Response to Initial Questionnaire from COVID-19 Public Inquiry

Steven Riley, 10th October 2022

These responses reflect a review of documents upto and including 23rd March 2022. If useful and requested, I am happy to revisit these questions after a further review of documents for the remainder of the period of interest.

Questions are *reproduced in italics* and a list of references for the numbered citations are given at the end of this document in section 9.

1 Overview of career

Please provide the following information:

1. A brief overview of your qualifications, career history, professional expertise and major publications.

1.1 Since 2003, I have published papers that have helped shape the science of infectious disease dynamics using advanced analytics, transmission models, primary data collection and secondary data analyses. I have tried to improve decision making during outbreaks, and, between outbreaks, discovered features of underlying ecological and biological processes that enable better health security policy.

1.2 My early work on SARS-CoV-1 that appeared in Science in 2003 was the first to quantify the transmissibility of a human coronavirus and showed that the overall reduction in social mixing in Hong Kong likely contributed to ending the outbreak [1]. Also, in addition to population-wide behaviour change, SARS-CoV-1 was controlled more easily than other respiratory viruses because the proportion of transmission arising from non-symptomatics was low [2].

1.3 After collaborating on SARS-CoV-1, I joined the University of Hong Kong's newly founded School of Public Health in 2004 to work on influenza as a case study of a potentially pandemic pathogen [3] and to dveelop spatial models of infectious disease [4].

1.4 While working in Hong Kong, I came to the conclusion that scientists sometimes make too much effort fitting models of disease systems to secondary data when important discoveries could be made more efficiently by gathering additional primary data. Therefore, during the 2009 influenza pandemic kicked-off the Hong Kong Influenza Serological Study to accurately estimate the low infection fatality rate [5] and started the FluScape cohort in Guangzhou to collect serum samples and behaviour data from a spatially stratified urban-rural population [6]. I returned to Imperial college in 2010. The FluScape study in Guangzhou continued up to the very start of the COVID-19 pandemic. I visited 3 or 4 times per year and had regular calls with colleagues at universities and hospitals in mainland China this maintaining a strong professional network in greater China.

1.5 I contributed substantially to the UK response to COVID-19 from the first Imperial College Report [7] on 17th January 2020 which highlighted the likely underestimation of infections in Wuhan at that time: the report was started on 16th January when the

second exported infection was confirmed at the Japanese border. Using his membership of the Scientific Pandemic Influenza - Modelling committee, I stated clearly on record on 10th March that the UK should implement stringent social distancing [8].

1.6 After the lockdown was implemented, as well as contributing to SPI-M and other SAGE sub-groups, I helped lead the REal-time Assessment of Community Transmission (REACT) study to ensure that England had the best possible primary data on community transmission of SARS-CoV-2 [9,10]. Results for this study were immediately made publicly available via pre-prints (www.medrxiv.org).

1.7 Since October 2021 I have been seconded into the UK Health Security Agency (UKHSA) as Director General for Data, Analytics and Surveillance (DAS). I am a founder member of the UKHSA Executive Committee and led the reshaping of teams from the Joint Biosecurity Centre into an enduring public health data and analytics function of ~600 people. The DAS Group aims to ensure that the UK government has at its disposal a substantial and scalable capacity to: capture, curate and generate insight from various data streams; so as to reduce harms from infectious disease and environmental hazards.

2 Group membership

2. A list of the groups (i.e. SAGE and/or any of its sub-groups) in which you have been a participant, and the relevant time periods.

2.1 I was an associate member of SPI-M prior to the pandemic. I believe that the distinction between associate member and full member was not carried forward when SPI-M was operationalised into SPI-M-O. I attended the vast majority of SPI-M meetings until my secondment into UKHSA at the start of October 2021. After that I attend some SPI-M meetings and also one or two SAGE meetings. I was a member of the children's task and finish subgroup of SAGE, but did not attend all the meetings. I may have attended meetings for other task and finish sub-groups of SAGE. I was also a member of the data debrief group (DDG) for the large surveillance studies which was initially convened directly by the Department of Health and Social Care (DHSC).

2.2 I have not been able to prioritise a thorough review of my records to give precise time periods and attendance records. I would be happy to cross-check a summary of records held by the SPI-M or SAGE secretariats, or to conduct a more thorough review if necessary..

3. An overview of your involvement with those groups between January 2020 and February 2022, including:

a. When and how you came to be a participant;

3.1.1 Please see point 2.2.

b. The number of meetings you attended, and your contributions to those meetings;

3.2.1 Please see point 2.2.

c. Your role in providing research, information and advice.

3.3.1 Up to joining UKHSA, I contributed to research feeding into government advice in the following ways: primary modelling work, primary data analyses, design of field work, review of analytical output, review of and synthesis of literature, provision of expert opinion on specific topics, oral responses to work by others in meetings, editing post-meeting consensus statements.

3.3.2 I also provided peer-support and leadership to others with similar roles to those described in point 3.3.1.

4 Summary of documents

4. A summary of any documents to which you contributed for the purpose of advising SAGE and/or its related subgroups on the Covid-19 pandemic. Please include links to those documents where possible.

4.1 I have not been able to prioritise drawing up a comprehensive list of documents to which I contributed. Elsewhere in this response, I cite some specific key documents. If required, I would be happy to validate a list of documents and authorships provided by secretariats at SAGE, SPI-M or Imperial College.

5 Summary of articles and interviews

5. A summary of any articles you have written, interviews and/or evidence you have given regarding the work of the above-mentioned groups and/or the UK's response to the Covid-19 pandemic. Please include links to those documents where possible.

5.1 I gave many media interviews both on and off the record and on background. In general I tried not to comment on the performance of these groups or on the overall quality of the response. I accepted media requests when I thought I was the right voice and had the right knowledge to clarify science that was relevant to the current policy debate. However, I am sure some of my comments would have touched on these issues at times, either directly or indirectly.

5.2 One exception that I recall is being interviewed for the book "Spike" by Jeremy Farrar with Anjana Ahuja. I had at least one long conversation with Anje and reviewed drafts of the relevant chapter. The chapter deals with the delay in the implementation of social distancing and the work I refer to later in this response. I did see and approve sections that dealt directly with my quotes and my opinion prior to publication, but I did not see or approve the final version of the chapter.

5.3 I was also interviewed for the book "Failures of State: The Inside Story of Britain's Battle with Coronavirus" Jonathan Calvert and George Arbuthnott. Similarly, I approved my quotes for this chapter.

6 Views on the work of the groups

6. Your views as to whether the work of the above-mentioned groups in responding to the Covid-19 pandemic (or the UK's response more generally) succeeded in its aims.

This may include, but is not limited to, your views on:

a. The composition of the groups and/or their diversity of expertise;

6.1.1 Over the course of the pandemic SAGE and its subgroups provided an incredible volume of high quality advice as evidenced by their papers and by the corresponding scientific output of their members. The rest of the world looked to the UK for scientific leadership throughout the pandemic and that was driven priamrly by SAGE and its subgroups. Comments about the composition of these groups and their diversity of experience must be considered in light of their output.

6.1.2 I do not believe that SPI-M / SPI-M-O should ever have been constituted and described as a modelling group. Even though many members of SPI-M used mechanistic models and many identify as modellers, this leads immediately to misconceptions about the type of evidence that the group was able to provide. The group was qualified to provide insights into the epidemiology and disease dynamics of SARS-CoV-2. Some of that evidence relied on mechanistic transmission models.

6.1.3 The group should have included more members who identified primarily as epidemiologists.

6.1.4 The group should have had a transparent process for the recruitment of new members through which typical measures of diversity such as gender and ethnicity could have been monitored.

b. The way in which the groups were commissioned to work on the relevant issues;

6.2.1 Often the commissions were too narrow, especially at the start of the pandemic. During key weeks leading upto the first national lockdown we were asked to give very precise numerical descriptions of the impact of possible interventions. We were asked for realistic worst case scenarios (RWCs).

6.2.2 We should have been asked to give considered opinions on what was happening in other countries and on what was likely to happen in the UK. We should have been told to use models as appropriate and to give a clear reflective description of the accuracy of our models given their assumptions and the currently available data and knowledge.

6.2.3 On reflection, we should not have been asked for a RWC. We should have been asked to describe scenarios that we thought were likely and/or relevant and to give an accompanying narrative. My note of 10th March was a direct consequence of my holding this opinion at the time.

c. The resources and support that were available;

6.3.1 The staff supporting SPI-M were excellent. They immediately grasped the science and were able to facilitate very difficult discussions and provide excellent consensus evidence for the commissions that we received. My decision to accept a secondment into the UK Civil Service was influenced greatly by the positive experience of working with the civil servants on the SPI-M team and those in the Joint Biosecurity Centre.

6.3.2 As a member of the MRC Centre for Global Infectious Disease Analysis, I was fortunate to benefit from some excellent additional support in the form of

communications professionals and policy liaison leads. I was also a member of a large team who were incredibly supportive of each other during the most difficult of times.

6.3.3 The pressure on senior academics participating in SPI-M was too much. From mid-February onwards, host institutions should have been given rapid grants and some accountability for project management, counselling (for stress management) and leadership support. The de facto expectations were not reasonable for academic leadership in the SPI-M groups to manage: evidence generation, group leadership, advice formulation, other stakeholders and global media.

d. The advice given and/or recommendations that were made;

6.4.1 See point 6.1.1. SAGE and its subgroups led the UK scientific effort which, in many ways over the entire course of the pandemic, led the global scientific response. These groups produced a large volume of the highest possible quality evidence and advice.

6.4.2 The instructions for this questionnaire state that module 2 of the inquiry is going to focus on the period from January to March 2020. That is the time period I focus on below.

6.4.3 I did not attend SAGE until October 2021. As a member of SPI-M I saw consensus statements as they were sent and I saw SPI-M papers. During the key period upto 23 March 2020, my main way to assess how evidence was coming together through SAGE, was via the public statements of senior advisors. SAGE papers were not made publicly available until later.

6.4.4 Having reviewed my own documents, emails, and tweets; it is my view that the health and scientific advice at the COBR meeting on 9 March 2020 should have been strongly in favour of immediate stringent social distancing. It was clearly trailed in the media that the meeting would be considering that option. I do not know whether or not such advice was given at that COBR meeting. However, when the prime minister and senior government science and health advisors gave a press conference later that day to explain why the UK was not implementing social distancing, there was no implication that the decision was driven by anything other than scientific and health issues. SAGE papers from that week contain no real consideration of stringent social distancing other than point 28 in the SAGE minutes of the 10th March: “SAGE agreed that a balance needs to be struck between interventions that theoretically have significant impacts and interventions which the public can feasibly and safely adopt in sufficient numbers over long periods.”

6.4.5 I had given very specific advice early that morning of 9 March to the SPI-M mailbox. I outlined why my view of the scientific evidence was that social distancing should be recommended at that COBR meeting.

6.4.6 The language used during the news conference later on 9 March suggested that the sum of scientific evidence supported continued delay until the recommendation of stringent social distancing. I did not agree with that at the time and I still do not agree with that assessment.

6.4.7 Early on 10 March I submitted a note to SPI-M and others in which I used a mechanistic transmission model to illustrate why I believed immediate social distancing was the correct policy choice. The note uses a simple model to show that any plan for the UK to 'weather' a large rapid wave of infection with the objective of achieving herd immunity was misguided because: even if such a wave did occur, the consequences would be catastrophic; and such a wave would not occur, because people would reduce their contacts when healthcare was overwhelmed, leading to either a prolonged period of high prevalence or a costly reactive lockdown. The expected period of prolonged high prevalence was similar to the time within which we might have reasonably expected a vaccine to become available.

6.4.8 I was told that my note was discussed during the SAGE meeting on 10 March. The note is publicly available as an appendix to a subsequent note sent on 16 March (Ref [8] in References section below).

6.4.9 Advice and policy seemed to change quickly after the news conference on 9 March. It seemed clear from the media and twitter that many groups were alarmed by the rationale being put forwards. I do not know how much difference my contribution of 10 March made nor how widely it was circulated after the SAGE meeting. If its conclusions did surprise people at that point, it may be useful to understand why that was the case.

6.4.10 It is my view that had the UK been in a position to implement stringent social distancing on 9 March or before, we could have had a much smaller first wave of the pandemic with a shorter period of stringent social distancing and far less disruption to our healthcare services. We will never know whether it would have been possible to achieve the support of the public at that time.

e. The extent to which the groups worked effectively together;

6.5.1 There were many excellent examples of effective commissions. However, at times, it seemed clear that SPI-M was viewed as providing modelling results while SAGE discussed the science. This was reflected in the commissions and the lack of requests for scientific synthesis or opinion from the SPI-M group. The value of the models -- even when results were presented from multiple groups -- should have been less important than the synthesis of the results of those models against the data. Later in the pandemic, when senior officials observed SPI-M directly, this aspect of the SAGE / SPI-M working relationship was less important because the interpretation alongside the results was more accessible.

f. The extent to which applicable structures and policies were utilised and/or complied with and their effectiveness.

6.6.1 I have no additional comments on this at this time.

7 Lessons learned

7. Your views as to any lessons that can be learned from the UK's response to the Covid-19 pandemic, in particular relating to the work of the above-mentioned groups.

Please describe any changes that have already been made, and set out any recommendations for further changes that you think the Inquiry should consider making.

7.1 I am currently seconded to the UK Health Security Agency as Director General for Data, Analytics and Surveillance and a member of the executive committee. My comments here are my own and do not necessarily reflect the agreed view of UKHSA.

7.2 Lessons from the early stages of the COVID-19 about the provision of scientific advice can be learned at many levels, from the specific to the general. The value from the inquiry looking at different issues will be a function of how generalizable those lessons are and how impactful the learnings are.

7.3 I encourage the inquiry to look for specific learnings about viral respiratory threats such as COVID-19 and influenza, in addition to more structural findings. These pathogens pose an ongoing substantial threat to the health security of the UK population, and we have learned a lot about how we respond as a population to those types of threat in the past ~3 years. Successful learning of lessons about viral respiratory pathogens, and subsequent investment, will lead to substantially increased health security for the UK population for a prolonged period of time. A minimum reasonable expectation from the UK population is that if a very similar threat were to arise in the near future, we would make substantial improvements in our response.

7.4 Having a very clear plan could create a risk that we would not be flexible enough if the next threat were different in an unexpected way. Technology, people and processes need to be constantly challenged with simulated exercises and guided by outside thinking, to ensure that the future response is sufficiently flexible. A very clear plan does not necessarily lead to an inflexible response.

7.5 Social mixing drives the transmission rate of respiratory pathogens. If the consequences of infection are severe, people will reduce their social mixing and therefore their contribution to the economy. In our developed economy, there is no plausible scenario where social mixing stays even approximately constant and hundreds of thousands of people die during a rapid epidemic of a respiratory pathogen.

7.6 The people of the UK can accept mandated changes in their behaviour for a long period of time and will respond to non-mandated messaging around infectious disease threats with substantial reductions in their social mixing.

7.7 Large scale changes in social mixing as a result of either a spontaneous reaction to the presence of a severe pathogen or as a result of government mandation have substantial negative indirect effects.

7.8 With sufficient information and communication, the period from January to July 2021 (the “Roadmap” period) has shown us that stringent social distancing can be relaxed in a controlled and stepwise manner.

7.9 Technology is available to produce effective safe vaccines against specific coronaviruses and (likely) influenza in a short period of time if sufficient investment is made now.

7.10 In future scenarios that could lead to situations similar to those of 9 March 2020, scientific advice should be structured so as to best support big decisions, e.g. those around the initiation of vaccine manufacturing and implementation of social distancing. If a severe respiratory pathogen were circulating in the UK we should

- Ensure vaccine production is already be underway
- Implement social distancing sufficiently strong to ensure that incidence of infection immediately goes into decline
- Be able to accurately and rapidly assess infection incidence trends
- After a short period when we were sure incidence of infection was declining, we would immediately implement a stepwise relaxation of social distancing with ministers deciding on priorities for relaxation (a very rapd “roadmap”)
- With excellent surveillance, we would ensure we achieve the maximum possible social mixing and economic activity but without allowing the prevalence of infection to increase
- We would vaccinate primarily according to individual risk and relax all social distancing as soon as acceptable
- Some countries around the world did achieve close to this during the current pandemic and had far less excess mortality and far less disruption to their economy

7.11 To be in a position to confidently present the plan outlined in 7.8 the UK needs to make substantial investment:

- Rapid high volume onshoring of mRNA vaccine production should continue to be a priority
- Technology, people and processes must be created and maintained to immediately recognise when we may be heading to a scenario similar to that of March 9 2020, so that evidence can be generated to support the decisions and inform the public. We will not be able to rapidly upscale the capabilities that are required to know if we need to upscale capabilities.
- Sound underlying science is required for every possible policy and technology that might be used to rapidly relax social distancing.
- The scale of these investments should be compared with investments in defence, intelligence and climate threats. They should not be judged alongside the yearly health and social care budget.

8 Documentation

8. A brief description of documentation relating to these matters that you hold (including soft copy material held electronically). Please retain all such material. I am not asking for you to provide us with this material at this stage, but I may request that you do so in due course.

8.1 The vast majority of my work relevant to the inquiry is described in my email and tweets. I have deleted only a handful of tweets over the years. I deleted one tweet

criticising the New England Journal of Medicine for an article that was very out of date that they published in final form at the end March 2020. My tweets for the period covered here can be accessed with the following search on the twitter website:

(from:srileyidd) since:2020-01-01 until:2020-03-24

8.2 I also have some contemporaneous notes and my whatsapp messages.

8.3 My scientific output is all available either at the imperial college website for the COVID-19 Response Team and REACT, or on medRxiv. My google scholar page gives a good list of publications, almost all of which are immediately available as full text.

https://scholar.google.com/citations?user=1mTtPIIAAAAJ&hl=en

9 References

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[4] Riley S. *Large-scale spatial-transmission models of infectious disease.* **Science.** 2007 Jun 1;316(5829):1298-301.

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[7] Imai N, Dorigatti I, Cori A, Riley S, Ferguson NM. *Report 1 - Estimating the potential total number of novel Coronavirus (2019-nCoV) cases in Wuhan City, China.* **Imperial College Report**, 17th January 2020. https://bit.ly/2XKZWvR

[8] S Riley. *Low critical care capacity and high severity of COVID-19 mean there is little functional difference between successful "flattening the curve" and ongoing containment.* Paper in support of **Scientific Advisory Group for Emergencies** meeting on 16th March 2020, including as an Appendix, *Mitigation of COVID-19 epidemics will likely fail if the population reduces rates of transmission in response to the saturation of critical care facilities*, circulated by email to **Scientific Pandemic Influenza -**

Modelling committee on 10th March 2020. Short link to official site: https://bit.ly/3Asr3dp.

[9] Riley S, Ainslie KEC, Eales O, Walters CE, Wang H, Atchison C, Fronterre C, Diggle PJ, Ashby D, Donnelly CA, Cooke G, Barclay W, Ward H, Darzi A, Elliott P. *Resurgence of SARS-CoV-2: Detection by community viral surveillance.* **Science**. 2021 May 28; 372(6545): 990–995.

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