188**].

69. By early 2021, better strategic thinking did start to emerge. The commission for the roadmap out of lockdown around this time was a good example of how to make a long-term plan with effective and timely science input. By then, we had good data to forecast vaccine availability and effectiveness, a good idea of hospitalisation and mortality rates by age, a good understanding about what the government wanted to achieve and a

good ability to monitor the effect of each stage of the 'unlocking' process [DAM/1 **INQ000232197** – paragraph 47]. The comparatively steady pace of decision-making through 2021 greatly benefitted from this forward planning about what decisions would be needed at what stage.

70. I can only speculate as to why longer-term and more strategic thinking of this sort was not seen until 2021. I recognise that there may be political naivety on my part to expect that arriving at a number for tolerable infection levels was ever something politicians would be prepared to do. I acknowledge that that would have been a difficult decision to make. If a clear numerical target is set, then it is obvious to everyone when that target is not being met, and given the devastating potential impact of the infection on those who suffer the most serious consequences, including death, the concept of a 'tolerable' level of infections is difficult to contemplate, however in my view it was necessary to do so. A symptom of the absence of longer-term strategic thinking was that the government's communication of risk especially coming out of the first lockdown, was confusing. I agree with Professor Edmunds' view that this inconsistency undermined public health messaging [DAM/9 **INQ000273553** – paragraph 15.5].

The distinction between science advice and decision-making

71. In all my capacities as a science adviser in government, I was clear on the distinction between giving science advice and making decisions, and I believe that the correct balance was struck. However, I accept that it can sometimes be difficult to conceive of the difference between the two. The work of SPI-M-O was to compare the outcomes of different policies put to us by civil servants across government. At times, it can be obvious from the modelling what decision should be made, i.e., if the modelling shows that policy A results in ten times more deaths than policy B, and the policy objective was to limit the number of deaths as far as possible, then policy B would be a clear recommendation. However, even in this scenario, the choice between policy A or policy B rests with decision-makers.

72. I cannot comment on whether the boundaries between science advice and decision-making were fully understood by the public, but I expect that there was some conflation between the two roles as Professor Medley observes [DAM/8 **INQ000260643** – paragraph 11.25]. With hindsight I do think it might have been better to separate out press conferences given by advisers and press conferences given by politicians.

Having advisers and decision-makers side-by-side answering questions from the press pack did nothing to illustrate the different roles they played.

73. Rather than "*following the science*" I think that "*hearing the science*" would have been a better phrase. "*Following the science*" does blur the distinction between advice and decision-making. It is also inaccurate, for the reasons given by Professor Edmunds in his statement [DAM/9 **INQ000273553** – paragraphs 6.17, 15.3]. The Inquiry's suggestion that politicians hid behind the "*following the science*" message to avoid accountability is a harsh assessment, which may nevertheless contain a grain of truth. Many of the choices politicians had to make were extremely difficult and unprecedented, and I had sympathy with that. In March 2020, the science advice was that if the population do not stay at home, then the NHS will not cope. In such situations, I can understand the appeal of setting out the science advice to make that decision more palatable. Looking to the future, I think it would be useful to think about what processes can be put in place to allow politicians to make unpalatable choices, without feeling the need to hide behind anything.

74. As observed by Professor Edmunds in his statement, "*Following the science*" also suggests that science advice was the only advice that Ministers received which was not the case [DAM/9 **INQ000273553** – paragraph 6.17]. Again, I think that having science advisers alongside decision-makers at press conferences, and no representatives of the sources of other evidence, may have led to the false impression scientists were the only ones advising government. This misconception was amplified by the 'transparency gap' – that scientific advice became very transparent but other advice was not.

MODELLING

75. I respectfully refer the Inquiry to Professor Medley's statement for an expert and detailed view of what models are, what they are not, and how they were used in the pandemic. I would endorse in particular his "*Explainer: Different types of models and model outputs*" [DAM/8 **INQ000260643** – paragraphs 3.69 – 3.94] "*Explainer: Models outputs and use*" [DAM/8 **INQ000260643** – paragraphs 3.95 – 3.109] and Section 8 "*The Use of Modelling during the Covid-19 Pandemic*" [DAM/8 **INQ000260643** – paragraphs 8.1 – 8.19]. I will not seek to replicate that work and those careful explanations in this statement.

76. I am asked whether there was an over reliance on epidemiological modelling during the pandemic. I do not believe that to be true. If you want to think about the future in a quantitatively consistent way, you need to use a model. This is especially true when confronted with an unprecedented situation with no historical data to guide you. Epidemiological modelling is designed to assist our understanding of the epidemic process. That said, there are lessons for the future in the best and wisest use of modelling. For instance, I consider that modelling would be best deployed to address the sorts of questions raised in the SAGE "*Mathematical Modelling Strategy*" paper [DAM/42 **INQ000148837**] in a systematic way, rather than as tools to support very short-term decision-making.

77. I also agree with Professor Medley's warning that "*models are tools to aid understanding and not a panacea to resolve policy problems"* [DAM/8 **INQ000260643** – paragraph 10.1]. We were acutely aware that there were limits to what models could achieve and blind faith should not be placed on modelling. Thoughtfully sceptical reception of all science, including modelling, is important. Scepticism is important, and I consider that there was robust and appropriate academic challenge through the SAGE process. The powers and limitations of modelling were understood by SAGE participants across a number of disciplines. Scientists from a variety of backgrounds such as the CMO, the government Chief Statistician, Professor Hayward and Sir Jeremy Farrar, were entirely capable of challenging modellers and models. One does not need to be a mathematician to do so. All scientists have been trained to be careful about quantitative methodologies such as modelling. I cannot comment on whether the limitations of modelling were sufficiently understood by decision-makers, however I think a further lesson for the future is to improve public and political understanding of the proper role of modelling in thinking about alternative policies.

78. Both prior to and during the pandemic, modellers developed reasonable worst-case scenarios ("RWCS") for pandemic planning generally, and then for Covid-19 specifically. As Professor Medley explains in his statement, the development of a RWCS became more complex as time went on [DAM/8 **INQ000260643** – paragraph 8.52], and it was eventually dropped after January 2021. Due to some confusion between scenarios and forecasting, the RWCS could be misinterpreted, and used to suggest that modelling was wrong because it presented an overly pessimistic view of the future that never eventuated. For example, a RWCS in autumn 2020 considered what would happen if the government took no measures to control the spread of the virus at all, which would have been unthinkable [DAM/44 **INQ000061565**]. This is set

out in Professor Edmunds' statement, and I gratefully adopt his clear explanation [DAM/9 **INQ000273553** – paragraph 14.5]. I am asked to address a suggestion that modellers were trying to create a "*climate of manipulated fear*". I do not think that this ever happened. Due to the difficulties faced by developing a RWCS during a pandemic response, and the unintended consequences of doing so, one lesson for the future is that we should consider what role, if any, RWCS have during a pandemic response. Addressing common misunderstandings of models would be an important consideration for the future, as would how models are reported and discussed by the public.

79. On 16 October 2020, I received an email from Professor Woolhouse [DAM/45 **INQ000103281**] expressing his concern that if SPI-M-O projections "*knowingly exaggerate*" the threat of Covid-19 then our advice would be undermined. I responded twice to this email, the second chain is [DAM/46 **INQ000103277**]. In SPI-M-O meetings, which Professor Woolhouse attended, we had sensible discussions about how to communicate scenarios in modelling more effectively, and I made sure to do so in the Friday off the record press briefings. Professor Woolhouse's email obscured this issue by confusing predictions and scenarios. This confusion, along with his 'I told you so' approach to the issue, was unhelpful and came at a stressful time. I was mystified that he knew the graph he was referring to was not a prediction yet persisted in treating it as one. I found his suggestion that SPI-M-O would "*knowingly exaggerate the threat*" offensive, and the scenario presented in the graph he so objected to did in fact play out. On 20 January 2021, 1,237 people died of Covid-19. I attempted to ask him to be more moderate because we all had to continue working together. He seemed to find that impossible.

80. I am asked by the Inquiry whether I consider that the models used by SPI-M-O were sufficiently granular. I respectfully refer the Inquiry to Professor Medley's "*Explainer: Granularity"* in his statement [DAM/8 **INQ000260643** – paragraph 8.20 – 8.40]. Importantly, I agree with Professor Edmunds and Professor Medley, that granularity should not be used synonymously with either accuracy [DAM/9 **INQ000273553** – paragraph 12.3] or detail [DAM/8 **INQ000260643** – paragraph 8.14]. In simple terms, a more granular and specific model is not necessarily a better (more reliable, or more useful) one. Broadly, I think that the models used by SPI-M-O were sufficiently granular. There was no point in making models more granular in respect of factors that did not relate to a policy question, or for which we did not have sufficient data. For example, even if it had been possible to account for specific drivers for disparities -

such as ethnicity - when producing models, it would not be clear what policy decision flowed from that inclusion and we had very little data on how Covid-19 affected different ethnic groups, especially early on in the pandemic. In some instances, it was more appropriate to deal with some policy questions by creating separate models, rather than to add an additional layer of complexity into existing models. However, we faced an enormous task, so had to be pragmatic about how many distinct models could be set up, especially in the early days.

81. I am asked how SPI-M-O accounted for heterogeneities in respect of Covid-19. We assumed that age was the most significant variable factor, as discussed in Professor Medley's statement [DAM/8 **INQ000260643** – paragraph 8.29, 8.31]. From early on it was clear that age was a very important determinant of the outcome of a COVID-19 infection, and it is well established (from common sense and the epidemiology of long-established infectious diseases) that age is also an important driver of social mixing and hence of the transmission of infection. The most likely place for people to catch Covid-19 was at home, and age was a large determinant of mixing in homes. All the 'big' models included age-dependent parameters and accounted for age-dependent mixing. The models also included elements of spatial heterogeneity, which is detailed by Professor Medley in his statement [DAM/8 **INQ000260643** – paragraph 8.30].

82. The CoMix social contacts study was set up to monitor the impact of Covid-19 on behaviour. Data from CoMix were vital for modelling, as they allowed us to observe changes in contact patterns [DAM/47 **INQ000317502**]. This is explained in Professor Medley's statement in his "*Explainer: Contact patterns*" [DAM/48 **INQ000260643** – paragraphs 2.9 – 2.12]. Importantly, models cannot predict how people are going to behave in the future, but knowing how people behaved last week is a huge advance in creating assumptions about how people may behave in the future.

83. I am asked why schools were included in the models when care homes, addressed below, were not. A model with age-specific mixing and time-varying contact rates very naturally includes schools because almost all children go to school. In order to parameterise this kind of model, extensive data were collected before and during the pandemic. Whether schools should be open or closed was expected to be a policy question, based on the experience of public health measures during other epidemics. For these reasons, schools were included in the models very early on. Professor Medley makes the same point in his statement [DAM/48 **INQ000260643** – paragraph 8.40].

84. I am asked by the Inquiry whether it would have been beneficial for there to have been a 'super model' incorporating various economic/ social impacts on different groups. Work that builds a theory to include economic and epidemiological modelling would be useful. We might have been able to do so with a strategic model (like the toy model) to build intuition. However, the SPI-M-O models used had decades of history, and my worry would be that trying to create a 'super model' in the midst of a pandemic would have been too onerous and had the potential to be unhelpful. That said, I think that this is an area of research worth pursuing in the future, and note Professor Keeling makes the similar observations on this point, concluding "*This type of new, ground-breaking interdisciplinary works takes time and is best undertaken before a pandemic"* [DAM/49 **INQ000217363** – paragraphs 50 – 51].

VULNERABLE POPULATIONS

85. The concept that infectious diseases always target the disadvantaged is well-known to all infectious disease epidemiologists, such that from the start of the pandemic it could be foreseen that the burden of mortality would fall disproportionately on the more deprived and marginalised. People with many advantages can arrange their lives so they are less likely to be infected: they have more space at home so it is easier to avoid infecting their families, they tend not to live in larger, multigenerational households, and they can access better healthcare if they become ill. I think it could be foreseen that the burden of Covid-19 mortality would follow this pattern, as played out. I respectfully refer the Inquiry to Professor Semple's statement which addresses this issue [DAM/50 **INQ000260637** – paragraphs 5.1 – 5.8].

86. In the same way, pre-existing structural and health inequalities within ethnic minorities meant that it was foreseeable that those groups would be at greater risk and suffer worse outcomes as a consequence of infection with Covid-19. In the earliest stages of the pandemic, we could see the existence of Covid-19 disparities from CO-CIN data. This was evidenced by data which showed that patients from certain minority ethnic groups who were as likely to be hospitalised for Covid-19, were more likely to die in hospital than their white counterparts, after adjusting for other comorbidities [DAM/51 **INQ000262569**].

87. The expert reports prepared for the Inquiry "*Ethnicity, Inequality and Structural Racism"* [DAM/52 **INQ000280057**], "*Structural Inequalities and Disability"* [DAM/53

INQ000280067] and "*Structural Inequalities and Gender*" [DAM/54 **INQ000280066**], address this matter, and I agree with their assessment of pre-existing structural inequalities in the UK and their confirmation of the well-established principle that pre-existing social inequalities are amplified during a pandemic (and were in the case of Covid-19), with severe consequences.

88. At a press conference on 5 May 2020, I stated that after lockdown was lifted and the numbers of infection subsided, the virus could find a haven among the "*hard to reach*"[2] and that authorities would have a responsibility to carry on hunting down pockets of infection in every part of society [DAM/55 **INQ000325153**]. At this point, I assumed that after lockdown was lifted the government would actively pursue a strategy of a very low number of new infections each day for as long as it took to find highly effective treatments or a vaccine. I imagined a flexible, agile test and trace system that would identify clusters of infection and quickly send the people who were most likely to have been infected into isolation and (if need be) close down places where it was clear that infection was spreading. We had discussions at the time about all the different tools beyond test and trace that could be used to find outbreaks and bring them under control [DAM/56 **INQ000215953**]. If that had happened, we would have had to think rather carefully about how best to help the most deprived communities. This issue was considered at SAGE 48 on 23 July 2020 in the context of the outbreak in Leicester [DAM/57 **INQ000061556** – paragraphs 19 – 28, 29 - 36]. By late September 2020, it was clear that a low incidence scenario, in which there would be localised flare ups that could be identified and dealt with, was not the reality that we were faced with.

89. In SPI-M-O consensus statements we repeatedly raised concerns about low vaccine uptake in Black, Asian, and minority ethnic communities, which we were concerned would lead to even worse clinical outcomes, greater risks, and amplify pre-existing inequalities [DAM/58 **INQ000317547**] [DAM/59 **INQ000253906**]

90. I do not recall any specific advice given personally by me to decision-makers on these matters, and as I was not the conduit for advice to decision-makers, I cannot comment on the extent to which disparities concerning both infection and the impact of NPIs were adequately considered by decision-makers. Most advice on inequalities came through SAGE, and the sub-group on science related to ethnicity and Covid-19 led by

[2] After that exchange, I had a very kind online tutorial teaching me to say "people who find it hard to access help" rather than "people who are hard to reach", which I accept is more appropriate.

Professor Khunti and Osama Rahman set up in August 2020, which SPI-M-O member Dr Eggo attended. I refer the Inquiry to Professor Khunti's module 2 evidence which reflects on the work of the sub-group [DAM/60 **INQ000252609**] [DAM/61 **INQ000317524**

91. Professor Ferguson observes that due to model complexity and a lack of data, no SPI-M-O models represented variation either by income group or ethnicity in the first two years of the pandemic [DAM/62 **INQ000249526** – paragraph 346]. I agree. On the inadequacy of data on the existence and drivers of Covid-19 disparities, there were some data, for instance on multigenerational households and adverse clinical outcomes, but there were not enough for modellers to account for such complex, intersectional disparities in the models. For example, we did not have data on wider societal outcomes. Further, the disproportionate impact the pandemic would have on specific minority ethnic groups was not really a question that modellers could address, as there was no obvious policy related to this issue that could be modelled. For the same reason, having more accurate and effective modelling is not the best route to addressing such inequalities during a pandemic response.

Care Homes

92. Closed institutions tend to harbour large epidemics of respiratory infections. For example, the textbook time-series for an influenza epidemic is a large outbreak in a boarding school. Because the people in care homes are older, they are much more vulnerable to serious disease and death upon infection with Covid-19. These two factors combined mean that respiratory outbreaks in care homes are often very problematic. Accordingly, from the outset I expected that there would be problems in care homes. My concern was that infection would get into care homes and then spread rapidly with a high case fatality rate.

93. At SAGE, care homes were discussed in this manner throughout early 2020. For instance, at SAGE 12 on 3 March 2020 the challenges of implementing social distancing in care homes was recognised [DAM/63 **INQ000061520**] and at SAGE 14 on 10 March 2020 SAGE advised that special policy consideration needed to be given to care homes, and the issue of testing in care homes was raised repeatedly [DAM/64 **INQ000061522**]. In April 2020, a SAGE sub-group on care homes was set up, which I was not involved with.

94. All science advice on care homes was provided through the care homes sub-group and SAGE. I had very little involvement in any work to do with care homes. I respectfully refer the Inquiry to Sir Patrick's statement which details the advice given by SAGE on care homes [DAM/26 **INQ000238826** – paragraphs 524 - 540]. I am not able to comment on most of the policies and practices adopted in care homes, which are largely operational matters.

95. SPI-M-O members were concerned that not enough was being done to protect those at a high risk of dying if infected with Covid-19 in care homes [DAM/65 **INQ000223519**]. The first direct record I have of observed problems in care homes is email correspondence with PHE on care home data on 17 April 2020 [DAM/98 **INQ000213297**], as is also true for Professor Medley [DAM/8 **INQ000260643** – paragraph 3.99]. There was little data on the social care sector, as observed by Professor Medley [DAM/8 **INQ000260643** – paragraph 3.100] and Professor Ferguson [DAM/62 **INQ000249526** - paragraph 194]. The issues that this lack of data presented were raised in the SPI-M-O consensus statement from 20 April 2020:

> *Without data on the patterns of cases within individual care homes, it is very difficult to understand the dynamics of COVID-19 in social care…There is evidence in continued growth in the number of care homes which have experienced cases of COVID-19. Any estimates of the proportion of care homes which will eventually experience outbreaks is highly speculative at this stage, but a figure approaching 90% cannot be ruled out if current trends are maintained"* [DAM/66 **INQ000213298**].

96. Despite this, I remember having conversations about how to include care homes in the modelling. On 20 April 2020, in the paper "*SAGE Mathematical Modelling Strategy"* Professor Medley and I asked *"Do we need separate models for the community, hospital and institution epidemics? Hospitals and care homes generate special questions that need modelling for example infection prevention and control"* [DAM/42 **INQ000148837**]. The following presented challenges to including care homes in models:

a. First, including care homes in scenario modelling was not particularly useful. I agree with Professor Medley's observations on this point [DAM/8 **INQ000260643** – paragraph 8.34].

b. Second, care homes could not be factored into models in the same simple way that schools were. If every individual went into a care home on their 80th birthday, it would have been possible to model the epidemic in care homes rather easily, but that is not the case. Even in respect of those who are in care homes or assisted living, care home provision varied significantly, with different staffing arrangements, size etc.

c. Third, as mentioned above, there were significant issues with data on care homes, which Professor Medley sets out in detail in his statement [DAM/8 **INQ000260643** – paragraph 8.33].

97. In spite of these difficulties, from May 2020, Imperial College did include a separate compartment for care homes within their main model [DAM/62 **INQ000249526** - paragraph 194], and modelling was done separately by the social care sub-group. SPI-M-O quality assured those models, and the group fed directly into SAGE rather than through SPI-M-O. Professor Medley makes a similar observation of the limited use of including care homes in modelling [DAM/8 **INQ000260643** – paragraph 8.34].

98. I am asked whether the concerns I had about the problems facing care homes were adequately addressed. I do not think that these concerns could ever have been 'adequately' addressed. Every death of a beloved older person in a care home was heart-breaking for someone. I am also asked whether I agree that "*right from the start we* [I assume the Department for Health and Social Care] *tried to throw a protective ring around our care homes".* I think they did *try*, but events show that those efforts were not enough.

99. In general, I think more attention should have been paid to all the possible routes of infection into care homes. However, I do not think that this could ever have been fully prevented; care homes could not be sealed off from the community and I do not know how possible it would have been to cohort staff or expect them to completely effectively shield. Like border controls, limiting access to care homes would only have put back the date on which you have an outbreak.

<u>The elderly and other at risks groups in the community</u>

100. I am asked by the Inquiry whether I think the public health response was sufficiently targeted at those who were vulnerable to the virus. I think that the advice for the

vulnerable to shield at home, and the provision of support for those groups to do so, was necessary and sufficiently targeted.

101. Segmentation i.e. segmenting the population into broad age and risk groups and targeting restrictions to those groups accordingly, was discussed at SAGE, for example at SAGE 50 on 6 August 2020 [DAM/67 **INQ000061558** – paragraphs 29 – 34] and SAGE 62 on 15 October 2020 [DAM/68 **INQ000061570** – paragraphs 18 – 22]. SPI-M-O also produced a summary of advice on segmentation [DAM/69 **INQ000074986**] We advised against this policy, and also anticipated that there would be ethical and legal difficulties with such a policy.

102. Professor Woolhouse was a particular advocate for 'super-shielding', an enhanced version of shielding, and I am asked about his views, including as expressed to me in an email on 1 April 2020 [DAM/70 **INQ000103255**]. The Edinburgh modelling group included shielding the vulnerable in some simple modelling to support the intuitively appealing idea that further protection of the vulnerable (beyond reducing their own social contacts) could be delivered by protecting those people who come into contact with the vulnerable, and this could be done instead of population-wide lockdown measures. I thought this concept was interesting.

103. However, it is my view that in order to protect the vulnerable - either by shielding, super-shielding, or segmentation – it is vital to simultaneously keep the epidemic low in the general population. Any public health response that keeps infection rates in the community low is an effective way to protect the vulnerable by keeping the chance of those groups coming into contact with someone who might infect them low. Experience showed how very difficult it was to keep care homes fully isolated from the general epidemic in the community. I do not think we could have avoided the need for lockdowns by enhanced shielding of the vulnerable instead.

104. Despite this difference of opinion, I took a number of steps to ensure that key policy-makers were exposed to and had an opportunity to consider Professor Woolhouse's views. On 28 April 2020, I attended a briefing in No.10 about the issue of shielding, and then later that day introduced Professor Woolhouse by email to Ben Warner, as well as civil servants in the Cabinet Office and the DHSC to discuss shielding [DAM/71 **INQ000317538**] [DAM/72 **INQ000317536**]

105. I cannot comment on why Professor Woolhouse's recommendations were not taken further. As I indicated in my earlier emails, I had the sense that this was something being actively considered by No.10 [DAM/70 **INQ000103255**]. As Professor Woolhouse sets out in his response to Ben Warner, his proposed super-shielding strategy required monitoring care home residents every day, maybe twice a day, and testing everyone who comes into contact with residents everyday, with same day results. I imagine that there were a number of operational issues and complexities that needed to be considered by decision-makers.

DATA

106. The fundamental importance of high quality and timely data has been emphasised to the Inquiry repeatedly. As others worked more closely with the data we had available at various points throughout the pandemic, I would defer to their more detailed descriptions of data availability and quality over time, and the impact that had on the work of SPI-M-O. I would gratefully, again, adopt in particular the evidence of Professor Medley on this point [DAM/8 **INQ000260643** – paragraphs 7.3 – 7.30].

107. However, what is clear is that the response to the pandemic highlighted the supremacy of data, and how much work it takes to make appropriate data available to independent research groups.

108. Early in the pandemic, we really did not have enough data. As a result, we had to make less well-informed calculations of how many people were infected, back-calculated from how many had died. There were complexities relating to who owned data, which made it difficult, and at times impossible, to obtain.

109. Later on in the pandemic, different data types were required, for example, we needed data on the effectiveness of vaccines at all stages on reducing the rate of infections, hospitalisation, and death.

110. SPI-M-O were always seeking better data. I am aware that vast quantities of highly relevant data are held by the private sector, for example, mobile phone and bank card usage generates data which may be invaluable in accurately assessing large scale movement and mobility patterns, which would be of obvious relevance to those

considering the spread of a virus. Naturally, there are privacy issues when such data are handled. I was also aware of confidentiality issues arising in respect of NHS data.

111. Eventually, we were able to work with the Defence Science and Technology Laboratory ("DSTL"), who set themselves up to be a trusted data haven. DSTL was able to use its significant expertise in managing and storing sensitive data to give confidence to data handlers that it would be managed safely and appropriately. DSTL thereafter played a critical role in handling and cleaning data. This permitted SPI-M-O to access anonymised and non-attributable data streams on many important matters including hospital admissions and deaths.

EARLY STAGES OF THE PANDEMIC

112. I am asked to provide details of my evolving understanding of Covid-19 and the government's strategy. Over New Year 2019-2020 whilst I was on holiday, I was aware of the evolving situation in Wuhan. On 25 January 2020, I was at a public science event in Oxford about infectious disease and I remember talking with colleagues that day about how Professor Edmunds was very worried about Covid-19, which made us all worried. Over the course of February 2020, my understanding of the potential risk of Covid-19 improved as I received more international data about its spread, and I became increasingly involved in the response. I started attending SAGE from 11 February 2020, at which time I understood that the government's strategy was to try to get a better picture of what was happening overseas and get a clearer description of the dynamics of the spread of infection and of the course of individual infections. I was not aware of "*contain*" and "*supress*" strategies until I became a participant of SAGE.

113. In early March 2020, I sensed there was a shift in the government's strategy, which came with the growing realisation that infection was seeded all over the country, and that we were in the middle of an exponential upswing in infections, which had the potential to create enough seriously ill people to overwhelm the intensive care unit ("ICU") capability of the NHS.

114. Three days in March 2020 stand out for me in particular:

    a. On 10 March I attended SAGE 14. I recall Ben Warner remarking that we were facing something extremely difficult, and I was uneasy about how many deaths would accompany a large wave of infections whilst the case fatality rate was at

1% or 2%. Professor Riley had produced an important report on the situation [DAM/73 **INQ000269367**], which was discussed. Professor Riley explains this report in detail in his statement [DAM/74 **INQ000270553** – paragraphs 4.25 – 4.36].

b. On 13 March I attended SAGE 15. I remember Professor Edmunds discussing alarming data on the paucity of ICU capacity, which he discusses in his statement [DAM/9 **INQ000273553** – paragraph 8.23]. His analysis suggested that ICU capacity was way below that which would be required if there was a wave of infections consistent with anything less than a major intervention. I also knew anecdotally from a relative working in a London ICU that they were dealing with enough cases that only a few doublings would quickly swamp their capacity. This meeting was a real wake up call.

c. On 15 March 2020, I sent the GCSA an email [DAM/75 **INQ000317539** spelling out my worries about the size of the wave we were expecting, against the background of the estimated data on ICU capacity in the NHS. The document which I attach [DAM/76 **INQ000195889** contained calculations of the number of deaths that could be expected under different assumptions. None of this required sophisticated modelling; it was premised on essential characteristics of the virus (case fatality rate and doubling time) and the size of the population. I sent the same document to Professor Medley that day [DAM/77 **INQ000213178**].

115. I am asked about my involvement with a paper presented to SAGE on 3 March 2020 entitled "*Illustrative impact of behavioural and social interventions lasting several months on a RWCS*" [DAM/78 **INQ000213033**] and I note that Professor Medley understands me to have been involved in the creation of this document [DAM/8 **INQ000260643** – paragraph 5.6]. I cannot recall having much if anything to do with writing this paper. I do recall it being presented to SAGE, I cannot recall by whom. As I was not on SPI-M-O at this point, and did not directly advise decision-makers, I am not in a position to say what role it played in advice provided at the time.

116. Returning to my understanding of the government's strategy over this period, in the first few weeks of March 2020, I began to feel that there did not seem to be a plan within government, or a clear sense of how many people were going to die. I was concerned by the lack of information on hospital capacity in particular. When I wrote in

the document I sent to the GCSA on 15 March: "*there is a discussion that I missed at Sage it if has occurred"* I was referring to ICU capacity [DAM/76 **INQ000195889** At SAGE we had always been aware of the need to understand NHS capacity, but we did not have the necessary data to have robust analysis on when that capacity would be breached.

117. I am asked by the Inquiry about the extent to which the concept of 'herd immunity' was discussed or an adopted strategy for responding to Covid-19 during this period. I am grateful to Professor Medley for explaining the concept of herd immunity in his statement, which I agree with [DAM/8 **INQ000260643** – paragraphs 4.15 – 4.26]. Importantly 'herd immunity' is an epidemiological concept, it is not a public health strategy. It is the inevitable outcome of an epidemic of infections. I cannot comment on the extent to which the concept of herd immunity had a bearing on decisions made in government. I was not aware of a deliberate government policy to encourage transmission of the virus in the hope of reaching herd immunity.

118. What was difficult about Covid-19 was that there was no immunity at all, compared with other pandemics, such as the A(H1N1)pdm09 ('swine flu') influenza pandemic. Therefore, a great number of people would have to newly acquire immunity before we came close to a degree of 'herd' or 'population' immunity (say two thirds to three quarters of the population).

119. Therefore, it was generally understood on SPI-M-O that it would have been impossible to achieve population or herd immunity quickly once one considered the cost of getting there. Right from the beginning we knew that there was never a quick or easy route through, even if we did not have the data to know exactly how long it would take. This was the point that I made in the document I sent to the GCSA and then to Professor Medley [DAM/76 **INQ000195889** I was highlighting that we needed to understand the outcome we were seeking, at a time when we did not know how quickly a vaccine would be available. Professor Medley will be better placed to explain what was meant by his reply [DAM/77 **INQ000213178**], but I considered it a very good response; I understood him to be acknowledging what would need to be done, by way of interventions including lockdowns, before there was a sufficient level of immunity through infections and/or vaccinations with as little death as possible. He was already imagining that we would need to consider multiple lockdowns, how many would be needed, how long they should last to have an effect, and he was acknowledging his role and that of SPI-M-O's in assisting. The concept of 'herd immunity' was sometimes

misunderstood and the term used as shorthand for allowing a single large wave over the summer of 2020 with attendant high levels of immunity at the onset of autumn.

120. I am asked whether there was a view in Government that Covid-19 was akin to influenza. As explained above, Covid-19 was not akin to influenza in that there was no degree of immunity to it in the population. However, one similarity with influenza was the route of transmission. I do not know what people in government understood the characteristics of Covid-19 to be, but we were worried that for whatever reasons, decision-makers had not taken on board quite how serious it was. I remember one early meeting in the MoD where I said that this would take at least 18 months, which was met with disbelief. There were 'mid-way' reviews in April 2020 as if we were halfway through the pandemic.

121. At a SAGE meeting on 10 March 2020 in a comment to Ben Warner, I echoed the sentiments of Professor Ferguson that there were going to be a large number of deaths. Ben Warner recalls me saying *"the only way out is through"* [DAM/79 **INQ000269182** – paragraph 98]. I would have said *"the best way out is through"*, a saying from our family misquoting a Robert Frost poem, said when faced with a difficult situation that needs to be dealt with. Ben Warner recalls that my comment was made in the context of me pushing for a mitigation strategy rather than pivoting to a suppression strategy. That is not a dichotomy I recognise. The main point I was trying to make was that whatever decision was made, hard times were ahead and I was hoping that decision-makers had some sense of how tough what was coming would be.

122. However, I acknowledge that in the early stages of the pandemic, I did not appreciate what an enormous act of imagination grappling with the emergence and potential consequences of the Covid-19 pandemic required. Previous experience of AIDS, A(H1N1)pdm09, and Ebola, whilst horrific for those who lost loved ones, did not impact on the lives of the entire population in the same way. Epidemiologists are used to considering these scenarios and numbers, and even then, I do not think I appreciated how shocking the first lockdown and early months of the pandemic would be. With hindsight, I think we could have done more to impress upon decision-makers just how serious the situation was. The situation in Italy should have been more of a turning point, as it served as a local point of comparison. A personal reflection relates to how forceful and repetitive one must be when alerting decision-makers to a really serious risk. However, that comes with the complexity that an adviser must judge how much

of a pain to be, as poorly judged interventions carry the risk that people will stop listening to you.

123. A final reflection on this pre-lockdown period relates to testing. If an adequate number of tests for both community and healthcare settings are available in the initial stages of a pandemic, testing and tracing can play a transformative role, as early contact tracing can help to contain the spread of infection. If an infection is seeded within the community, proper testing can keep high risk people and settings safer, and all-round prevalence lower (which in turn means that less testing and tracing is required). Adequate testing early on would also allow for infection prevalence studies to get going much sooner, allowing for accurate prevalence estimates to better inform advice and decisions. Accordingly, I agree with the WHO's advice from 16 March 2020 to "*test, test, test*". The UK could not have followed this advice because it did not have enough tests. However, it was still right to tell countries where they should be aiming, even if they did not have the capacity to extensively test. I am asked whether this advice applies just to less developed countries. I do not agree and that was not my understanding at the time. If anything, it was even more relevant to more developed countries with their aging populations and hence larger at-risk population.

124. Testing and contact tracing were operational issues. As such, I do not recall having any conversations with any decision-makers about testing, and I am not able to comment on what influenced the testing strategy. I respectfully refer the Inquiry to Sir Patrick Vallance's statement which details the advice that was given by SAGE on testing and tracing [DAM/26 **INQ000238826** – paragraphs 496 – 551]. As far as I can recall, SAGE were told about the operational decision to end community testing in mid-March 2020. We were not asked to advise on this. SAGE was told that this was a capacity issue; the decision was made to prioritise testing in hospitals which I think was the right thing to do in those circumstances.

125. The lesson to be learnt from the UK experience of testing is that testing capacity needs to be a priority. As the experiences of other countries with good public health infrastructure such as Germany and South Korea demonstrate, if you are able to set up an effective test and trace system early, then the number of infections can be kept low by a highly effective test-trace-isolate, and as a result the task for testing and tracing is operationally easier, as you have fewer people you need to test and better chances of turning those tests around in good time. I agree with the observations made by Sir Patrick Vallance during the module 1 hearings [DAM/80 **INQ000317523**] and by

Sir Mark Walport [DAM/81 **INQ000147707** – paragraph 135 - 137] on lessons to be learnt from Germany's ability to test and trace, in particular their manufacturing and diagnostics capacity.

THE FIRST NATIONAL LOCKDOWN

126. The country went into national lockdown on 23 March 2020. I am asked about the timing, and I think we should have gone into lockdown sooner. In an ideal world we would have gone into lockdown two weeks earlier, but with the benefit of hindsight we certainly should have gone into lockdown on 16 March 2020, when the Prime Minister advised the country to stay at home and avoid all non-essential contact. Although lots of people changed their behaviour as a result of this press conference on 16 March, which had an impact on the number of infections, a full mandatory lockdown on this date still would have made a large difference.

127. As I was not a decision-maker, I am not aware of all the factors that led to what I would consider a delay in introducing the first lockdown. Elsewhere in this statement, I comment more generally about delays to decision-making, and those views apply here.

128. In terms of whether science advice contributed to any delays to introducing the first lockdown, I do not think that SAGE was unanimous in the weeks leading up to the decision to go into full lockdown. This was one reason why I was so anxious to sit down and produce the document I emailed to the GCSA on 15 March 2020 [DAM/76 **INQ000195889**] However, part of the reason why our advice to lockdown was not made in stronger terms sooner, was that the quality of the information we were receiving at the time was very poor (as is clear from that document I sent on 15 March).

129. The experience of giving science advice throughout the pandemic caused me to learn that the government tended to delay making decisions on interventions until the last possible minute. Had SAGE known this from the beginning, it may well have been more unequivocal in its advice in early March 2020. As advisers we should have thought more critically about the state-of-mind of those we were advising and the reasons for this delay; we needed to assume that elected officials do not want to make unpopular decisions, and that it is extremely difficult for them to do so. If we had a better sense of how unpalatable lockdown was to decision-makers, if anything this

would have expedited strong advice to lock down, rather than give us cause to delay providing the advice or to weaken its terms. Looking to the future, I think advisers should err on the side of giving unequivocal advice earlier in the context of advising on time-sensitive matters, and during pandemics should advise that interventions need to be made faster, harder and broader than you think is necessary, as observed by Sir Patrick Vallance in his statement [DAM/26 **INQ000238826** – paragraph 225].

APRIL 2020 ONWARDS

130. I am asked about an email I sent to Professor Medley on 18 April 2020 in which I asked whether we should challenge the view that the virus cannot be eliminated [DAM/82 **INQ000215682**]. By 'eliminate' I meant attempt to have zero infections in the country and keep Covid-19 out of the country, whilst it spread elsewhere in the world. An elimination strategy was being pursued in countries like Australia at the time. At this stage, none of us thought Covid-19 could be eliminated. However, I was of the opinion that there might be value in checking and in showing our workings on all our assumptions, even if they seemed obvious to us. In the end, we had so much else to work on at this stage, that answering obvious questions was not a priority and this was never explored further. If we had explored it further, I have no doubt that we would have concluded that Covid-19 could not be eliminated from the country.

Emergence from lockdown

131. On 10 April 2020 I attended a SAGE small working group meeting on "*The science of exit"* from lockdown [DAM/83 **INQ000216319**]. The minutes of the meeting have been provided to the Inquiry [DAM/84 **INQ000212094**]. This working group meeting arose from a SAGE discussion about two different epidemiological scenarios for coming out of lockdown: a low incidence scenario where levels of infection were kept and maintained at the lowest possible level through NPIs until vaccines or excellent drugs were available, in the hope that a good contact tracing system allowed for more mixing (i.e. as low as possible); and a higher incidence scenario were levels of infection were similar to that observed in early April 2020 but not worse (i.e. low enough and within NHS capacity limits). We also referred to these two scenarios as running the epidemic

'cold' or 'hot' respectively. In this discussion we discussed the harms and benefits of both scenarios.

132. We were asked to draw up a table to show the key features of the two scenarios, which we did in a draft paper dated 10 April [DAM/84 **INQ000212094**] which was circulated on 12 April [DAM/85 **INQ000212100**]. I may have discussed this with Sir Patrick Vallance as he suggested but I cannot recall. The paper was then finalised on 14 April [DAM/43 **INQ000216188**]. This work informed papers submitted to attendees in advance of further meetings on 24 and 27 April (discussed below) [DAM/86 **INQ000317501**] As I indicated in my email, in order for us to have properly modelled either a high or low incidence scenario we would have needed decision-makers to define what 'tolerable' levels of infections were, and as I explain elsewhere in this statement, we never had a response on this. I am not able to say how these scenarios mapped on to the options that decision-makers believed they were faced with at the time.

133. The question of immunity was relevant to both scenarios. Running the epidemic cold placed greater reliance on early development of vaccines to provide immunity. Running the epidemic hot meant that a degree of population-level immunity might have accrued sooner, as the rate of infections was higher. You do not need to get all the way to herd immunity for immunity among your population to be helpful. At this stage we knew nothing about the duration of immunity.

134. The 14 April paper [DAM/43 **INQ000216188**], together with modelling on the requirements for an effective test and trace system post-lockdown, were discussed at two meetings on 24 and 27 April 2020. During the meeting on 24 April, we mainly discussed what an effective monitoring system would look like in a low incidence scenario [DAM/56 **INQ000215953**]. A follow-on meeting was then held on 27 April, which reviewed further papers sent [DAM/87 **INQ000317507**]. I have been unable to find a note of that second meeting.

135. The general consensus was that low incidence was preferable as we suspected that immunity might not be long lasting, and that there was not enough benefit from accrued immunity to counterbalance the detriment of running the epidemic hot. We also concluded that the question about identifying a 'tolerable' level of incidence for running the epidemic hot was a political question, not a scientific one.

136. The strategy that the government in fact adopted post lockdown was to keep R below 1, without taking a view about how many infections were tolerable. As such, I agree with the Institute for Government's assessment that there was a lack of joined-up thinking in government when exiting the first lockdown in 2020. Without a commitment to a target level of infections, the aim of keeping R below 1 is only half a strategy. For the same reason, I do not understand what HMT meant by aiming to "*stay ahead*" of the virus. It is not clear to me what the government meant with this phrase.

137. In a press conference on 19 May 2020 I observed that if lockdown measures were to be lifted they needed to be replaced with another way to keep R below 1 (such as an effective track and trace system being in place) and that any lifting of restrictions needed to be based on observed levels of infection, for instance by reference to the R number and number of daily infections, and not on a fixed date. On the former point, the ready-reckoners we produced were a good way of evaluating different kinds of NPIs that could be imposed in the place of lockdown. In my view, these principles were not observed. If they had been we may have been able to keep the number of infections at a more manageable level in the autumn of 2020, which we always understood was going to be a period of rising infections (see for example the graphs in the SPI-M-O consensus statement of 4 May 2020 on the potential relaxing of social distancing measures) [DAM/37 **INQ000236423** Instead, it appeared that the government was very keen to restore economic activity as fast as possible.

Summer 2020

138. The ONS CIS are the best data for looking at what did in fact happen with infections [DAM/88 **INQ000075671**]. The graph at Figure 1 shows that the percentage of people testing positive was low through July and August, but clearly picked up by the beginning of September with R above 1 by late August [DAM/89 **INQ000317506**

139. In May 2020, Professor Ferguson resigned from SAGE and I am asked why it was considered appropriate for him to continue attending SPI-M-O meetings. It was my view that Professor Ferguson's decision to resign from SAGE was appropriate, but his reason for doing so did not render him unsuitable to be a participant of SPI-M-O. Professor Medley shared my view. Professor Ferguson's expertise and experience in epidemiology were an important resource for SPI-M-O. Professor Ferguson was very good at letting more junior colleagues present his unit's work, however it remained

essential to have him present to comment on: the state of the epidemic, the kind of analysis it would be useful to present, and to critique the work presented by others. There is no doubt in my mind that SPI-M-O greatly benefitted from Professor Ferguson's continuing attendance. I agreed to take the heat if anyone within government or the press took issue with that decision [DAM/90 **INQ000215941**].

140. The Inquiry have asked a series of questions about the 'Eat Out To Help Out' policy. This was announced on 8 July 2020 and was in effect throughout August 2020. As Sir Patrick Vallance observes, SAGE were not consulted on this policy prior to it being implemented [DAM/26 **INQ000238826** – paragraph 346]. I also do not recall any SPI-M-O commissions for advice on the policy. I have not been able to find any references to this phrase in any papers tabled to SAGE or SPI-M-O consensus statements between June and August 2020. Professor Medley similarly does not recall being asked for advice about the scheme [DAM/8 **INQ000260643** – paragraph 6.17b]. Therefore, I have no knowledge about what science advice, if any, informed this scheme.

141. I am asked whether the scheme of incentivising people to enter public spaces and normalise dining in hospitality establishments after the first lockdown was consistent with suppressing the number of Covid-19 infections. It was not. A SPI-M-O paper "*Comments on Social Distancing Measures"* from 22 June 2020 observed that "*SPI-M-O do not believe it is possible to return to a "pre-COVID" normality, without levels of contact tracing and COVID security effectiveness that would be difficult to achieve, without some sort of additional increase in immunity"* and "*In order to be able to re-open schools in September without causing a second wave, it* [is] *therefore critical that some measures remain in place"* [DAM/91 **INQ000074930**] If SPI-M-O had been asked to advise on the scheme, the advice would have been in line with these observations.

<u>September – October 2020</u>

142. On 20 September 2020 I attended a meeting with the Prime Minister, the Chancellor of the Exchequer, Dominic Cummings, the Cabinet Secretary, Professors Edmunds, Gupta and Heneghan, Dr Tegnell, the GCSA, the CMO and a few others from No.10. Sir Patrick Vallance explains why this meeting was set up in his statement [DAM/26 **INQ000238826** – paragraph 372]. The question to be addressed was: "*Should the UK Government intervene and if so how?".* Professors Edmunds, Gupta, Heneghan, Dr

Tegnell and I were asked to submit papers in advance and present our views at the meeting. The paper I produced has been provided to the Inquiry [DAM/92 **INQ000146609**]. I did not take a note of the meeting, but from memory, the gist of the views of the other scientists were as follows:

a. Professor Gupta argued that we could conduct tests to establish the risks of infection with influenza and Covid-19, or alternatively we could take steps to protect the vulnerable while allowing those who are at low risk to accumulate immunity.

b. Professor Heneghan argued that the road ahead would be bumpy and there will be more deaths but that deaths were lower than influenza and pneumonia.

c. Dr Tegnell commented that the myth that Sweden did nothing during the pandemic was false and that the UK government should intervene now.

d. Professor Edmunds argued that there was an urgent need to lock down.

143. I argued that without decisive action we could expect to breach the RWCS in the next few days, and that we could not rely on test and trace to function effectively in a large second wave. My view was that we needed to reintroduce more stringent NPIs. When asked directly what I thought the government should do I said we should lockdown but keep schools open. At SAGE 58 the next day it was recommended that a national 'circuit breaker' should be considered for immediate introduction [DAM/93 **INQ000212102**]. In my view a circuit breaker should have been introduced; although I did not think it would be enough, there could have been further consideration of what to do next nearing the end of it. A circuit breaker was not introduced, which showed a lack of caution on the part of decision-makers.

144. I can confirm that the series of WhatsApp messages about which I am asked, exchanged with Professor Edmunds on 20 September, were sent during this meeting [DAM/94 **INQ000207199**]. The messages are a running commentary on the presentations, and I cannot recall exactly what they refer to. They contain gallows humour in what was a private exchange with a trusted colleague during a stressful situation. Part of the context was that the 'Eat Out To Help Out' policy had demonstrated that the government was, in respect of that policy, willing to accept a level of Covid-19 cases in exchange for opening up the economy. As discussed below,

I found the period September 2020 and October 2020 to have been a particularly challenging time, the worst period for me during the pandemic, as we could see what was coming and could not understand why the government did not act upon the science advice by introducing effective interventions.

145. The day after the meeting, I forwarded Professor Edmunds an email chain in which Professors Gupta and Heneghan complained about the format of the meeting [DAM/95 **INQ000212108**]. I cannot recall having a discussion with Professor Edmunds beyond this email exchange. I agree with the sentiment expressed by Professor Edmunds in his email in response, namely that the presentations of Professors Gupta and Heneghan had been inaccurate. Among the more important inaccurate assertions made by Professors Gupta and Heneghan were that: most of the population were immune ('dark immunity'), we could not measure immunity, we should let everyone acquire immunity by allowing a huge second wave because we could fully shield all the vulnerable, and that Covid-19 was less dangerous than influenza.

146. I am asked about a paper I co-authored concerning children. On 17 October 2020, I co-authored a paper with Professor Edmunds titled "*A short note on the role of children in transmission of SARS-Cov-2*" [DAM/96 **INQ000206750**]. We wrote this paper because we shared concerns about how data on children's susceptibility and infectiousness were being discussed. Our aim was to change the discourse from "children are not important in transmission so schools can stay open" to "children are important in transmission, we must keep schools open, so how can we manage this". My view at the time was that being in school was very important for children so we needed to do everything we could to keep schools open, but that we needed a nuanced approach on how to do so. As schools re-opened in September 2020 and because good testing was available, we thought it was a good time to revisit the evidence and bring this to the attention of SAGE. The paper summarises data that illustrate that children can catch Covid-19 at the same rate or faster than adults and are more likely to pass it on to other people in their household than adults (as shown in Figure 7 on the last page of the paper). The role of children in the transmission of Covid-19 was discussed in many SAGE meetings in October and November 2020. I cannot recall discussion of this paper in particular. Emails sent in August 2020 on mass testing are not relevant to this work [DAM/97 **INQ000215820**]. The role that children (hence schools) played was later acknowledged, but by the time it was it was too late to inform well designed policies on schools. I agree with Professor Edmunds' comment to this effect [DAM/94 **INQ000207199**].

147. I am asked whether I consider the government's approach was sufficiently cautious during this period (i.e. around mid October 2020). I do not think it was. We could see infection rates rising. We knew that a large proportion of the population had still not been infected so were still susceptible. It was therefore inevitable that the epidemic would grow larger. The policies of 'Eat Out To Help Out', the tier system (discussed below), and a failure to implement a circuit-breaker all suggested, from my perspective, a lack of caution on the part of decision-makers.

148. On 23 October 2020 I sent an email entitled "*how long have we got?"* to the GCSA and CMO, which contained simple, back-of-the-envelope calculations to address the question: if we do not want hospital admissions to get worse than they were in the first wave how soon do we need to intervene to bring the R number below 1 [DAM/98 **INQ000062800**]. We concluded we had 2.5 weeks. If we wanted to do better than the first wave then we had five days. The GCSA replied saying that he would make sure the Cabinet Secretary saw my calculations, and the CMO wondered if a regional version of the same calculations were possible [DAM/99 **INQ000317535**] If I remember correctly, we did not produce regional versions of these calculations.

149. I have been asked questions about the tier system introduced in October 2020. Neither SAGE [DAM/26 **INQ000238826** – paragraph 382] nor SPI-M-O [DAM/8 **INQ000260643** – paragraph 6.38] were asked to advise on this policy. The Inquiry have asked for my views on the Tier System.

150. Neither tier 1 nor tier 2 could reliably stop growth. So, for places in tier 1, infections just kept rising as they did in many places in tier 2. It was a poor strategy. This was explained in "*The UK's 4 nations autumn interventions"* paper discussed above [DAM/15 **INQ000114473**] On p.9, figures 3a-d of that paper compared the growth rates of Covid-19 in areas placed into tiers 1 to 3 respectively. The paper observed: "*Through the autumn England waited until after prevalence had increased to impose measures just about able to slow or stop epidemic growth. The inexorable outcome was high prevalence in many places and the need for four weeks of national restrictions. For the future a more logical procedure might be to introduce measures (such as Tier 2) that can be hoped to retard the growth everywhere and maintain low prevalence. As soon as rising prevalence is detected, measures should escalate to interventions that are associated with negative growth rates (such as Tier 3)*". My view is that there was nothing wrong with the concept of tiers, just that they were introduced the wrong way

round. It would have been more sensible to put the whole country into tier 2, monitor whether infections rose or fell, and then decided whether to move the various regions into tier 3 or 1 (or to keep them in tier 2) on the basis of that information. The poorly conceived nature of the tier system was a symptom of not being cautious enough in this period.

151. Tiers were also considered in a SPI-M-O consensus statement prepared for SAGE 66 on 5 November 2020 [DAM/100 **INQ000253921** and a SPI-MO statement prepared for SAGE 67 on 12 November 2020 [DAM/101 **INQ000071722**

152. As well as 'Eat Out To Help Out' and the tier system, other policies such as the 'rule of 6' were made without guidance from SAGE nor SPI-M-O [DAM/26 **INQ000238826** – paragraph 354].

Second lockdown onwards

153. December 2020 to January 2021 was a terrible moment of the pandemic. However, for me, the worst moment of the pandemic was September and October 2020; we could see what lay ahead, the epidemic was growing at pace, we were giving science advice that reflected that, and I could not understand why the government did not act upon that advice to make an effective intervention earlier.

154. On 21 December 2020, I attended an extraordinary meeting of NERVTAG and SPI-M-O on Covid-19 variants [DAM/102 **INQ000212114** This was a meeting to discuss the emergence of a new variant of concern, later to be called the Alpha variant. I attended this meeting and cannot recall making any contributions.

155. There was a risk that coming out of lockdown in early 2021 would lead to disaster. At this point, we knew it would take some time until enough of the population were vaccinated, so we needed to carefully consider the timing of when to relax NPIs. At this point, even though burden of disease still fell largely on the elderly, there were a significant number of younger people with no known risk factors who fell gravely ill. There was the possibility that other variants might arise. In early 2021, the commission for the roadmap out of lockdown was a good example of how to make a long-term plan with effective and timely science input. We knew we needed approximately five weeks between each step to observe how rates of infection responded. We had good data to

forecast vaccine availability and effectiveness, a good idea of hospitalisation and mortality rates by age, a good understanding about what the government wanted to achieve, and a good ability to monitor the effects of each stage of 'unlocking'. In my view, the roadmap out of lockdown had a proper focus on data rather than dates. The government needed to be flexible about its plans to unlock and accepted that it was not possible to know exactly what would happen next. The agility of the process was tested with the emergence of a new variant in the spring of 2021 which delayed the unlocking plan in an appropriate manner.

156. In 2021, I explained that we needed to move away from a focus on the R number to timing and considering the proportion of those who were at risk. Once we had a vaccine that we could see was keeping vaccinated people out of hospital, my thinking about what could go wrong got a bit more complicated. The more people were vaccinated, the fewer people were at horrible risk if the R number got larger than 1 for long. We knew that one day we would have done all we could to protect people with vaccines and, as with other infections, we would accept the spread of Covid-19. The question became how far along the path to that state were we? The roadmap out of lockdown discussed above made precisely these kinds of calculations. However, as far as I know, all public communications remained focused on the R number.

157. I am asked about a message I received from Professor Edmunds on 29 November 2021 [DAM/94 **INQ000207199**]. I cannot recall the context of these messages. I had a speaking engagement on that date, as well as a SAGE meeting [DAM/103 **INQ000061605**]. Professor Edmunds can speak to what he meant by his message. It may be that Professor Edmunds meant that the CMO was expressing scepticism about modelling. My view is that the CMO had a healthy and well-informed scepticism about all forms of evidence.

LESSONS LEARNED

158. Throughout this statement, I have reflected on important lessons to be learned for the future. To draw out some key, recurring themes:

159. First, the importance of reaching a consensus in modelling. As already mentioned, early in the pandemic, SPI-M-O placed significant reliance on the work of the Imperial College research group. This was a natural result of the fact that Imperial College very

quickly produced the earliest models. SPI-M-O output was much improved when we had three or four research groups addressing the same policy questions with largely the same data.

160. Second, the response to the pandemic highlighted the supremacy of data, and how much work it takes to make appropriate data available to the appropriate collection of independent research groups. We need better systems for collecting and analysing data inside government, and better systems for securely sharing data outside government when necessary. I am aware that this is an area of improvement which has been highlighted by witnesses to the Inquiry during Module 1, and I endorse their comments on the need for better data and data processes.

161. Third, the extent of the pandemic showed that real life can be worse than the RWCS. In the planning stage, we need to find good ways to manage our own optimism bias and find ways to prepare for civil emergencies that we can afford. In the response stage, I have commented above on the need to re-evaluate the role for RWCS. In a long-duration emergency, it becomes untenable to design a policy neutral RWCS.

162. Fourth, there is a need for focused, collaborative and coherent commissioning of science advice, and some means of oversight of this, right from the start of any emergency response. For that we need more competent hands inside government to ask for advice and then receive it and use it widely inside government. That includes feeding back when advice is not helpful and why. We were lucky to have Ben Warner and then Rob Harrison as interlocuters at the heart of No.10 and the Cabinet Office, but we needed many more such figures.

163. Fifth, advisory groups such as SAGE and SPI-M-O can work most effectively in the context of a clearly defined strategic plan. This requires decision-makers to formulate and then clearly articulate their strategic aims. Models should be used to support longer-term strategic thinking, through scenarios. This is discussed extensively above. I respectfully refer the Inquiry to Ben Warner's observations on this point [DAM/79 **INQ000269182** – paragraph 93].

164. I am asked by the Inquiry whether I think it would have been beneficial for an advisory economics and/or social impacts group, akin to SAGE, to have provided advice to core decision-makers during the pandemic. I think that an important feature of advice within government, irrespective of whether it is given by individuals or through advisory groups or bodies, is that it is transparent. There are a lot of economists in government,

I am not sure whether there was the same need for external advisers, but it would have been useful if they had been transparent about how they were assessing and modelling the economic impacts of different policies. Therefore, if an economic/social impact group existed and published its minutes in the same way SAGE did, I think that would have been highly beneficial. If we had a better understanding of what the economics advice was, and by what method it had been arrived at, we may have been better placed to put to bed the false trade-off between public health and the economy. As I had no exposure to decision-making throughout the pandemic, I cannot comment on the extent to which other considerations, such as economic or social impacts, were considered in decision making.

Science advisory mechanisms

165. Dr Wainwright's fourth statement [DAM/104 **INQ000148406** – paragraphs 11 – 33] describes how the effectiveness of SAGE has been studied by individuals and groups. In September 2021, I organised a discussion with over 30 SAGE and sub-group participants to reflect on major challenges and successes during the SAGE Covid-19 activation, to reflect on which data streams were needed to underpin SAGE and sub-group advice, how these data streams had been sourced and what blockers had to be overcome to access the data, and to consider how to prepare for and ensure access to data streams during emergencies. A note of that discussion can be found at [DAM/105 **INQ000064199**]. I defer to other witnesses about the work that has been done, and continues to be done, to address learnings from these studies in relation to SAGE. In particular, I refer the Inquiry to the Government Office for Science's lessons learned statement [DAM/106 **INQ000064446**].

166. In terms of whether SPI-M-O needs to be re-evaluated, it is worth bearing in mind that SPI-M-O's processes and ways of working evolved during the response to reflect ongoing learning and changes in context. This process is still ongoing. The SPI-M secretariat are currently reviewing SPI-M, in the context of the ongoing development of UKHSA's role and responsibilities. This may have implications for SPI-M-O and its relationship with SAGE in the future. I defer to the views of those carrying out this work on what they recommend for the future.

167. Broadly, I think there are a number of points to reflect on concerning how science advice is provided to government:

a. We should have a discussion about how pro-active we want our advisers to be. Should they wait to be asked or wade-in and point out where the big gaps are?

b. We need more technically trained quantitative analysts, including modellers, in the heart of government. Government ought to be able to do most of its own modelling.

c. We need to put more effort and resource into ways of presenting advice. Decision-makers are under extreme time pressure. Advisers need help to make their advice very easy to assimilate.

d. Relying on good-will and volunteering was probably asking too much. We should not assume that the same community will step up with the same vigour and enthusiasm if we have an infectious disease emergency in the near future.

168. I am asked how scientists and policy-makers can work more closely and collaboratively together in order to ensure the effective translation of science advice into evidence-based policy. My view is that:

a. Working together in peace-time' builds relationships and trust as well as technical products (e.g. models and methods of analysing data) all of which will help with this translation should emergencies arise. Perhaps we could use epidemiology and economic modelling as a case study in how to build a community across government and between policy-makers and scientists (both within the government and in academia).

b. We should use the existing porosity agenda to bring early career scientists into central government to get to know their peers, our problems, and our ways of working. We should try to persuade some of them to stay to address the issue identified above of not having enough technically trained quantitative analysts in government.

c. It is not obvious to me that we do enough exercising of the risks in the National Risk Register. I see exercising as an excellent opportunity to build communities and identify problems together.

169. Finally, I would like to pay tribute to the work of the National Academies, who were fantastically helpful in many ways. I was personally particularly grateful for the Royal Society's RAMP Rapid Review group who did an excellent job of reviewing unsolicited help that poured in from multiple sources.

Statement of Truth

I believe that the facts stated in this witness statement are true. I understand that proceedings may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief of its truth.

Signed: Personal Data

Dated: 19 October 2023