Module 2 of the UK Covid-19 Public Inquiry
Response to request for Evidence under Rule 9 of the Inquiry Rules 2006
Reference for Request: M2/SAGE/01/RB

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

I trained as a mathematician, completing a 4-year integrated undergraduate and Masters degree in Mathematics in 2014 and a PhD in Mathematics in 2019, both from the University of Sussex. My PhD research used network-based models to understand real-world processes; my thesis title was 'Modelling and analysing neuronal and epidemiological dynamics on structured static and dynamic networks'. Since my PhD studies, my research has focussed on data-driven modelling to characterise the spread of infectious disease.

In 2018, I became a Research Fellow in Infectious Disease Modelling in the Life Sciences department at the University of Sussex. During this time I worked with Professor Pierre Nouvellet modelling the spatiotemporal spread of the Ebola virus disease outbreak in West Africa in 2013-16. In July 2020, I joined the London School of Hygiene & Tropical Medicine (LSHTM) as a Research Fellow in Infectious Disease Modelling, working with Professors Mark Jit and John Edmunds. My role at LSHTM since July 2020 has been funded by a European Commission project which aims to provide epidemic intelligence to minimise the public health, economic and social impact of COVID-19 in Europe (Grant agreement ID: 101003688).

After joining LSHTM in July 2020, I worked mostly with LSHTM colleagues Mark Jit, John Edmunds and Nicholas Davies to model the community transmission of SARS-CoV-2 in England. This involved using and further developing the existing 'covidm' model of community SARS-CoV-2 transmission, built by Nicholas Davies in early 2020, to generate modelling outputs for UK decision makers via SPI-M and for traditional research publications. Selected publications are as follows:

- Modelling the medium-term dynamics of SARS-CoV-2 transmission in England in the Omicron era | Nature Communications
- Projected epidemiological consequences of the Omicron SARS-CoV-2 variant in England, December 2021 to April 2022 | medRxiv
- Impact of non-pharmaceutical interventions on SARS-CoV-2 outbreaks in English care homes: a modelling study | BMC Infectious Diseases
- Estimated transmissibility and impact of SARS-CoV-2 lineage B.1.1.7 in England | Science
- Association of tiered restrictions and a second lockdown with COVID-19 deaths and hospital admissions in England: a modelling study - The Lancet Infectious Diseases
- Epidemic threshold in pairwise models for clustered networks: closures and fast correlations | SpringerLink
- Edge-Based Compartmental Modelling of an SIR Epidemic on a Dual-Layer Static–Dynamic Multiplex Network with Tunable Clustering

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 have been a participant in Scientific Pandemic Influenza Group on Modelling (SPI-M) meetings since October 2020. I attended the Social Care Working Group (SCWG) meeting once in October 2020.

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.

In September 2020 I began producing medium-term projections of SARS-CoV-2 community transmission to submit as evidence to SPI-M. At this point I was granted access to SPI-M data and issued invitations to SPI-M sub-group meetings concerned with medium-term projections and growth rate/R estimates.

In October 2020 I was involved in some modelling work assessing different testing strategies in care home settings. This work was presented to the Social Care Working Group meeting on the 23rd October 2020, which I attended. On the 21st October 2020 I attended my first main meeting of SPI-M. I attended SPI-M's main meeting again on the 28th of October 2020 as I had contributed to modelling work assessing the impact of the tiered restrictions introduced in England, which was being presented to SPI-M. I attended the SPI-M main meeting again on the 25th November 2020, the 22nd December 2020 (when I had been involved in modelling work presented to SPI-M assessing the impact of the new variant of concern), and on the 6th January 2021.

From March 2021 onwards, I was involved in discussions related to SPI-M modelling which was commissioned by the Cabinet Office. This commission was to assess the potential impact on SARS-CoV-2 transmission of implementing the so-called 'roadmap' steps out of lockdown in early 2021. I attended the SPI-M main meetings on the 17th and 24th March, the 21st and 28th April, and on the 5th, 19th, and 26th May 2021.

On 28th May 2021 I confirmed I was happy for SPI-M to publish my name on their membership list. I attended SPI-M's main meetings on the 2nd, 9th, 16th, 23rd, and 30th June, the 7th, 14th, and 28th July, the 11th and 25th August, the 8th September, the 6th and 13th October, the 3rd and 24th November, and the 1st, 8th, 15th, 22nd, and 30th December 2021. In 2022, I attended the SPI-M main meeting on the 6th, 12th, 19th, and 26th January, on the 2nd and 16th February.

My contributions to these meetings consisted of providing and presenting modelling evidence (either in the form of weekly medium-term projections, or ad-hoc modelling commissions),

answering questions related to modelling evidence I had generated and provided, asking questions related to modelling commissions and other work presented and contributing to discussions where relevant.

My role was to provide modelling in the form of medium-term projections of SARS-CoV-2 transmission in England, as well as commissioned modelling scenarios related to policy changes (such as the relaxation of the lockdown in early 2021), and in response to emerging variants of concern such as the Delta and Omicron variants. I was required to provide reports summarising the modelling results and assumptions, as well as provide data to the SPI-M secretariat, and to answer any questions related to this work from SPI-M members or secretariat.

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.

For medium-term projections of SARS-CoV-2 transmission, I provided only data to SPI-M. For ad-hoc modelling commissions, I contributed to and produced written reports outlining modelling results and assumptions. For example:

- An estimate of the transmissibility and severity of SARS-CoV-2 variant B.1.1.7-N501Y in South East England, 22 December 2020 - GOV.UK
- LSHTM: Interim roadmap assessment: prior to Step 2, 31 March 2021 - GOV.UK
- LSHTM: Interim roadmap assessment – prior to steps 3 and 4, 5 May 2021 - GOV.UK
- LSHTM: Interim roadmap assessment – prior to Step 4, 9 June 2021 - GOV.UK
- LSHTM: Updated roadmap assessment – prior to delayed Step 4, 7 July 2021 - GOV.UK
- LSHTM: autumn and winter scenarios 2021 to 2022, 13 October 2021 - GOV.UK
- LSHTM: Modelling the potential consequences of the Omicron SARS-CoV-2 variant in England, 11 December 2021 - GOV.UK
- LSHTM: Omicron scenarios: 28 December restrictions, 22 December 2021 - GOV.UK

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 an interview to BBC Radio 4's More or Less programme (see BBC Radio 4 - More or Less, How effective is one dose of the vaccine?), about my research on the Alpha B.1.1.7 SARS-CoV-2 variant in late 2020, before I was a formal member of SPI-M.

I have written various Twitter threads which directly and indirectly talk about work produced for SPI-M, for example:

- https://twitter.com/BarnardResearch/status/1342087036241666049
- https://twitter.com/BarnardResearch/status/1404502417304084485

- https://twitter.com/BarnardResearch/status/1414636107548045317
- https://twitter.com/BarnardResearch/status/1469646833563615237
- https://twitter.com/BarnardResearch/status/1562086678818430976

I have written and contributed to the following blog posts/news stories about my research, which I deem relevant:

- Modelling the potential impact of Omicron in England | LSHTM
- Modelling the key factors influencing SARS-CoV-2 transmission | Nature Portfolio Health Community
- Looking back at the past 2 years Reflections from the EpiPose team captured at our first face-to-face meeting in Antwerp, 7-8 June 2022

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;
    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.

Given what I have observed from October 2020 onwards, I think that the work of the above-mentioned groups (e.g. mainly SPI-M, but also the SCWG) have been largely successful in achieving their aims.

However, I think there are areas which could be improved for future outbreaks. Specifically:

- SPI-M and other sub-group members are volunteers, but the amount of work required to contribute to these modelling commissions, at least for me personally, went far beyond even a single person's full-time equivalent FTE. I was lucky to be able to contribute so much because the remit of my grant funding was in alignment with the aims of these groups, and my managers were supportive. However, I believe that this funding mechanism will exacerbate existing inequalities across the research community.
- Work was clearly commissioned and with suitable research questions being explored, but often on extremely tight deadlines (e.g. commissions were often received on Friday evenings and the work expected to be submitted the following Tuesday). I am not sure this can be avoided in an unfolding epidemic, but it is an important factor to consider.
- These groups were largely white and male, and consequently a majority of contributions in SPI-M meetings were from those same individuals. These groups were also mostly composed of very senior academics, with fewer early career individuals. In my opinion it was earlier career researchers who were often much more actively involved with the

intricacies of the work itself (e.g. data processing, modelling, analysis, and report writing), but early career researchers were not as involved in meetings as more senior academics. On the other hand, I did observe a very comprehensive diversity of expertise across different academic fields.

- The resources and support provided by the SPI-M secretariat and other civil servants was exemplary. For future outbreaks, I think this could be improved by ensuring that the public data sources match the data sources being used by SPI-M members. Further, computing resources could be provided to SPI-M members who are generating modelling evidence.

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.

Other than my points in response to question 6, I think that all forms of evidence used by decision-makers should be made public. The evidence generated by SPI-M was made public, but I believe that ministers and government officials relied on many different forms of evidence, and they often used the phrase "following the science" to explain their decision making process. This seemed to put the blame on scientists such as myself (who had evidence published in the public domain), as I believe that many other forms of evidence used by decision makers were not made available to the public.

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 hold soft-copy material includings: emails, modelling reports, meeting agendas and agenda items, and Slack messages.