Dr Leon Danon
Associate Professor in
Infectious Disease Modelling
Engineering Mathematics
University of Bristol

9 November 2022

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

RE: UK COVID-19 Inquiry: Module 2 - Rule 9 Request to Dr Leon Danon - Reference: M2/SAGE/01/LD

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

Leon Danon

Personal Data

Questionnaire response
UK COVID-19 Inquiry: Module 2 - Rule 9 Request to Dr Leon Danon - Reference: M2/SAGE/01/LD

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

Please find a summary below. I have also attached my full CV for further details.

Education

PhD	University of Barcelona, Statistical Physics Dissertation: "Community Structure in Complex Networks"	2006
MSc	University of Barcelona, Statistical Physics Thesis: Finite "Size Scaling in the 3-D Ising Model"	2004
MSci	Imperial College London, Physics Thesis: "Unified Scaling Law for Earthquakes"	2001

Current Position

Associate Professor in Infectious Disease Modelling and Data Analytics 2021-

University of Bristol, Engineering Mathematics

Previous Positions

Senior Lecturer in Data Analytics 2017-2020

Exeter University, Computer Science

Lecturer in Infectious Disease Modelling 2015-2017

University of Bristol, Population Health Science

Lecturer in Applied Mathematics and Leverhulme Fellow 2013-2015

Queen Mary University of London, School of Mathematical Sciences

Leverhulme Early Career Fellow 2011-2013

University of Warwick, Mathematics Institute

Research Fellow 2007-2011

University of Warwick, School of Life Sciences, Mathematics Institute

Visiting Scholar 2008-2010

Harvard University, Harvard School of Public Health

Awards

Weldon Memorial Prize 2022

SPI-M-O Award for Modelling and Data Support (SAMDS) 2022

Best paper at KDD Health Day 2022

Catherine Richards Prize of best article in Mathematics Today 2013

Leverhulme Early Career Fellowship 2011
Warwick University, Queen Mary University of London

Catalan Government PhD Scholarship 2002-2006
University of Barcelona

Stuart Young Award

Publications

1. Hyams, C., Challen, R., Begier, E., Southern, J., King, J., Morley, A., Szasz-Benczur, Z., Gonzalez, M. G., Kinney, J., Campling, J., Gray, S., Oliver, J., Hubler, R., Valluri, S., Vyse, A., McLaughlin, J. M., Ellsbury, G., Maskell, N. A., Gessner, B. D., Danon, L., Finn, A. Incidence of community acquired lower respiratory tract disease in Bristol, UK during the COVID-19 pandemic: A prospective cohort study. *The Lancet Regional Health - Europe* **21,** 100473 (2022).
2. Yang, C., Song, H., Tang, M., Danon, L. & Vigfusson, Y. Dynamic Network Anomaly Modeling of Cell-Phone Call Detail Records for Infectious Disease Surveillance. in *Proceedings of the 28th ACM SIGKDD Conference on Knowledge Discovery and Data Mining* 4733–4742 (Association for Computing Machinery, 2022). doi:10.1145/3534678.3542678
3. Morvan, M., Jacomo, A. L., Souque, C., Wade, M. J., Hoffmann, T., Pouwels, K., Lilley, C., Singer, A. C., Porter, J., Evens, N. P., Walker, D. I., Bunce, J. T., Engeli, A., Grimsley, J., O'Reilly, K. M. & Danon, L. An analysis of 45 large-scale wastewater sites in England to estimate SARS-CoV-2 community prevalence. *Nat Commun* **13,** 4313 (2022).
4. Hyams, C., Challen, R., Marlow, R., Nguyen, J., Begier, E., Southern, J., King, J., Morley, A., Kinney, J., Clout, M., Oliver, J., Ellsbury, G., Maskell, N., Jodar, L., Gessner, B., McLaughlin, J., Danon, L., Finn, A. & Group, T. A. C. R. Severity of Omicron (B.1.1.529) and Delta (B.1.1.617.2) SARS-CoV-2 infection among hospitalised adults: a prospective cohort study. 2022.06.29.22277044 Preprint at https://doi.org/10.1101/2022.06.29.22277044 (2022)
5. Lazarus, R., Taucher, C., Brown, C., Čorbic Ramljak, I., Danon, L., Dubischar, K., Duncan, C. J. A., Eder-Lingelbach, S., Faust, S. N., Green, C., Gokani, K., Hochreiter, R., Wright, J. K., Kwon, D., Middleditch, A., Munro, A. P. S., Naker, K., Penciu, F., Price, D., Querton, B., Riaz, T., Ross-Russell, A., Sanchez-Gonzalez, A., Wardle, H., Warren, S. & Finn, A. Safety and immunogenicity of the inactivated whole-virus adjuvanted vaccine VLA2001: A randomized, dose escalation, double-blind phase 1/2 clinical trial in healthy adults. *Journal of Infection* (2022). doi:10.1016/j.jinf.2022.06.009
6. Hyams, C., Arnold, D. T., Heath, R., Amin-Chowdhury, Z., Hettle, D., Ruffino, G., North, P., Grimes, C., Fry, N. K., Williams, P., Danon, L., Williams, O. M., Ladhani, S., Finn, A. & Maskell, N. A. Parapneumonic effusions related to Streptococcus pneumoniae: serotype and disease severity trends. 2022.03.16.22272461 Preprint at https://doi.org/10.1101/2022.03.16.22272461 (2022)
7. Woods, C., Hedges, L., Edsall, C., Brooks-Pollock, E., Parton-Fenton, C., McKinley, T., Keeling, M. & Danon, L. MetaWards: A flexible metapopulation framework for modelling disease spread. *JOSS* **7,** 3914 (2022).
8. Hyams, C., Arnold, D. T., Heath, R., Amin-Chowdhury, Z., Hettle, D., Ruffino, G., North, P., Grimes, C., Fry, N. K. & Williams, P. Parapneumonic effusions related to Streptococcus pneumoniae: serotype and disease severity trends. *medRxiv* (2022).

9. Brooks-Pollock, E., Northstone, K., Pellis, L., Scarabel, F., Thomas, A. C., Nixon, E. J., Matthews, D. A., Steves, C. J., Bower, V. & Garcia, M.-P. Impact of voluntary risk-mitigation behaviour on transmission of the Omicron SARS-CoV-2 variant in England. *medRxiv* (2022).
10. Challen, R., Brooks-Pollock, E., Tsaneva-Atanasova, K. & Danon, L. Meta-analysis of the severe acute respiratory syndrome coronavirus 2 serial intervals and the impact of parameter uncertainty on the coronavirus disease 2019 reproduction number. *Stat Methods Med Res* 09622802211065159 (2021). doi:10.1177/09622802211065159
11. Canto-Osorio, F., Stern, D., Pérez-Ferrer, C., Garza, E. A. la, Danon, L., Barrientos-Gutiérrez, T. & Lajous, M. Seroprevalencia de SARS-CoV-2 en niños y adolescentes mexicanos en edad escolar. *Salud Pública de México* **63,** 803–806 (2021).
12. Campling, J., Begier, E., Vyse, A., Hyams, C., Heaton, D., Southern, J., Danon, L., Finn, A., Madhava, H., Gessner, B. D. & Ellsbury, G. A novel approach to calculate disease incidence for hospital-based health events in England. *The Lancet* **398,** S30 (2021).
13. Danon, L., Lacasa, L. & Brooks-Pollock, E. Household bubbles and COVID-19 transmission: insights from percolation theory. *Phil. Trans. R. Soc. B* **376,** 20200284 (2021).
14. Danon, L., Brooks-Pollock, E., Bailey, M. & Keeling, M. A spatial model of COVID-19 transmission in England and Wales: early spread, peak timing and the impact of seasonality. *Phil. Trans. R. Soc. B* **376,** 20200272 (2021).
15. Challen, R., Tsaneva-Atanasova, K., Pitt, M., Edwards, T., Gompels, L., Lacasa, L., Brooks-Pollock, E. & Danon, L. Estimates of regional infectivity of COVID-19 in the United Kingdom following imposition of social distancing measures. *Phil. Trans. R. Soc. B* **376,** 20200280 (2021).
16. Brooks-Pollock, E., Read, J. M., McLean, A. R., Keeling, M. J. & Danon, L. Mapping social distancing measures to the reproduction number for COVID-19. *Phil. Trans. R. Soc. B* **376,** 20200276 (2021).
17. Brooks-Pollock, E., Read, J. M., House, T., Medley, G. F., Keeling, M. J. & Danon, L. The population attributable fraction of cases due to gatherings and groups with relevance to COVID-19 mitigation strategies. *Philosophical Transactions of the Royal Society B: Biological Sciences* **376,** 20200273 (2021).
18. Brooks-Pollock, E., Danon, L., Jombart, T. & Pellis, L. Modelling that shaped the early COVID-19 pandemic response in the UK. *Phil. Trans. R. Soc. B* **376,** 20210001 (2021).
19. Nixon, E., Trickey, A., Christensen, H., Finn, A., Thomas, A., Relton, C., Montgomery, C., Hemani, G., Metz, J., Walker, J. G., Turner, K., Kwiatkowska, R., Sauchelli, S., Danon, L. & Brooks-Pollock, E. Contacts and behaviours of university students during the COVID-19 pandemic at the start of the 2020/2021 academic year. *Sci Rep* **11,** 11728 (2021).
20. Thomas, A., Danon, L., Christensen, H., Northstone, K., Smith, D., Nixon, E., Trickey, A., Hemani, G., Sauchelli, S., Finn, A., Timpson, N. & Brooks-Pollock, E. Limits of lockdown: characterising essential contacts during strict physical distancing. *Wellcome Open Res* **6,** 116 (2021).
21. Hemani, G., Thomas, A. C., Walker, J. G., Trickey, A., Nixon, E., Ellis, D., Kwiatkowska, R., Relton, C., Danon, L., Christensen, H. & Brooks-Pollock, E. Modelling pooling strategies for SARS-CoV-2 testing in a university setting. *Wellcome Open Res* **6,** 70 (2021).
22. Vigfusson, Y., Karlsson, T. A., Onken, D., Song, C., Einarsson, A. F., Kishore, N., Mitchell, R. M., Brooks-Pollock, E., Sigmundsdottir, G. & Danon, L. Cell-phone traces reveal infection-associated behavioral change. *PNAS* **118,** e2005241118 (2021).
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25. Hyams, C., Marlow, R., Maseko, Z., King, J., Ward, L., Fox, K., Heath, R., Tuner, A., Friedrich, Z., Morrison, L., Ruffino, G., Antico, R., Adegbite, D., Szasz-Benczur, Z., Garcia Gonzalez, M., Oliver, J., Danon, L. & Finn, A. Effectiveness of BNT162b2 and ChAdOx1 nCoV-19 COVID-19 vaccination at preventing hospitalisations in people aged at least 80 years: a test-negative, case-control study. *The Lancet Infectious Diseases* **21,** 1539–1548 (2021).
26. Gog, J. R., Hill, E. M., Danon, L. & Thompson, R. N. Vaccine escape in a heterogeneous population: insights for SARS-CoV-2 from a simple model. *Royal Society Open Science* **8,** 210530 (2021).
27. Gibbs, H., Nightingale, E., Liu, Y., Cheshire, J., Danon, L., Smeeth, L., Pearson, C. A. B., Grundy, C., Group, L. C. C.-19 working, Kucharski, A. J. & Eggo, R. M. Detecting behavioural changes in human movement to inform the spatial scale of interventions against COVID-19. *PLOS Computational Biology* **17,** e1009162 (2021).
28. Challen, R., Brooks-Pollock, E., Read, J. M., Dyson, L., Tsaneva-Atanasova, K. & Danon, L. Risk of mortality in patients infected with SARS-CoV-2 variant of concern 202012/1: matched cohort study. *BMJ* **372,** n579 (2021).
29. Booton, R. D., MacGregor, L., Vass, L., Looker, K. J., Hyams, C., Bright, P. D., Harding, I., Lazarus, R., Hamilton, F., Lawson, D., Danon, L., Pratt, A., Wood, R., Brooks-Pollock, E. & Turner, K. M. E. Estimating the COVID-19 epidemic trajectory and hospital capacity requirements in South West England: a mathematical modelling framework. *BMJ Open* **11,** e041536 (2021).
30. Lacasa, L., Challen, R., Brooks-Pollock, E. & Danon, L. A flexible method for optimising sharing of healthcare resources and demand in the context of the COVID-19 pandemic. *PLOS ONE* **15,** e0241027 (2020).
31. Rodrigues, F. M. P., Marlow, R., Simões, M. J., Danon, L., Ladhani, S. & Finn, A. Association of Use of a Meningococcus Group B Vaccine With Group B Invasive Meningococcal Disease Among Children in Portugal. *JAMA* **324,** 2187–2194 (2020).
32. Kishore, N., Mitchell, R., Lash, T. L., Reed, C., Danon, L., Sigmundsdóttir, G. & Vigfusson, Y. Flying, phones and flu: Anonymized call records suggest that Keflavik International Airport introduced pandemic H1N1 into Iceland in 2009. *Influenza and other Respiratory Viruses* **14,** 37–45 (2020).
33. Christensen, H., Turner, K., Trickey, A., Booton, R. D., Hemani, G., Nixon, E., Relton, C., Danon, L., Hickman, M. & Brooks-Pollock, E. COVID-19 transmission in a university setting: a rapid review of modelling studies. *medRxiv* 2020.09.07.20189688-2020.09.07.20189688 (2020).
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35. Brooks-Pollock, E., Danon, L., Altes, H. K., Davidson, J. A., Pollock, A. M. T., Van Soolingen, D., Campbell, C. & Lalor, M. K. A model of tuberculosis clustering in low incidence countries reveals more transmission in the United Kingdom than the Netherlands between 2010 and 2015. *PLoS Computational Biology* **16,** (2020).
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for Ascaris lumbricoides to increase impact—An investigation using mathematical models. *PLOS Neglected Tropical Diseases* **12,** e0006195 (2018).

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39. Brooks-Pollock, E. & Danon, L. Defining the population attributable fraction for infectious diseases. *International Journal of Epidemiology* (2017). doi:10.1093/ije/dyx055
40. Rodrigues, F., Danon, L., Morales-Aza, B., Sikora, P., Thors, V., Ferreira, M., Gould, K., Hinds, J. & Finn, A. Pneumococcal serotypes colonise the nasopharynx in children at different densities. *PLoS ONE* **11,** (2016).
41. Danon, L. & Brooks-Pollock, E. The need for data science in epidemic modelling: Comment on: "Mathematical models to characterize early epidemic growth: A review" by Gerardo Chowell et al. *Physics of Life Reviews* **18,** (2016).
42. House, T., Read, J. M., Danon, L. & Keeling, M. J. Testing the hypothesis of preferential attachment in social network formation. *EPJ Data Science* **4,** 13–13 (2015).
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46. Mirzoyan, L., Berendes, S., Jeffery, C., Thomson, J., Othman, H. B., Danon, L., Turki, A. A., Saffialden, R. & Valadez, J. J. New evidence on the HIV epidemic in Libya: Why countries must implement prevention programs among people who inject drugs. *Journal of Acquired Immune Deficiency Syndromes* **62,** 577–583 (2013).
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48. Danon, L., House, T. A., Read, J. M. & Keeling, M. J. Social encounter networks: Collective properties and disease transmission. *Journal of the Royal Society Interface* **9,** 2826–2833 (2012).
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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-O: February 2020 until its last meeting.
- Social Care Working Group: May 2020 until its last meeting
- Reopening of Large Events and Spaces: Task and Finish group
- Wastewater Working group

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 in the end of February 2020 to present my model of COVID-19 in the UK developed with Ellen Brooks-Pollock (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.

Social Care Working Group (SCWG):
Following work with Jewish Care Care Homes that I advised informally, I was invited by the SPI-M-O and SCWG chairs to attend meetings on Care Homes which later became the Social Care Working group

Large Events Working group: I was asked to contribute to this SAGE subgroup by the SPI-M secretariat.

Wastewater Working group: I was asked to advise UKHSA on the use of wastewater for tracking COVID-19 by the SPI-M chairs.

Nowcasts and R working group: I volunteered to contribute regular R estimates and nowcasts of the current state of the epidemic.

Spatial analysis working group

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

SPI-M-O: I attended every meeting from February 2020 until the final meeting. I contributed analysis and modelling results via reports and presentations. I provided critical analysis and comments on others' work, and contributed to interpretation and writing of consensus statements.

SCWG: I attended every meeting from May 2020 until the final meeting. I contributed to the discussions, provided critical challenge when needed, contributed data on potential for ingress and contributed to writing documents and consensus statements, and additional analyses.

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

SPI-M-O and the SCWG: I conducted the analysis and modelling. I worked closely with other SPI-M-O members, in particular Ellen Brooks-Pollock and Robert Challen. I led the formulation of questions, designed and performed analyses, wrote code 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.

Spatial Model

A major contribution of mine was the development of a spatial model for the initial spread of the pandemic in the UK. This model was one of the first to consider the spatial spread of the pandemic across the UK based on my previous work (https://doi.org/10.1016/j.epidem.2009.11.002 and https://doi.org/10.1073/pnas.1000416107).

Estimates of R and Nowcasts

Reproduction number estimates - Weekly spreadsheets via the CrystalCast RiskAware SPI-M Rt submission portal (https://riskawarecouk-my.sharepoint.com/personal/sowdagar_badesha_riskaware_co_uk/).

Regular reports on growth rate of cases, hospitalisations and deaths by age, documents available on the SPI-M group site (https://dhexchange.kahootz.com/connect.ti/DHSC_SPIM/grouphome).

Evidence on the impact of support bubbles and the festive period

I led modelling work on support bubbles and Christmas bubbles that provided evidence that single adult households could form a support bubble with a larger household without adversely impacting COVID transmission. 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, 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).

- 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
- 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
- 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
- "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
- 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

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

With Ellen Brooks-Pollock, we calculated the Population Attributable Fraction (PAF) of cases due to gatherings of different sizes. This method was then 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.

- 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
- 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:

- 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

With Ellen Brooks-Pollock we developed a new method for predicting the impact of interventions and their trade-offs. This method was dubbed "the ready reckoners" and 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.*

A comprehensive list of documents and contributions to SPI-M-O, SCWG and SAGE are held by the secretariats. Those I can recall are listed here, but may not be complete.

Weekly estimates of R and nowcasts (with Robert Challen).

I contributed to the development of a tool for quantifying the impact of social distancing measures on the reproduction (R) number (named "ready reckoners").

I contributed to the following documents:

- 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
- 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
- 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

Scientific paper that summarises the method and results:

- 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.

- 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
- The impact of face-to-face teaching on University student contact patterns: evidence from an online contact survey.

Academic paper:

- 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

Wastewater Analytics

I led a working group from October 2020-September 2022 supporting UKHSA in their analysis of wastewater for tracking COVID-19. Work from this group was presented to SPI-M-O and SAGE in May 2021.

Academic paper:

- https://www.nature.com/articles/s41467-022-31753-y

Scenario planning

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

Relevant documents:

- 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

- 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.

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

- 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

- 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
- 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
- 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

- 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

With Ellen Brooks-Pollock, we 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.

- 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
- 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
- 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
- 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

Variants of concern

I led the work on measuring the increased mortality risk associated with alpha variant of concern in late 2020.

- Challen, Brooks-Pollock, …, & Danon (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

I led analysis on emerging threats due to variants: I wrote a paper on the emergence and early spread of the Delta variant that was considered by SAGE:

- https://www.medrxiv.org/content/10.1101/2021.06.05.21258365v1
- https://www.gov.uk/government/publications/juniper-potential-community-transmission-of-b16172-inferred-by-s-gene-positivity-briefing-note-11-may-2021

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 guest edited a special issue in Royal Society Philosophical Transactions. The Special Collection contained 21 pieces of work all of which were used and presented to SPI-M-O/SAGE. Each piece was 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:

Radio and TV

January 2022	BBC News at 9AM (5 January)
December 2021	BBC News at 8PM (16 December, 20 December)
May 2021	Newsnight.
May 2021	Press briefing at the Science Media Centre.
January 2021	Today Programme BBC Radio 4.
November 2020	Today Programme BBC Radio 4.
August 2020	BBC Radio Bristol.
April 2020	Antena 3, Spanish TV, invited scientific expert.

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.

Initial advice, especially in the very early stages of SPI-M-O was heavily influenced by a centralised set of researchers from Imperial College and LSHTM. I would argue that this led to advice being less robust than it could have been if a broader group of experts was empowered to provide analysis and advice from the outset.

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

I believe this changed over time – early commissions were dominated by larger groups, but later on, 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-O/SCWG secretariat worked closely with us in interpreting the results for the consensus statements and releasing documents.

The technical eam from DSTL was instrumental in providing data crucial for analysis. They were highly skilled, responsive and invaluable to our efforts; the analysis and modelling our group did would simply have been impossible without those contributions.

At the same time, access to data through the ONS "Secure Researcher Service" was set up and encouraged. This involved a long process of onboarding but ultimately was not used by our team. That analysis platform on this system was simply not appropriate for rapid response work.

I volunteered considerable time and effort, especially early on. Support at the beginning of the pandemic was limited. Support later on in the pandemic was post-hoc.

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

The analyses performed were done to the best of our ability and that of SPI-M-O as a group. All efforts were made to evaluate advice, incorporate robust and pertinent findings and provide a consensus where possible.

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

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 supported that, however this was not always achieved.

Similarly, SCWG functioned efficiently and effectively led by the chairs.

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 and support a broad range of academics, groups and approaches from the very outset. Very early, critical decisions would have benefitted from plurality of opinion which was characteristic of later SPI-M-O working. This would have required a faster engagement with, and support for, groups such as ours.

The support we received was post-hoc; it would have been much better if our time was ring-fenced to fully focus on the critical work we undertook from the beginning.

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. A concerted effort to publish materials, code and papers was made throughout the response work, which is publicly available.