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13th October, 2022

To: Baroness Hallett, Chair of the UK Covid-19 Inquiry.

Re: UK COVID-19 Inquiry: Module 2 - Rule 9 Request to Professor Rowland Kao - Reference: M2/SAGE/01/RK

Dear Baroness Hallett,

Please find below my response to the questionnaire as requested. I apologise for the lateness of the reply and can only offer as an excuse an unsual combination of personal and professional pressures. I hope my reply is in sufficient time to be useful.

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

I received my PhD in statistical physics in 1995 and immediately moved to work in infectious disease epidemiological modelling, working first at the Agricultural and Pastoral Research Institute in New Zealand, before moving to the Institute of Animal Health in 1999 then the University of Oxford in 2001. In 2003 I was awarded a Wellcome Trust Research Fellowship which I held at Oxford in the Dept of Zoology, followed by a Wellcome Senior Research Fellowship which I held at the University of Glasgow from 2007. In 2017 I moved to take up my current position at the University of Edinburgh.

My expertise is in the use of mathematical, statistical and computational models of disease transmission, exploiting highly complex datasets. While largely in the realm of livestock diseases, I have also published a number of analyses on diseases of wildlife and in humans. Below are listed published papers that, using the iCITE index, have been cited more frequently that 95% of papers in their respective networks of citations (i.e. amongst papers in a similar field).

Rowland R. Kao
Sir Timothy O'Shea Chair of Veterinary Epidemiology and Data Science
Royal (Dick) School of Veterinary Studies, University of Edinburgh

Year	Title	Authors	Journal
2021	Phylogenetic Structure and Sequential Dominance of Sub-Lineages of PRRSV Type-2 Lineage 1 in the United States.	Igor A D Paploski, Nakarin Pamornchainavakul, Dennis N Makau, Albert Rovira, Cesar A Corzo, Declan C Schroeder, Maxim C-J Cheeran, Andrea Doeschl-Wilson, Rowland R Kao, Samantha Lycett, Kimberly VanderWaal	Vaccines (Basel)
2019	Combining genomics and epidemiology to analyse bi-directional transmission of <i>Mycobacterium bovis</i> in a multi-host system.	Joseph Crispell, Clare H Benton, Daniel Balaz, Nicola De Maio, Assel Ahkmetova, Adrian Allen, Roman Biek, Eleanor L Presho, James Dale, Glyn Hewinson, Samantha J Lycett, Javier Nunez-Garcia, Robin A Skuce, Hannah Trewby, Daniel J Wilson, Ruth N Zadoks, Richard J Delahay, Rowland Raymond Kao	Elife
2014	Supersize me: how whole-genome sequencing and big data are transforming epidemiology.	Rowland R Kao, Daniel T Haydon, Samantha J Lycett, Pablo R Murcia	Trends Microbiol
2013	A restatement of the natural science evidence base relevant to the control of bovine tuberculosis in Great Britain.	H Charles J Godfray, Christl A Donnelly, Rowland R Kao, David W Macdonald, Robbie A McDonald, Gillian Petrokofsky, James L N Wood, Rosie Woodroffe, Douglas B Young, Angela R McLean	Proc Biol Sci
2012	Whole genome sequencing reveals local transmission patterns of Mycobacterium bovis in sympatric cattle and badger populations.	Roman Biek, Anthony O'Hare, David Wright, Tom Mallon, Carl McCormick, Richard J Orton, Stanley McDowell, Hannah Trewby, Robin A Skuce, Rowland R Kao	PLoS Pathog
2009	Revealing the history of sheep domestication using retrovirus integrations.	Bernardo Chessa, Filipe Pereira, Frederick Arnaud, Antonio Amorim, Félix Goyache, Ingrid Mainland, Rowland R Kao, Josephine M Pemberton, Dario Beraldi, Michael J Stear, Alberto Alberti, Marco Pittau, Leopoldo Iannuzzi, Mohammad H Banabazi, Rudovick R Kazwala, Ya-Ping Zhang, Juan J Arranz, Bahy A Ali, Zhiliang Wang, Metehan Uzun, Michel M Dione, Ingrid Olsaker, Lars-Erik Holm, Urmas Saarma, Sohail Ahmad, Nurbiy Marzanov, Emma Eythorsdottir, Martin J Holland, Paolo Ajmone-Marsan, Michael W Bruford, Juha Kantanen, Thomas E Spencer, Massimo Palmarini	Science
2008	Estimates for local and movement-based transmission of bovine tuberculosis in British cattle.	Darren M Green, Istvan Z Kiss, Andrew P Mitchell, Rowland R Kao	Proc Biol Sci
2007	Disease dynamics over very different time-scales: foot-and-mouth disease and scrapie on the network of livestock movements in the UK.	Rowland R Kao, Darren M Green, Jethro Johnson, Istvan Z Kiss	J R Soc Interface
2006	Demographic structure and pathogen dynamics on the network of livestock movements in Great Britain.	R R Kao, L Danon, D M Green, I Z Kiss	Proc Biol Sci
2006	The network of sheep movements within Great Britain: Network properties and their implications for infectious disease spread.	Istvan Z Kiss, Darren M Green, Rowland R Kao	J R Soc Interface

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.

I was been a member of SPI-M-O from Jan 2021 until its end (and then with its successor, SPI-M).

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;
    b. The number of meetings you attended, and your contributions to those meetings;
    c. Your role in providing research, information and advice.

My initial work in analysing COVID-19 models involved working with the Scottish government, including among other things the development of a simulation model to produce medium term projections of the epidemic in Scotland. It was the view of the Scottish govt modelling lead, Dr. Mel Giarchi, that my involvement with the national body SPI-M would be beneficial and I also had conversations with the SPI-M-O co-chair Prof. Graham Medley in this regard. As a result I received an invitation to join SPI-M in Dec 2021 from which point I attended weekly meetings with only occasional absences (I have recorded four absences through the period to Feb 2022). I also attended weekly meetings with the "Space" subgroup of SPI-M (chaired by Prof. Julia Gog) from Jan 2022. I contributed in meetings by critiquing presentations.

Additional analyses of the use of wastewater surveillance, showing the relationship between detection of RNA in wastewater and cases of COVID across multiple sewage treatment sites was presente to SPI-M in 2021 (I do not have the exact date of the meeting).

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Some other analyses I led were also presented at SPI-M, including an analysis of case ascertainment rates (i.e. how many infections were reported over time and by region of GB), an analysis of COVID-19 vaccination uptake and weekly reports of analyses of the spatial variation in cases and severe outcomes (hospitalization, ICU admissions and mortality) in Scotland as part of the Space group report, from Jan 2022.

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.

The analyses I have presented to SPI-M have all now been largely published at least as preprints. While not exactly as presented to SPI-M, they are representative of the analyses that were presented.

SCoVMod–a spatially explicit mobility and deprivation adjusted model of first wave COVID-19 transmission dynamics. CJ Banks, E Colman, T Doherty, O Tearne, M Arnold, KE Atkins, D Balaz, … Wellcome Open Research 7 (161), 161 (2022)

This spatial model was used to support projections of epidemic curves in Scotland including estimates of the reproduction number, R. While not a regular submission to SPI-M, it was initially presented at a SPI-M subgroup when the analysis was first assessed for use in Scotland (I do not have an exact record of the date, but approx. Sept 2020).

Ascertainment rate of SARS-CoV-2 infections from healthcare and community testing in the UK. E Colman, G.A. Puspitarani, J.Enright, R.R.Kao MedRXiV, 2021

This analysis identified estimates of COVID-19 reporting rates for regions of England, and for Scotland, Wales and Northern Ireland. It showed that between 20 and 40% of potential cases were being reported with significant variation in time and across regions and variants. This was reported several times and was also supplied for use in other analyses by SPI-M members.

Site specific relationships between COVID-19 cases and SARS-CoV-2 viral load in wastewater treatment plant influent. SF Fitzgerald, G Rossi, AS Low, SP McAteer, B O'Keefe… R.R. Kao & A. Corbishlye - Environmental science & technology, 2021

This analysis was the first to show the strong correlation between reported COVID-19 cases and signals of RNA detection in Wastewater, also estimating the practical limits of detection and variation across sampling sites. The results were reported to SPI-M early in 2021.

Spatio-temporal characteristics of the SARS-CoV-2 Omicron variant spread at fine geographical scales, and comparison to earlier variants. AJ Wood, AR Sanchez, PR Bessell, RR Kao. medRxiv (2022)

Updates to an analysis of the spatial variation and variation by deprivation was presented weekly at the SPI-M Space subgroup from Jan 2022 and a summary presented to SPI-M.

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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.

The following were presented before joining SPI-M

    i) An interview and analysis for BBC Disclosue in Scotland (air date 11 May 2020) showed that an earlier lockdown could have had substantial benefits. The results of this analysis are in part presented in the paper Banks et al. 2022 as above. A link to the news story related to that interview is found here: https://www.bbc.co.uk/news/uk-scotland-52617895

    ii) On 30th June 2020 a further analysis using the same model was presented on BBC Scotland (see https://www.bbc.co.uk/news/uk-scotland-53233974) showing that a later lockdown or a 'Sweden-like' approach would have likely resulted in substantially more deaths. The model used was the same as above (Banks et al. 2022).

    iii) I provided three opinion pieces for the Guardian newspaper. These can be found here: https://www.theguardian.com/profile/rowland-kao. In summary the three pieces (i) provided an opinion on why the R number, the most commonly reported statistic at the time, did not show the full story in regards to the progress of the pandemic, (ii) in response to the controversies over Dominic Cummings actions in March 2020, showed why the actions of influential people can have an impact on the responses of the many to regulations and how this might influence COVID-19 restriction compliance, and (iii) a cautionary piece on the potential for a winter wave of COVID-19 from the perspective of Aug 2020.

After joining SPI-M I provide three more opinion pieces for the iNews, found here - https://inews.co.uk/author/professor-rowland-kao. In summary these articles (i) on 22nd Feb 2021 discussed the dangers of the lockdown easing policy of the time, (ii) on 5/08/2021 showed why offering COVID-19 vaccines to teens was an evidenced based choice and (iii) on 21/10/21 advocated stronger measures for the winter of 2021/22

I also conducted a very large number of interviews with news media (print, radio and TV) both nationally and internationally. However I do not have a complete record of these. These were largely to provide information rather than as critiques of government policy.

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;
    b. The way in which the groups were commissioned to work on the relevant issues;
    c. The resources and support that were available;
    d. The advice given and/or recommendations that were made;

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

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

As a relatively late joining member of SPI-M it was interesting to see the group dynamics involved. There was a strong camaraderie in the group, and broadly speaking a clear intent to offer advice where advice could be given but not to be drawn into controversies over the application of this advice. There was considerable collaborative working with individuals across research teams often helping each other out. As such the overall working tone was also good. The group was well supported by the secretariat. The camaraderie and inclusiveness of the group may have made it difficult for dissenting voices to be heard – there was no intentional exclusiveness, however the long term nature of the interaction and consistency of membership (I was not aware of any other senior academic joining after me) may have made it difficult for novel approaches or points of view to be heard. To counterbalance this, there was a very strong inclusion of occasional presentations from outside the membership and the chairs of the group worked very hard to make sure that opinions were evenly heard.

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.

While there were many ways in which having a modelling group was beneficial, such an approach, separating out all the modelling analysis from say, the input of SPI-B (the behaviour subgroup) in my view has the disadvantage of promoting silo-ing. Preferable to me would be to develop multi-disciplinary teams to address individual questions, rather than having modelling advice across all matters of interest in one place, and social science advice in another place. This may have alleviated some of the criticisms regarding suspicions of the modelling analyses that were done and integrated advice across disciplines from an early stage rather than having this happen only in the context of SAGE meetings themselves.

8. I have some rough notebooks from meetings though these are often sketchy at best – and not a reliable aid for all the meetings I attended.

Again very sorry for the very late reply to the request.

With best regards,

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