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Tim Suter
UK Covid-19 Public Inquiry

Dear Mr Suter,

In reply to your request for information M2/SAGE/01/CXJ, here are my responses to your questions:

1. I am a Professor in Statistics at Lancaster University. My main research interest is in Bayesian statistical methods for calibration of complex spatial epidemic models to disease data in real time. I have 13 years of experience of research in this field, and have historically worked on application in foot and mouth disease (UK and US), avian influenza (domestic poultry), bovine theileriosis (NZ), antimicrobial resistance (Malawi, humans), human influenza (US), visceral leishmaniasis (India), and now Covid19 in the UK.

My publications may be found via my ORCID record <https://orcid.org/0000-0002-7902-2178>.

My current qualifications are:

- BSc(Hons) Molecular Biology, University of Liverpool, 2002;
 - BVSc, University of Liverpool, 2004;
 - MSc Statistics, Lancaster University, 2005;
 - PhD Statistics, Lancaster University, 2009.
2. I was a member of SPI-M-O from February 2020 until the group was closed in April 2022. Within SPI-M-O, I was also a member of the working group on spatial analysis, late 2020 to April 2022.
 3. I was invited to join SPI-M-O by Prof. Graham Medley following the pre-print announcement of a paper on dissemination of SARS-CoV-2 between cities in China and worldwide via airline networks. I attended the vast majority of the main SPI-M-O weekly (and latterly fortnightly) meetings between the dates outlined in (2).
I contributed weekly spatial analyses (submitted to SPI-M-O secretariat as PDF files, and included in the meeting informational literature), and one-off reports on the effects of compliance with stay-at-home measures (March 2020), the spatial distribution of the early pandemic and the importance of spatial data provision, and a document evaluating the efficacy of Tier 2 and 3 restrictions in Q3 2020. My role was as a scientific advisor to the SPI-M-O committee, specialising in spatial statistical analysis of the epidemic data.
 4. Documents submitted to SPI-M-O were
 - (a) Read *et al.* (2020) Novel coronavirus 2019-nCoV: early estimation of epidemiological parameters and epidemic predictions. Medarxiv <https://doi.org/10.1101/2020.01.23.20018549>;
 - (b) Monograph on compliance with stay-at-home restrictions (Jewell and Neal, 2020, document submitted to SPI-M-O, March 2020);

- (c) Monograph on the principles of testing immigrants for SARS-CoV-2, and the number of tests needed to be confident an individual was disease free (Jewell and Read, 2020, document submitted to SPI-M-O);
 - (d) Monograph on the importance of spatial data provision (Jewell, 2020, document submitted to SPI-M-O and Cabinet Office);
 - (e) Weekly spatial analyses of the UK epidemic, including spatial measures of reproduction number, short-term prediction, and smoothed case incidence (Jewell *et al.* 2020-2022, documents submitted to and included as informational documents for SPI-M-O weekly meetings).
5. As a methodologist, my written articles were the early paper on estimation of epidemiology parameters (point a above), and on MCMC-based fitting methods for the “EpiBeds” model (<https://arxiv.org/abs/2110.06193>). I expect to publish papers detailing the methodology that was used for the spatial analyses mentioned above in Q4 2022, with the SPI-M-O summary document available at https://github.com/chris0dwc/covid19uk/blob/master/doc/lancs_space_model_concept.pdf.
 6. I fully believe that in and of itself, SPI-M-O did succeed in its aims: to provide timely and relevant advice on epidemic situational awareness and likely outcomes under a range of possible intervention strategies. The group was unique internationally in being composed of members of academia from a large number of different institutions, who came together to offer a consensus on the available information where possible, and a detailed critique of conflicting evidence where this was necessary. Our work through the spatial sub-group made a point of being grounded in observed data at all times, and we were highlighted as being non-speculative by the SPI-M-O chair. Being a small group of academics (Imperial, LSHTM, Warwick, Lancaster, Edinburgh, Cambridge), we worked well together and were able to discuss, describe, and communicate where our analyses effectively differed. The data that was made available to us was broadly satisfactory by Q3 2020, but we were never able to access timely data on human mobility which we very much needed to improve the analytic accuracy of our model-based methods. This mobility data stands out as the single most valued, but missing, piece of the puzzle – my understanding is that commercial concerns were insurmountable even in the event of a national emergency. My understanding is that the structure within SPI-M-O, where analytic information flowed from sub-groups to SPI-M-O main meeting, to SAGE, and then to Cabinet Office worked well, with complex information being summarised under discussion from the analytic groups in order to convey the overall messages clearly. This was undoubtedly helped by having a leading academic as SPI-M-O chair, as well as an academic community within SAGE.
 7. Three major lessons can be learned from the UK’s response:
 - (a) Firstly, we have a *massive* gap in the capability of statistics to effectively calibrate epidemic models. The result was that we were simply not able to fit the detailed models we would have liked to have fitted through a lack of ready-to-go and proven statistical methods. The reason for this is in the disinclination by UKRI to fund methodological work on epidemic analysis in the years after the H1N1 “swine flu” epidemic in 2009. Given that the UK is the leading authority in the field of Statistics, we were definitely found wanting.
 - (b) Secondly, it is my belief that the badly needed timely human mobility data (referred to above) was not available due to commercial concerns hiding behind “data privacy” concerns. These data were vital to gain an understanding of why certain regions of the country became “hotspots” ahead of others, and therefore provided local public health authorities with vital evidence to forestall small case surges before they became larger.
 - (c) Thirdly, UK-wide disease surveillance (for anything, not just Covid19) is currently inadequate. It is unable to give accurate measures of disease prevalence at a spatially meaningful level, and cannot respond quickly to new outbreaks. Commendable steps have been made by ONS to ameliorate this situation, but their funding level is currently inadequate to achieve the sort of coverage we require in the future.
 8. We retain all our analytic outputs, and the methods and datasets used to create them. Subject to some of the raw datasets are covered by a data sharing agreement with UKHSA, we are happy to

share the materials as and when required.

Yours sincerely,

Chris Jewell