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3 October 2022

Dear Baroness Hallett Chair of the UK COVID-19 Inquiry,

RE: UK COVID-19 Inquiry: Module 2 - Rule 9 Request to Dr Ellen Brooks-Pollock - Reference: M2/SAGE/01/EBP

I received your letter requesting details relevant to the Inquiry's work. I have responded to the questionnaire and attempted to provide a summary of the work I contributed to in support of the UK COVID response. If you require any further details, please contact me again.

Yours sincerely

Ellen Brooks-Pollock

Personal Data

Questionnaire response
UK COVID-19 Inquiry: Module 2 - Rule 9 Request to Dr Ellen Brooks-Pollock - Reference: M2/SAGE/01/EBP

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

I am an Associate Professor in Infectious Disease Modelling at the University of Bristol. I have a first class MSci in Mathematics from University College London (awarded 2003) and a PhD in Mathematical Epidemiology from the University of Warwick (awarded 2008).

I have worked in the area of infectious disease modelling since 2004, at the University of Warwick (2004 - 2008), the Harvard School of Public Health (2008 - 2010), the London School of Hygiene and Tropic Medicine (2010 – 2011), the University of Cambridge (2011 – 2015) and the University of Bristol (2015 -). I work closely with Public Health England, the Animal and Plant Health Agency and the European Centre for Disease Control.

Prior to COVID, the areas I contributed to included: (with selected publications)

Tuberculosis in the UK and globally and BCG vaccination policy in England

- Brooks-Pollock, E. & Jacobsen, K.R. (2018) "Rethinking tuberculosis control by targeting previously treated individuals". Invited commentary Lancet Global Health 6 (4), e361-e362

- Abbott, Christensen, Lalor, Zenner, Campbell, Ramsay, Brooks-Pollock (2019) Exploring the effects of BCG vaccination in patients diagnosed with tuberculosis: observational study using the Enhanced Tuberculosis Surveillance system, Vaccine 37: 5067-5072.
- Packer, S., Green, C., Brooks-Pollock, E., Chaintarli, K., Harrison, E., Beck, C.R. (2019) "Social network analysis and whole genome sequencing in a cohort study to investigate TB transmission in an educational setting" BMC Infectious Diseases 19 (1), 154.
- Abbott, Christensen, Welton, Brooks-Pollock (2019) Estimating the effect of the 2005 change in BCG policy in England: a retrospective cohort study, 2000 to 2015, Eurosurveillance 24(49): 1900220
- Brooks-Pollock, E., Danon, L., Kortals Altes, H., Davidson, J., Pollock, A., van Soolingen, D., Campbell, C., Lalor, M. (2020) "A model of tuberculosis clustering in low incidence countries reveals more transmission in the United Kingdom than the Netherlands between 2010 and 2015" PLoS Comp Bio https://doi.org/10.1371/journal.pcbi.1007687
- Brooks-Pollock, E., Becerra, M., Goldstein,E., Cohen, T., & Murray, M.B. (2011) "Epidemiological inference from the distribution of tuberculosis cases in households in Lima, Peru" The Journal of Infectious Diseases 203 (11). pp. 1582–1589.

Bovine TB in cattle in Great Britain

- Brooks-Pollock, E., Roberts, G.O. & Keeling, M.J. (2014) "A dynamic model of bovine tuberculosis in Great Britain" Nature 511, 228–231.
- Brooks-Pollock, E., Conlan, A.J.K., Mitchell, A., Blackwell, R., McKinley, T.J. & Wood, J.L.N. (2013) "Age-dependent patterns of bovine tuberculosis in cattle", Vet Res 44:9.
- Conlan, A.J.K., Brooks-Pollock, E., McKinley, T.J., Mitchell, A.P., Jones, G.J., Vordermeier, M. & Wood, J.L.N. (2015) "Potential costs and benefits of cattle vaccination as a supplementary control for bovine Tuberculosis" PLoS Comput Biol 11 (2), e1004038-e1004038.
- Brooks-Pollock, E. & Wood, J.L.N. (2015) "Eliminating bovine tuberculosis in cattle and badgers: insight from a dynamic model". Proc R Soc B 282:20150374.

Influenza, including pandemic influenza in England

- Eames, K.T.D., Tilston, N., Brooks-Pollock, E., Edmunds, W.J. (2012) "Measured Dynamic Social Contact Patterns Explain the Spread of H1N1v Influenza" PLoS Comput Biol 8(3): e1002425.
- Eames, K.T.D., *Brooks-Pollock, E., Paolotti, D., Perosa, M., Gioannini, C. & Edmunds, W.J. (2011) "Rapid assessment of influenza vaccine effectiveness: analysis of an internet-based cohort" Epidemiology and Infection 12:1-7. *joint first authorship.
- Brooks-Pollock, E., Tilston, N., Edmunds, W.J. & Eames, K.T.D. (2011) "Using an online survey of healthcare-seeking behaviour to estimate the magnitude and severity of the 2009 H1N1v influenza epidemic in England" BMC Infectious Diseases 11(68).

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.

SPI-M: June 2022 – ongoing.
SPI-M-O: February 2020 until its last meeting.
SPI-B: October 2020 – June 2021
Review of Emergency Preparedness Countermeasures: Epidemiology and Modelling Subgroup: May 2021 – November 2021

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;

SPI-M-O:
I was invited to a SPI-M-O meeting on Monday 2 March 2020 to present a model of COVID-19 in the UK that myself and a colleague Leon Danon had developed (Danon, Brooks-Pollock, Bailey and Keeling "A spatial model of COVID-19 transmission in England and Wales: early spread, peak timing and the impact of seasonality", Phil Trans B 2021 https://doi.org/10.1098/rstb.2020.0272). I was invited to subsequent SPI-M-O meetings.

SPI-B:
SPI-M-O chair Graham Medley asked if I would attend SPI-B meetings to facilitate communication between SPI-M-O and SPI-B.

Children's Task and Finish Group: I was asked to contribute to this SAGE subgroup, I think by the SPI-M secretariat.

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

SPI-M-O: I attended every meeting from 2 March 2020 until the final meeting. I contributed analysis and modelling results in the form of reports at those meetings, as well as critiquing the work of others and contributing to the discussion.

SPI-B: I contributed to the discussions and fed back any relevant information to SPI-M-O.

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

SPI-M-O and the Children's Task and Finish Group: I conducted the analysis and modelling. I worked closely with other SPI-M-O contributors, particular Leon Danon. For the pieces of work led by me, I, in discussion with others, formulated the question, designed the analyses, wrote the code, analysed and interpreted the results, wrote the reports and presented the results at meetings. For pieces of work led by others, I analysed and interpreted the results.

A major contribution of mine was the development of a new method for predicting the impact of interventions and the trade-offs between different interventions. This method was nicknamed "the ready reckoners" as it was used extensively during 2020 (e.g. meeting notes from SAGE 43, 23 June, point 18: "The 'ready reckoners' in the endorsed SPI-M paper provide a useful way to consider the risks associated with changes in different scenarios [...] ensure SPI-M ready reckoner is seen and understood by Cabinet Office and DHSC policy officials"
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904665/S0561_Forty-third_SAGE_meeting_on_Covid-19.pdf)

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 impact of preventing mass gatherings (prior to the March 2020 lockdown)

Leon Danon and I calculated the Population Attributable Fraction (PAF) of cases due to gatherings of different sizes. This new method was used to estimate that preventing gatherings with more than 50 individuals might prevent less than 4% of cases and would not be sufficient to control transmission.

1. SPI-M-O Concensus Statement on public gatherings 11 March 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/888760/S0048_SAGE15_200311_SPI-M_consensus_statement_on_public_gatherings.pdf
2. JUNIPER and LSHTM: The population attributable fraction (PAF) of cases due to gatherings with relevance to COVID-19 mitigation strategies, 22 April 2021, https://www.gov.uk/government/publications/juniper-and-lshtm-the-population-attributable-fraction-paf-of-cases-due-to-gatherings-with-relevance-to-covid-19-mitigation-strategies-22-april-20

Scientific paper that contains the results I presented:

3. Brooks-Pollock *et al*. The population attributable fraction of cases due to gatherings and groups with relevance to COVID-19 mitigation strategies. *Philos. Trans. R. Soc. B* **376**, 20200273 (2021). https://doi.org/10.1098/rstb.2020.0273

Re-opening of schools in England in May/June 2020

I led the development of a tool for quantifying the impact of social distancing measures on the reproduction (R) number (named "ready reckoners") as part of the Children's Task and Finish Group. In collaboration with the Avon Longitudinal Study of Parents and Children team (http://www.bristol.ac.uk/alspac/) we sent a report to SPI-M on the impact of keeping nursery schools open.

I contributed to the following documents:

4. The role of children in transmission 16 April 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/894616/s0141-sage-sub-group-role-children-transmission-160420-sage26.pdf
5. TFC: Modelling and behavioural science responses to scenarios for relaxing school closures, 30 April 2020. https://www.gov.uk/government/publications/tfc-modelling-and-behavioural-science-responses-to-scenarios-for-relaxing-school-closures-30-april-2020
6. TFC: Modelling and behavioural science responses to scenarios for relaxing school closures, 1 May 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/894884/s0300-tfc-modelling-behavioural-science-relaxing-school-closures-sage31.pdf
7. Avon Longitudinal Study of Parents and Children (ALSPAC) report on nurseries in the time of COVID (not yet online – can be made available upon request).

Scientific paper that summarises the method and results:

8. Brooks-Pollock Read, McLean, Keeling & Danon Mapping social distancing measures to the reproduction number for COVID-19. Philos. Trans. R. Soc. B 376, 20200276 (2021). https://doi.org/10.1098/rstb.2020.0276

Return of University students to Higher Education Institutions.

Our team developed the first COVID-19 transmission model for a UK university – we presented this at SPI-M. We also conducted a social contact survey aimed specifically at university students. We used the student survey to estimate the impact of face-to-face teaching on contact patterns.

9. Principles for managing SARS-CoV-2 transmission associated with higher education, 3 September 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/914978/S0728_Principles_for_Managing_SARS-CoV-2_Transmission_Associated_with_Higher_Education_.pdf
10. The impact of face-to-face teaching on University student contact patterns: evidence from an online contact survey.

Academic paper:

11. Brooks-Pollock, Christensen, Trickey, Hemani, Nixon, Thomas, Turner, Finn, Hickman, Relton, Danon (2021) "High COVID-19 transmission potential associated with re-opening universities can be mitigated with layered interventions" Nature Communications 12, 5017 https://doi.org/10.1038/s41467-021-25169-3

Evidence on the impact of support bubbles and the festive period

I contributed to the modelling work on support bubbles and Christmas bubbles provided evidence that single adult households could form a support bubble with a larger household without adversely impacting COVID transmission (led by Leon Danon). This work demonstrated that bubbles formed of two or more larger households had the potential to lead to sustained and uncontrolled transmission.

In advance of Christmas 2020, Leon Danon and I calculated that five days lockdown would be required for each single day of "relaxation" in order to get incidence back to the initial levels (presented at SPI-M-O on 18 November).

12. See the SPI-M-O statement on Bubbles from 13 May 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/891927/S0357_SPI-M-O_Statement_on_Bubbles.pdf
13. SAGE Task and Finish Group Key Evidence and Advice on Celebrations and Observances during COVID-19, 5 November 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/939166/S0866_Key_Evidence_and_Advice_on_Celebrations_and_Observances_during_COVID-19.pdf
14. SPI-M-O Notes on Festive Period, 19 November 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/939074/S0911_SAGE69_201115_SPI-M-O_-_Notes_on_Festive_Period.pdf
15. "Five days of stringent measures" explainer – 27 November 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/939302/201120_5_day_explainer_v3.0_-_clean_for_release_FINAL__1_.pdf
16. The resulting scientific paper on bubbling: Danon, Lacasa. & Brooks-Pollock. Household bubbles and COVID-19 transmission: insights from percolation theory. Philos. Trans. R. Soc. B 376, 20200284 (2021). https://doi.org/10.1098/rstb.2020.0284

Scenario planning

Dr Ellen Brooks-Pollock, University of Bristol: Response to preliminary request from the COVID-19 Public Inquiry.

In 2020, I co-led the Universities of Bristol and Exeter contribution to contribute to possible scenarios for the pandemic.

Relevant documents:

17. 25 March 2020 scenario planning https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/887470/26-spi-m-o-working-group-scenario-planning-consensus-view-25032020.pdf

18. SPI-M-O: Consensus view on the potential relaxing of social distancing measures, 4 May 2020. https://www.gov.uk/government/publications/spi-m-o-consensus-view-on-the-potential-relaxing-of-social-distancing-measures-4-may-2020. One of four modelling groups.

19. BSI and related interventions 1 April 2020 https://www.gov.uk/government/publications/bsi-and-relaxed-interventions-social-contact-survey-analysis-1-april-2020

20. SAGE 43 23 June "The "ready reckoners" in the endorsed SPI-M paper provide a useful way to consider the risks associated with changes in different scenarios" https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904665/S0561_Forty-third_SAGE_meeting_on_Covid-19.pdf
21. SPI-M-O: Planning and reasonable worst-case scenarios 20th May 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/926903/S0414_SPI-M-O_Planning_and_reasonable_worst-case_scenarios.pdf
22. Summary of the effectiveness and harms of different non-pharmaceutical interventions 21 September 2020 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/925854/S0769_Summary_of_effectiveness_and_harms_of_NPIs.pdf
23. University of Bristol (Ellen Brooks-Pollock and Leon Danon): Trade off between population immunity and return-to-work for COVID-19 control, autumn and winter 2021 scenarios, 12 October 2021 https://www.gov.uk/government/publications/university-of-bristol-trade-off-between-population-immunity-and-return-to-work-for-covid-19-control-autumn-and-winter-2021-scenarios-12-october-202

Scientific paper

24. Danon, Brooks-Pollock, Bailey, Keeling (2020) A spatial model of COVID-19 transmission in England and Wales: early spread and peak timing, Philos. Trans. R. Soc. B 376, 20200272 (2021). https://doi.org/10.1098/rstb.2020.0272

Vaccine rollout

I used the ready reckoner methodology to investigate vaccine rollout. We reported on the impact of age-based eligibility criteria for vaccination, and conducted a bespoke survey in collaboration with Avon Longitudinal Study of Parents and Children and TwinsUK/Covid Symptom Study (CSS) Biobank) of voluntary risk mitigation measures, which we used to estimate the impact of the Omicron variant in January 2022.

25. SPI-M-O: Summary of modelling for scenarios for COVID-19 autumn and winter 2021-22 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1027851/S1383_SPI-M-O_Summary_autumn_winter_scenarios.pdf
26. University of Bristol and PHE: COVID-19 reckoners with vaccination, 6 April 2021 https://www.gov.uk/government/publications/university-of-bristol-and-phe-covid-19-reckoners-with-vaccination-update-6-april-2021
27. JUNIPER: Transitioning from non-pharmaceutical interventions to vaccination to control COVID-19 transmission, 7 July 2021 https://www.gov.uk/government/publications/juniper-transitioning-

from-non-pharmaceutical-interventions-to-vaccination-to-control-covid-19-transmission-7-july-2021

28. University of Bristol: Impact of voluntary risk-mitigation behaviour on the magnitude of a COVID-19 Omicron variant wave in England, 11 January 2022 https://www.gov.uk/government/publications/university-of-bristol-impact-of-voluntary-risk-mitigation-behaviour-on-the-magnitude-of-a-covid-19-omicron-variant-wave-in-england-11-january-2022

Other contributions

I was part of the team (led by Leon Danon and Rob Challen) who measured the increased mortality risk associated with a variant of concern in late 2020.

29. Challen, Brooks-Pollock et al. (2021) "Risk of mortality in patients infected with SARS-CoV-2 variant of concern 202012/1: matched cohort study" BMJ 372:n579 https://doi.org/10.1136/bmj.n579

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.

I gave evidence as a Witness to the Select Committee on Science and Technology on 2 June 2020 https://committees.parliament.uk/oralevidence/444/pdf/ , also https://committees.parliament.uk/committee/193/science-and-technology-committee-lords/publications/oral-evidence/?page=4

I guest edited a collection of scientific papers, all that were presented at SPI-M-O and/or SAGE subgroups in a Royal Society Philosophical Transactions journal. The Special Collection contained 21 pieces of work. Authors were given the option of including an "in context" note which described how the evidence was used. https://royalsocietypublishing.org/toc/rstb/2021/376/1829

I co-wrote the introduction to the theme issue "Modelling that shaped the early COVID-19 pandemic response in the UK" which describes the work of SPI-M-O and how it operated: https://doi.org/10.1098/rstb.2021.0001.

Other interviews and contributions:

TV		
Newsnight	COVID-19 vaccine rollout and lifting restrictions	4 February 2021
Newsnight	Impact of re-opening schools on COVID rates	3 August 2020
Newsnight	COVID-19 R number, meaning and interpretation	16 May 2020
BBC news	Impact of lockdown on COVID rates	10 August 2020
Radio		
Broadcasting House BBC Radio 4	Impact of big gatherings on COVID rates	4 July 2021
BBC Radio Bristol	COVID rates and the return of schools in September	15 August 2020
Today Programme BBC Radio 4	Plans for university students breaking up for Xmas	11 November 2020
Today Programme BBC Radio 4	COVID outbreaks in universities	15 October 2020
Online		
Live COVID Q&A with Thangam Debbonaire MP		November 2020

Cosmic Shambles with Robin Ince	11 June 2020
Cosmic Shambles with Robin Ince	5 April 2020
Talks	
Parliamentary and Scientific Committee 'Mathematical modelling and Algorithms' https://www.youtube.com/watch?v=k6sHTu7eT2g	13 September 2021
Print	
Article for Science in Parliament magazine *Infectious disease modelling for policy during the COVID-19 pandemic*	December 2021

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;

SPI-M-O involved the leading infectious disease modelling teams in the UK, which consisted regularly of over 50 modellers. In my opinion, this large number of contributors massively increased the robustness of the output – for example the official R estimates comprised of 7 or more independent estimates. This reduced the potential for bias and human error. Smaller commissions were responded to by at least 3 groups – again increasing the reliability on the results.

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

I believe this changed over time – so that all SPI-M-O contributors were aware of the main asks and able to submit results for consideration.

c. The resources and support that were available;

The SPI-M secretariat worked closely with us in interpreting the results for the consensus statements and releasing documents.

The DSTL team that provided us with the necessary data for modelling were highly skilled, responsive and invaluable. A lot of the modelling wouldn't have been able to be done without them. At the same time, members of SPI-M-O were going through the long process of gaining access to the ONS data via the "Secure Researcher Service" – this system was not appropriate or set up for rapid response work and I didn't use it at all during the pandemic.

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

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

I think SPI-M-O functioned incredibly efficiently and effectively. The SPI-M-O chairs Graham Medley and Angela McLean were key to ensuring the functionality – drawing from a wide group of subject experts and approaching tasks inclusively. An effort was made that all groups had equal access to the necessary data, and the SPI-M secretariat support that.

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

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.

A recommendation for the future is to include a range of groups and approaches.

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.

I have emails, interim documents, code for models, model outputs.