Witness Name:
Melinda Mills
Dated: 11.10.2022
Ref: M2/SAGE/01/MXM

COVID-19 INQUIRY – MODULE 2

Questionnaire Response – Professor Melinda Mills

1: Overview of qualifications, career history, professional expertise and major publications:

Qualifications

1.1. The following table outlines my qualifications:

Table 1- Qualifications

Since 2010	Further training in molecular genetics, biostatistics
2000	PhD Demography, University of Groningen, Netherlands
1996	Masters Sociology (specialisation in Demography), University of Alberta, Canada
1994	Bachelor Sociology (specialisation in Demography), University of Alberta, Canada

Employment History

1.2. The following table outlines my employment history:

Table 2 – Employment History

2014- present	Statutory Nuffield Professor of Demography and Sociology & since 2019 Director, Leverhulme Centre for Demographic Science, University of Oxford and Nuffield College, UK
2022-present	Professor of Data Science and Public Health Policy, Dual-appointment at Department of Economics, Econometrics and Finance, University of Groningen and Department of Genetics, University Medical Centre Groningen, The Netherlands
2022-present	Special Advisor, European Commissioner of the Economy (Paolo Gentiloni)
2008-2014	Full Professor Sociology of the Life Course & Rosalind Franklin Fellow, (12/2008-2014), Associate Professor & Rosalind Franklin Research Fellow (01-11/2008), Assistant Professor & Rosalind Franklin Research Fellow (01/2006-12/2007), Faculty of Behavioural and Social Sciences, University of Groningen the Netherlands
2002-2005	Assistant Professor, Department of Social Research Methodology, Faculty of Social Sciences, Vrije Universiteit, the Netherlands
2000-2002	Assistant Professor (2001-2); Senior Researcher (2000-1), Faculty of Sociology, University of Bielefeld, Germany

Professional Expertise

1.3. The following outlines my professional expertise:

- Research expertise: demography; empirical sociology; genetics; statistics; modelling; cross-national comparisons; family and households; labour market
- Professional experience: Previously member of ESRC/UKRI Executive Board; Supervisory Board Dutch Science Council; Head of Department; European Commission Special Advisor

Publications

1.4. Full publication list available at https://scholar.google.com/citations?user=HX9KQ5MAAAAJ&hl=en&oi=ao

Genomics, biostatistics, demography, human reproduction (selection)

1.5. Howe, L.J. et al. (2022). Within-sibship GWAS improve estimates of direct genetic effects, Nature Genetics, 54: 581–592.

1.6. Mills, M.C. et al. (2021) Identification of 371 genetic variants for age at first sex and birth linked to externalising behaviour, Nature Human Behaviour, 5: 1717–1730.

1.7. Mills, M.C. and C. Rahal. (2020). The GWAS Diversity Monitor tracks diversity by disease in real-time, Nature Genetics. 52: 242–243.

1.8. Mills, M.C., N. Barban and F.C.Tropf. (2020). An Introduction to Statistical Genetic Data Analysis. Cambridge, MA: The MIT Press.

1.9. Mills, M.C. and C. Rahal. (2019) A Scientometric Review of Genome-Wide Association Studies, Communications Biology 2(9)

1.10. Tropf, F.C. et al. M.C. Mills. (2017). Hidden heritability due to heterogeneity across seven populations, Nature Human Behaviour, 1: 757-765.

1.11. Barban, N…….M.C. Mills (2016). Genome-wide analysis identifies 12 loci influencing human reproductive behavior, Nature Genetics, 48: 1462-1472.

1.12. Okbay, A. et al. (2016) Genetic variants associated with subjective well-being, depressive symptoms and neuroticism identified through genome-wide analyses. *Nature Genetics*. 48: 624-633.

1.13. Mehta, D.,…..M.C. Mills, N.R Way, S.Hong Lee. (2016). Evidence for genetic overlap between schizophrenia and age at first birth in women. *JAMA Psychiatry*, 73(3):193-194.

1.14. Mills, M. (2011). Introducing Survival and Event History Analysis. Thousand Oaks, CA/London: Sage.

1.15. Mills, M., R.R. Rindfuss, P. McDonald and E. te Velde (2011). Why do people postpone parenthood? Reasons and social policy incentives, Human Reproduction Update, 17(6): 848-860.

COVID-19 related (selection)

1.16. Mills, M.C. & T. Rüttenauer (2021). The impact of mandatory COVID-19 certificates on vaccine uptake: Synthetic Control Modelling of Six Countries, The Lancet Public Health, 7(1): E15-E22.

1.17. Dye, C. & M.C. Mills (2021). COVID-19 vaccination passports, Science, 371: 1184.

1.18. Mills, M.C. & C. Dye (2021). Twelve criteria for the development and use of COVID-19 vaccine passports. London: Royal Society.

1.19. Aburto, JM et al, M.C. Mills (2021). Estimating the burden of the COVID-19 pandemic on mortality, life expectancy and lifespan inequality in England and Wales: a population-level analysis, Journal of Epidemiology & Community Health

1.20. Aburto, J.M et al. (2021). Quantifying the impacts of the COVID-19 pandemic through life-expectancy losses: a population-level study of 29 countries, International Journal of Epidemiology, dyab207.

1.21. Ding, X., D.M. Brazel & M.C. Mills (2021). Factors affecting adherence to non-pharmaceutical interventions for COVID-19 infections in the first year of the pandemic in the UK, BMJ Open, 11: e054200.

1.22. Jennings, W., et al. M.C.Mills (2021). Lack of Trust, Conspiracy Beliefs, and Social Media Use Predict COVID-19 Vaccine Hesitancy, Vaccines, 9(6): 593.

1.23. Razai, M.S. et al. (2021) COVID-19 Vaccine Hesitancy: the five Cs to tackle behavioural and sociodemographic factors, Journal of the Royal Society of Medicine, 01410768211018951

1.24. Mills, M. & J. Sivelä (2021). Should spreading anti-vaccine misinformation be criminalised? British Medical Journal, 372:n272.

1.25. Mills, M.C., C. Rahal, D. Brazel, J. Yan and S. Gieysztor. (2020). Vaccine Deployment: Behaviour, ethics, misinformation and policy strategies. London: Royal Society.

1.26. Dowd, JB, Andriano, A, Brazel DM, Rotondi, V., Block, P, Ding, X, Liu Y & M.C. Mills (2020). Demographic Science aids in understanding the spread and fatality rates of COVID-19, PNAS: Proceedings of the National Academy of Sciences, 117(18): 9696-98

1.27. Block, P., Hoffman, M., Raabe, I.J., Dowd, J.B., Rahal, C., Kashyap, R. & M.C. Mills (2020). Social network-based distancing strategies to flatten the COVID-19 curve in a post-lockdown world Nature Human Behaviour, 4: 588-596.

1.28. Gaye, B. et al. (2020). Socio-demographic and epidemiological consideration of Africas COVID-19 response: what is the possible pandemic course? Nature Medicine. 26: 996-999.

1.29. Verhagen, M.D., Brazel, D.M., Dowd, J.B., Kashnitksy, I. & M.C. Mills (2020). Forecasting spatial, socioeconomic and demographic variation in COVID-19 health care demand in England and Wales, BMC Medicine, 18: 203

1.30. Dowd, J.B., P. Block, V. Rotondi & M.C. Mills (2020). Dangerous to claim "no clear association" between intergenerational relationships and COVID-19, PNAS: Proceedings of the National Academy of Sciences, 117(42): 25975-25976.

1.31. Mills, M. & D. Salisbury. (2020). The challenges of distributing COVID-19 vaccinations, EClinicalMedicine, 100674.

1.32. Mills, M. C. Rahal & D. Brazel (2020). Vaccine Deployment: Behaviour, ethics, misinformation and policy strategies. London: Royal Society.

1.33. Dowd, J.B., X. Ding, E.Akimova & M.C. Mills. (2020) Health and inequality: The implications of the COVID-19 pandemic, London: The British Academy.

1.34. Mills, M.C., C. Rahal, E. Akimova. (2020). Face masks and coverings for the general public: Behavioural knowledge, effectiveness of cloth coverings and public messaging, Royal Society.

1.35. Ding, X., D.M. Brazel & M.C. Mills (2022). Gender differences in sleep disruption during COVID-19: cross-sectional analyses from two UK nationally representative surveys, BMJ Open, 12(4) http://dx.doi.org/10.1136/bmjopen-2021-055792

2: List of groups I participated in and the relevant time period:

2.1. Scientific Pandemic Insights Group on Behaviours (SPI-B) (11 January 2021 - February 2022)

2.2. Ethnicity Subgroup (13 August 2020 – 12 May 2021)[1]

2.3. Vaccine Science Coordination Group (SPI-B representative) (13 August 2020 – February 2022)

3: Overview of involvement in groups between January 2020 and February 2022:

When and how you came to be a participant

My involvement with these groups was as follows:

Ethnicity Subgroup

3.1. I was invited to become a member of the SAGE Ethnicity sub-group 13 August 2020.

3.2. It was never clarified to me directly why I was invited, but it was likely related to my previous work in this area. This may be unrelated but I was previously contacted by the Cabinet Office's Race Disparity Unit to try to understand what analyses were taking place or planned and evidence gaps related to COVID-19 and the lockdown and ethnicity (email 23 July 2020, Alice Whitfield and cc Vasileios Antonpoulos). During this meeting I complained about the lack of

[1] Received email 12 May 2021 noting that no further meetings would be scheduled.

access to ONS mortality data by ethnicity and they were helpful in discussing and trying to unlock this.

SAGE-SPI Subgroup

3.3. **30 April 2020**: I applied to an openly advertised call for embedded scientists on SAGE SPI-B.

3.4. **15 May 2020**: My application to serve as an embedded scientist on SAGE SPI-B was rejected.

3.5. **03 July 2020**: Invited to present the Royal Society SET-C report I wrote 'Face masks and coverings for the general public: Behavioural knowledge, effectiveness of cloth coverings and public messaging'[2] (published online by RS 26 June 2020) to SPI-B Co-ordination Group (presentation available upon request, mirrors report)

3.6. **27 October 2020**: Invited to present my Royal Society SET-C report I wrote 'COVID-19 Vaccine Deployment: Behaviour, ethics, misinformation and strategies'[3] (published online by RS 21 October 2020) to SPI-B Co-ordination Group (presentation available upon request, mirrors report)

3.7. **04 December 2020**: Invitation to join working group on Vaccines for SPI-B (report due to SAGE 17 December 2020)

3.8. **11 January 2021**: Invited to become a member of the SPI-B Co-ordination Group and the Vaccines Science Coordination group, see accompanying attachments:

- SPI-B Terms of Reference, Effective from October 2020
- Scientific Pandemic Insights Group on Behaviour (SPI-B): Covid-19 Participant Guidance, Effective from October 2020
- SPI-B Declaration of Interest

Vaccine Science Coordination Group

3.9. **11 January 2021**: Invited to become a member of the SPI-B Co-ordination Group and the Vaccines Science Coordination group

[2] https://royalsociety.org/-/media/policy/projects/set-c/set-c-facemasks.pdf
[3] https://royalsociety.org/-/media/policy/projects/set-c/set-c-vaccine-deployment.pdf

3.10. The selection of how I (or others) became a participant on these SAGE sub-groups is not transparent to me. As documented above, I applied to an open call for Embedded Scientists on SPI-B on 30 April 2022, explaining my interdisciplinary expertise in behaviour, social sciences, statistics, demography, sociology, health, and genetics arguing that I felt this problem needed the broader interdisciplinary expertise that I could offer. I also noted the importance of understanding the public and need to focus on broader economic and social issues. In addition, I noted that I had recently started a centre who could support research as we were already working in this area.

3.11. In my application, I noted the importance of our (peer-reviewed published) work that covered different topics from what SPI-B had focussed on such as the importance of the demographic composition of the population[4] and evidence-based behavioural mathematical simulation models (stochastic infection curves) combining infection information from epidemiology with social network and statistical event models from empirical sociology.[5] I explained how we used modelling to demonstrate how to keep the reproduction number (R) low via different types of social network interactions (i.e., evidence-based social bubbles) to ensure that fewer individuals would be infected by each carrier via the simulation of various approaches such as creating social bubbles and repeated contact within similar groups (e.g., school classes, employment shifts).

3.12. I was sent a rejection letter on 20 May 2022 from, Adam Eccles SAGE Secretariat, Behavioural Science and X-Whitehall Engagement stating: "Unfortunately, your experience didn't match the profile we are looking for on this occasion, so we will not be progressing your application any further. As a point of clarification, we are aware that in some reports the media misrepresented our call for expression of interest for academics to join the GO-Science team supporting SAGE. We are not currently looking for new SAGE or SAGE sub-group participants. Rather, we are looking for an early career researcher to support the work of SPI-B (the behavioural science subgroup of

[4] https://www.pnas.org/doi/10.1073/pnas.2004911117
[5] https://www.nature.com/articles/s41562-020-0898-6

SAGE) as an embedded academic within the GO-Science team acting as the secretariat to SPI-B, in line with the responsibilities outlined in the advert."

3.13. It is unclear to be me if my application is related to being invited later or the visibility of some of my research. But on 03 July 2020, I was invited to the SPI-B meeting to present the report I led as a member of the Royal Society's SET-C (Science in Emergencies Tasking-COVID) Group[6] (published on 26 June 2020) entitled: 'Face masks and coverings for the general public: Behavioural knowledge, effectiveness of cloth coverings and public messaging'.[7] This report examined:

- Effectiveness of cloth face coverings (including existing evidence of effectiveness of public wearing in community settings, empirical meta-analyses showing the effectiveness of masks in health care settings and by mask types, difference by fabric type, construction and gaps, also drawing from testing/materials literature)
- International face mask and covering policies and adoption and uptake to date (UK with similar comparator countries)
- Systematic literature review on behavioural factors related to face mask adherence (public understanding of transmission, risk perception, previous experience and trust in government and science, individual characteristics and perceived barriers)
- Relationship with other interventions and importance of public messaging
- Appendices included additional data analysis and information and importantly, the use of GRADE (Grading of Recommendations, Assessment, Development and Evaluation)[8] to ensure a systematic process and transparency of research and quality of evidence was explicit for each topic

[6] https://royalsociety.org/topics-policy/projects/set-c-science-in-emergencies-tasking-covid/#:~:text=SET%2DC%20is%20part%20of,to%20tackle%20Coronavirus%20COVID%2D19.
[7] https://royalsociety.org/-/media/policy/projects/set-c/set-c-facemasks.pdf
[8] https://bestpractice.bmj.com/info/toolkit/learn-ebm/what-is-grade/

3.14. On 27 October 2020, I was again invited to SPI-B to present another Royal Society SET-C report that I led and wrote entitled 'COVID-19 Vaccine Deployment: Behaviour, ethics, misinformation and strategies' (published 21 October 2022).[9] This report examined:

- Immunisation coverage and vaccine hesitancy (herd immunity thresholds, immunisation coverage for existing diseases, cross-national comparison of vaccine hesitancy)
- Behavioural and socio-demographic factors underlying vaccine uptake (complacency and threat appraisal, trust under conditions of uncertainty, convenience and planning, sources of information and knowledge deficits, socio-demographic characteristics of vaccine uptake)
- Ethics and equity considerations in allocation of vaccinations
- History of anti-vaccination movements, misinformation and public dialogue (misinformation, who generates and funds anti-vaccination material, sites of information gathering of public, polarisation)
- Conclusion and recommendations (dialogue and community engagement, inoculating public against misinformation)
- Appendix including data and methods and explicit search terms used the Systematic Review and where evidence was gathered

3.15. I was invited to join the ethnicity subgroup on 13 August 2020 and the SPI-B Co-ordination Group and the Vaccines Science Coordination group on 11 January 2021.

The number of meetings you attended, and your contributions to those meetings & your role in providing research, information and advice.

3.16. SAGE-SPI-B

Meeting	Date	Attendance	Contribution and role

[9] https://royalsociety.org/-/media/policy/projects/set-c/set-c-vaccine-deployment.pdf

1-22	24 February 2020 – 30 September 2020	Not member of SAGE SPI-B	-
CG01-CG09	30 September 2020 – 05 January 2021	Not member of SAGE SPI-B	-
CG10	12 January 2021	Attended	Provided comments on: SPI-B: Return to campus for Spring term: risk of increased transmission from student migration[10] EMG/SPI-B/SPI-M: Reducing within- and between-household transmission in light of new variant SARS-CoV-2, 14 January 2021[11] Discussed evidence gaps in mental health (young people, parents, financial insecurity, vaccine uptake with severe mental illness)
CG11	19 January 2021	Attended	Provided comments on: SPI-B Policing and Security subgroup Behavioural Aspects on International Importation[12] Discussed:

[10] https://www.gov.uk/government/publications/spi-b-return-to-campus-for-spring-term-risk-of-increased-transmission-from-student-migration-13-january-2021

[11] https://www.gov.uk/government/publications/emgspi-bspi-m-reducing-within-and-between-household-transmission-in-light-of-new-variant-sars-cov-2-14-january-2021

[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012413/S1048_SPI-B_-_Behavioural_aspects_of_international_importation.pdf

			Master list of science questions from Vaccine Science Coordination group Upcoming behaviour of those who had COVID and lifting interventions
CG12	02 February 2021	Attended	Discussed: lifting interventions, review of previous SPI-B advice and potential updates lessons learnt on NPIs over the last year & what is different now (vaccines, new variants, failure TTI, ending job retention scheme, move to tiers, attention to local/regional and surge testing, need to think of prioritising advice), DfT longitudinal study and updates in other areas (education, vaccines, DHSC compliance analysis, mental health)
CG13	09 February 2021	Attended	Discussed: Lifting NPIs DHSC compliance prototype (i.e., levels of adherence and behaviour) – asked about interpreting data, what 'good compliance' would look like, data caveats (e.g., self-reported data) Commented on updates on work on: Barriers and enablers to vaccine uptake in seriously mentally ill (SMI)[13] Education

[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974605/SPI-B_-_Severe_mental_illness_and_COVID-19_vaccination.pdf

			Vaccine Prioritisation
CG14	23 February 2021	Attended	Provided comments on: Barriers and enablers to vaccine uptake in seriously mentally ill (SMI)[14] Discussed coordination of ongoing work: Embedding long-term behaviour change/baseline restrictions Daily contact testing DHSC compliance analysis Vaccines Large venues Transmission in prisons
CG15	09 March 2021	Attended	Presented and discussed paper I lead on: SPI-B: Behavioural considerations for vaccine uptake in Phase 3 and beyond[15] Discussed ongoing work and updates including: Testing in underrepresented groups Embedding long-term behavioural changes Certification Large Venues Behaviours and transmission (based on CO suggested set of behaviours to prioritise)

[14] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974605/SPI-B_-_Severe_mental_illness_and_COVID-19_vaccination.pdf
[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984351/S1162_SPI-B_-_Behavioural_Considerations_for_Vaccine_Uptake_in_Phase_2.pdf

CG16	20 April 2021	Attended	Discussed paper: SPI-B: Sustaining behaviours to reduce SARS-CoV-2 transmission,[16] 22 April 2021 used to inform Social Distancing Review Feedback provided from CO teams on SPI-B impact
CG17	27 April 2021	Attended	Discussed in more detail resubmission of paper and specifically Annex A (background and methods) in SPI-B: Sustaining behaviours to reduce SARS-CoV-2 transmission,[17] for resubmission to SAGE Commented on paper: EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs,[18] 22 April 2021
June	22 June 2021	Attended	Farewell to Departing chairs and introduction new Deputy Chair, Patrick Vallance joined, Secretariat provided information on processes and future engagement
CG18	13 September 2021	Attended	Working group on re-introducing protective measures
Sept	23 September 2021	Attended	Discussed new request from CO from experts across SAGE regarding whether there is sufficient new evidence or change

[16] https://www.gov.uk/government/publications/spi-b-sustaining-behaviours-to-reduce-sars-cov-2-transmission-30-april-2021/spi-b-sustaining-behaviours-to-reduce-sars-cov-2-transmission-22-april-2021
[17] https://www.gov.uk/government/publications/spi-b-sustaining-behaviours-to-reduce-sars-cov-2-transmission-30-april-2021/spi-b-sustaining-behaviours-to-reduce-sars-cov-2-transmission-22-april-2021
[18] https://www.gov.uk/government/publications/emg-spi-m-and-spi-b-considerations-in-implementing-long-term-baseline-npis-22-april-2021

			in epidemiological context to warrant updated advice, with a focus on certification and WFH
CG19	05 October 2021	Attended	Discussion of Plan B measures and discussing paper that I led: SPI-B: Behavioural considerations for maintaining or reintroducing behavioural interventions and introducing new measures in autumn 2021,[19] 14 October 2021
CG20	01 February 2022	Did not attend	GO-Science states this meeting occurred but unclear if I was invited and it is not in my agenda

3.17. Ethnicity subgroup

Meeting	Date	Attendance	Contribution and role
1	21 August 2020	Invited but was unable to attend	Unable to attend but post-meeting able to provide comments on: COVID-19: mitigation of risks in occupational settings with a focus on ethnic minority groups Consensus statement from Public Health England, the Health and Safety Executive and the Faculty of Occupational Medicine.[20]

[19] https://www.gov.uk/government/publications/spi-b-behavioural-considerations-for-maintaining-or-reintroducing-behavioural-interventions-and-introducing-new-measures-in-autumn-2021-14-october-2

[20] https://www.gov.uk/government/publications/covid-19-mitigation-of-risks-in-occupational-settings-with-a-focus-on-ethnic-minority-groups

2	01 September 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Group received email 02 September 2022 that a core group was established by Kamlesh Khunti and Osama Rahman and that we would receive meeting summaries & leads of next reports would be taken by Vittal Katikireddi and Atiya Kamal
3	15 September 2020	GO-Science reported meeting occurred	I could not locate any communication on this within my emails
4	22 September 2020	GO-Science reported meeting occurred, in my agenda it says 'Cancelled'	A note was distributed summarising this meeting 25 September to all who were not invited
5	29 September 2020	Attended	Commented on: 1. Public Health Data Asset Briefing 2. Priority Research Questions Template
6	13 October 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	A note was distributed summarising this meeting 19 October to all who were not invited

7	20 October 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	A note was distributed summarising this meeting 23 October to all who were not invited
8	03 November 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Could not locate any information
9	10 November 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Could not locate any information
10	17 November 2020	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Could not locate any information
11	08 December 2020	Attended	Agreed to write section on vaccine uptake paper regarding current barriers to uptake among minority ethnic groups, including healthcare workers

12	15 December 2020	Attended	Reviewed final draft of paper on vaccine uptake: Factors influencing COVID-19 vaccine uptake among minority ethnic groups[21]
13	05 January 2021	Attended	Purpose of meeting was to discuss and review the findings from OPENSafely on mortality among minority ethnic group in the U.K. between September and November 2020
14	12 January 2021	Attended	Unable to locate agenda and notes
15	26 January 2021	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Could not locate any information
	12 February 2021	Meeting and papers in my email, agenda	Discussion of papers by OpenSafely/ONS on mortality and ethnicity, focus on attenuation of risk to Black groups between waves 1 and 2; Increase of risk to Bangladeshi and Pakistani groups.
16	09 March 2021	GO-Science reported meeting	Could not locate any information

[21] https://www.gov.uk/government/publications/factors-influencing-covid-19-vaccine-uptake-among-minority-ethnic-groups-17-december-2020

		occurred, it is not in my agenda and I do not appear to have been invited	
17	23 March 2021	GO-Science reported meeting occurred, it is not in my agenda and I do not appear to have been invited	Could not locate any information

Received email 12 May 2021 noting that no further meetings would be scheduled.

3.18. Vaccine Science Coordination Group

Meeting	Date	Attendance	Contribution and role
2	22 January 2021	Attended	Provided an update representing SPI-B on activities and questions for master vaccines science list Briefed on information on: Update from meeting 1 (policy landscape) Information on National Core Studies data
3	08 February 2021	Attended	Briefed and discussion on: Purpose of group, CO update Reports from groups (focus on data availability), REACT, PHE, ONS, Clinical trials, SPI-M, Virology/immunology subgroup, Vaccines Taskforce Discussed outstanding areas for clarification (routine data on CT values, data availability

			for care homes, vaccine refusals – linkage ONS CIS and NIMS)
4	02 March 2021	Attended	Briefed and discussion on: Impact of new variants on treatments Airfinity presentation on variants Vaccines and variants discussion Therapeutics Taskforce paper on variants
5	23 April 2021	Attended	Briefed and discussion on: OCTAVE immunology study NCS evidence on capability in the UK PHE + ONS presentation on vaccine efficacy in the real world Variants
6	03 June 2021	Attended	Discussion about: % figures used to measure vaccine effectiveness across different markers/variants. what infrastructure is in place to collect data on waning immunity post-vaccination
7	29 September 2021	Did not attend	Listed by GO-Science as meeting date, is not in my agenda

3.19. Other related SAGE meetings:

- SAGE main meeting, COVID SAGE 96 (presented and answered questions on SPI-B paper),[22] 14 October 2021
- SAGE: Small group meeting Work from Home/Certification, 23 September 2021, provided comments on Consideration for potential impact of Plan B measures[23]
- Security Briefing with Dominic Fortescue, Government Chief Security Officer, 28 April 2021

4: A Summary of documents to which I contributed for the purpose of advising groups:

In context of SAGE SPI-B group

I provided comments on:

3.1. **SPI-B: Return to campus for Spring term: risk of increased transmission from student migration[24].** This was in response to DfE's updated guidance on the return of University students to campus on 4 January 2021. It provided information on what was needed to encourage and support the uptake of testing and health-protective behaviours and the short, medium and long-term risks to students and the wider community. It noted that University students are in highly-connected environments, susceptible to higher rates of transmission. The report provided evidence on randomised testing, contact tracing and quarantine to contain campus outbreaks. It argued that additional work is needed to understand the costs, feasibility and acceptability of asymptomatic testing in Universities. Also following a positive test, the need to provide guidance and information on the principles of self-isolation and finally, long-term planning beyond the end of the spring term for students and staff.

[22] https://www.gov.uk/government/publications/spi-b-behavioural-considerations-for-maintaining-or-reintroducing-behavioural-interventions-and-introducing-new-measures-in-autumn-2021-14-october-2
[23] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1027586/S1393_SPI-B_SPI-M_EMG_Considerations_for_potential_impact_of_Plan_B_measures_13_October_2021.pdf
[24] https://www.gov.uk/government/publications/spi-b-return-to-campus-for-spring-term-risk-of-increased-transmission-from-student-migration-13-january-2021

3.2. **EMG/SPI-B/SPI-M: Reducing within- and between-household transmission in light of new variant SARS-CoV-2, 14 January 2021.**[25] This document summarised the current scientific evidence on actions that would serve to reduce household transmission of SARS-CoV-2. It was largely based on previous SAGE papers and took into account of the potential impacts of the new variant of the virus. It emphasized that within-household transmission was very common, higher risks of transmission within households, also given the increased transmissibility of B1.1.17. It proposed pre-emptive measures that could be taken to avoid secondary infection within households, need for wider communications coverage, and attention to different cultures and sectors of society. It also proposed the need to consider a broader range of barriers to adherence including financial, practical, informational and emotional. It arrived at an estimate that there would be an overall 25% reduction in within-household transmission if all measures outlined in the paper were followed, associated with a 10-15% lower prevalence after three weeks.

3.3. **SPI-B Policing and Security subgroup Behavioural Aspects on International Importation.**[26] This report considered questions on behavioural aspects of cross-border travel including testing pre-travel, counterfeit certificates, post-travel quarantine behaviours, including compliance and hiding symptoms. Also, issues including the behaviour of the traveller and problems related to different types of transport and longer-term issues such as international travel protocols. It noted a lack of data concerning specific types of travellers in and out of the UK and reasons for travelling during the pandemic. Key points included highlighting that the UK had no control over the quality of test certificates used by other countries, and presence of circulation of fraudulent certificates. It noted that removing exemptions to current testing arrangements such as for hauliers would be unlikely to lower infection. Layering of pre-travel measures (e.g., PCR tests within 72 hours, etc.) would make it more difficult to evade measures. Testing for inbound travellers could be increased by providing certification on arrival and larger commercial vessels

[25] https://www.gov.uk/government/publications/emgspi-bspi-m-reducing-within-and-between-household-transmission-in-light-of-new-variant-sars-cov-2-14-january-2021

[26] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012413/S1048_SPI-B_-_Behavioural_aspects_of_international_importation.pdf

arriving in the UK could be tested before being allowed to embark, with an argument to reconsider the exemption of air-crew from testing. Given the uncertainty over certificates, the success of infection control would likely be more reliant on quarantine. But self-regulated was more feasible and institutionalised quarantine would only be viable as a short-term option. It noted that self-regulated quarantine poses problems of adherence, also in households with multiple members. Adherence could be enhanced with more frequent spot checks. It concluded with the need for an international framework for testing, screening, and certification to assist economic recovery and movement.

3.4. **Barriers and enablers to vaccine uptake in seriously mentally ill (SMI).**[27] The aim of this report was to identify from existing literature the opportunities to improve vaccination uptake in those with severe mental illness (SMI). It highlighted pre-pandemic inequalities in healthcare for those with SMI and need for rapid involvement of people with SMI in vaccination design to determine their preferences for location, setting, timing and type of support required. It noted that modifications to the programme could improve uptake. Co-produced communication interventions aimed at population and carers could be more targeted and raise vaccination rates in this group. It focussed on the opportunity for mental health professionals to proactively inform their patients, and delivery of vaccinations in this context as well as primary care, mobile units. It also argued for the involvement of support networks of a person with a SMI, and suggested that uptake would differ by key characteristics (age, co-morbid physical conditions, ethnicity), and that monitoring of uptake at the local and national level of this group was essential.

3.5. **Risk factors associated with places of enduring prevalence and potential approaches to monitor changes in this local prevalence**,[28] 22 April 2021, Paper prepared by various groups (SPI-M, SPI-B, EMG, Health and Safety Executive, PHE) for consideration at SAGE 87 on 22 April 2021. This paper summarised the evidence regarding: (1) risk factors linked to the enduring

[27] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974605/SPI-B_-_Severe_mental_illness_and_COVID-19_vaccination.pdf
[28] https://www.gov.uk/government/publications/cross-organisation-study-risk-factors-associated-with-places-of-enduring-prevalence-and-potential-approaches-to-monitor-changes-in-this-local-prevale

increased SARS-CoV-2 prevalence observed in some areas of England; and, (2) the consideration of novel approaches which might be used to: i) identify the emergence of new areas at risk of enduring prevalence; ii) identify the rate of changes in prevalence (positive or negative) in existing area of enduring prevalence for both existing and new variants of the virus; iii) assess how effective interventions may be developed. It found that the mix of factors related to enduring prevalence are complex and inconsistent across different geographical areas and difficult to disentangle. It suggested that statistical analysis and qualitative research at a more granular level could help to provide insights and support targeted interventions, co-designed with local areas. It highlighted the important of workplace interventions and support for local public health team interventions. It also noted the disconnect between local experiences and the communication of changes to advice at the national level and need for control measures in local areas of enduring prevalence. It argued that insufficient financial support and precarious employment were key barriers to self-isolation and getting a test when unwell. Longer term approaches to understand these issues were multidisciplinary data gathering and analysis of community resilience structures between area that share similar characteristics but, have high and low case rates.

In the following reports, I was the main author and/or leader of reports:

3.6. **SPI-B, SPI-M and EMG: Considerations for potential impact of Plan B measures**,[29] 14 October 2021, It was considered at SAGE 96 on 14 October 2021. This paper considered the potential impact of several measures described by government as Plan B, including reintroduction of working from home guidance, legally mandating face coverings in some settings, and vaccine-only certification in some limited settings. It argued that the Plan B interventions were likely to be the most effective in combination, are not additive and may have complementary interactions. The largest impact on transmission was argued to be the working from home guidance, for those who could, but attention should be placed on associated harms and unequal impacts. It noted

[29] https://www.gov.uk/government/publications/spi-b-spi-m-and-emg-considerations-for-potential-impact-of-plan-b-measures-13-october-2021/spi-b-spi-m-and-emg-considerations-for-potential-impact-of-plan-b-measures-13-october-2021

that the version of certification proposed in Plan B differed markedly from versions implemented in most other countries due to the fact that it was vaccine only and included only a relatively narrow range of settings in which it would apply. A primary empirical analysis found that vaccine-only certification as proposed would have a very small direct impact on transmission but the potential to improve vaccine uptake in certain groups, particularly young adults, but potential harms and inequalities and additional recommendations (e.g., applicable settings, time limitation) also needed to be considered. It reiterated the view that face coverings were likely to reduce transmission through all routes by partially reducing emission of and/or exposure to the full range of aerosol and droplets that carry the virus. It also noted the importance of high-quality face covering materials and the need to wear them correctly. Whether Plan B would be required would depend on vaccine and booster uptake and suggested that other measures could be considered in addition include testing in the workplace and community and ensuring self-isolation for those who test positive.

3.7. **SPI-B: Behavioural considerations for vaccine uptake in Phase 2 and beyond**[30] 09 March 2021. This reported provided behaviourally-informed evidence to ensure equitable access and effective delivery for Phase 2 vaccine uptake. Given the scant literature on COVID-19 vaccinations and behaviour, we undertook new primary analyses to: (1) describe vaccine uptake by disaggregated stratified groups, (2) understand recent motivations of vaccine hesitancy by more stratified groups and nuanced understanding, (3) understand adherence to non-pharmaceutical interventions (NPIs) in the general population, by those who have been vaccinated and by differences by first or second dose, (4) understand the relationship of adherence to infections; and, (5) advise on how this evidence may guide public messaging and operational delivery. To increase transparency, details of all analyses were included (Appendices 1-2) and the quality of the evidence and strength of recommendations was scored according to the GRADE system (Appendix 3). The report found substantial variation in vaccine uptake until the end of

[30] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984351/S1162_SPI-B_-_Behavioural_Considerations_for_Vaccine_Uptake_in_Phase_2.pdf

February 2021 by key sociodemographic factors, with low uptake in certain economic and ethnic groups. Using a large sample of ONS data, it showed that vaccine hesitancy was the highest amongst non-Asian BAME (particularly Black) individuals. But also, that individuals who were the most compliant to following NPIs were more likely to support mass testing and lockdowns, with the vaccine hesitant also significantly less likely to follow or support NPIs. Those less likely or able to comply with NPIs were younger (16-29 years), employed, from larger households, noting a striking reduction in following NPIs from 10 to 24 February 2021. We found little evidence of changes in following NPIs after vaccination, but nuances by the type of NPI and group. Those who were vaccinated modestly increased their mobility range. Modelling positive tests (N=409,009) nested in households (N=72,866) for individuals aged 18-64 from May 2020 to February 2021, we found that the level of autonomy in the ability to comply with COVID-19 behavioural measures (e.g., ability to maintain physical distancing at work, work at home, avoid public transport) did not alone predict testing positive for COVID-19. Rather, autonomy to follow NPIs had a large and statistically significant effect on positive infections only when people did not wear a face covering or mask, suggesting that face coverings could mitigate the unequal effects of exposure to COVID-19. On the basis of this report, we proposed: (1) a more data-driven approach using transparent modelling of timely and nuanced disaggregated data, (2) move beyond broad categories of age and ethnicity to nuanced sub-groups that properly control for confounders and recognise intersectionality of stratified traits that result in cumulative disadvantage in order to be more effective and avoid stigmatising groups, (3) focus on the timeline over which immunity develops, particularly after the first dose, (4) continue messaging about positive effects of behavioural interventions such as face coverings, high vaccine uptake, vaccine hesitancy, and return to longer goals and avoid blame or enforcement, (5) breakdown practical operational barriers to match the everyday lived experiences of individuals (large households, need to take public transportation, difficulties of maintaining physical proximity at certain workplaces).

3.8. **SAGE SPI-B: Behavioural considerations for maintaining or reintroducing behavioural interventions and introducing new measures in Autumn 2021**[31] 07 October 2021. This paper considered the potential reintroduction of restrictions in Autumn and Winter 2021, which was in a different context than previous restrictions (e.g., vaccinations, Delta variant, end of furlough scheme, areas of enduring transmission). 12 behavioural interventions were examined across 30 countries, showing no decline in effectiveness (cases, hospitalisations, death) of interventions when they were introduced for a second or third time. Analyses showed a drop in all self-reported behavioural NPIs, particularly wearing a face covering, avoiding contact and physical distancing. We reiterated that advice needs to have ongoing capability, opportunity, and motivation for the group to engage in sustained behaviour. The report examined evidence for face coverings, vaccine certification, advice to work from home (WFH), communicating risks to the public and test and trace adherence to self-isolation and staying at home when at risk. For face coverings, it noted the large body of growing evidence of effectiveness in reducing transmission and noted public confusion regarding effectiveness and required settings and who is responsible for enforcement. It provided advice for clearer face covering regulations such as clarifying the settings (and explicit definition of them), mandatory versus voluntary, who is responsible for enforcement, and implications for lack of adherence. It highlighted that communications of reintroduction should focus on the above but also highlight that there is updated and clear scientific evidence on their effectiveness, how and why they work and correct usage. It also noted potential resistance if made mandatory by anti-authoritarian forces. The work on vaccine certification outlined the criteria that would need to be considered before introduction, including that: it meets benchmarks for immunity; accommodates differences in efficacy between vaccines and emerging variants; has clearly defined uses; is internationally standardised; is based on a platform of interoperable technologies; keeps personal data secure; meets legal and ethical (equity and non-discrimination) standards; is portable and affordable for individuals, businesses and governments; and that conditions of use are understood and accepted by

[31] https://www.gov.uk/government/publications/spi-b-behavioural-considerations-for-maintaining-or-reintroducing-behavioural-interventions-and-introducing-new-measures-in-autumn-2021-14-october-2

certificate holders. A primary analysis examined the impact of introducing COVID certification on vaccine uptake.[32] Mirroring an RCT, the model compared six countries (Denmark, Israel, Italy, France, Germany, Switzerland) that introduced certification (May-August 2021), with 20 control countries. Estimates provided a counterfactual trend of what would have happened in virtually identical circumstances if certificates were not introduced on daily COVID-19 vaccine dosage uptake. This analysis of the international experience of certification suggested that if vaccine certification was introduced and tied to particular settings, it could increase vaccine uptake in certain groups. However, given already higher levels of uptake in older age groups (in comparison to France, Italy when certificates were introduced), the absolute impact would be smaller, tied more to <20s. WFH was argued as an effective measure to reduce infection, but measures and communications should recognise the ability to WFH exists for half of employees and varies according to occupation, socioeconomic status, demographic traits and regional variations in industry. Given that many employees cannot WFH and lack autonomy to follow some behavioural guidelines, employers should provide clear guidance and encourage measures to ensure safety for those that remain in close proximity to workers, customers or patients (e.g., ventilation, distancing, face coverings). It argued that employers should develop measures to cope with the potential of longer-term WFH implications of mental and physical health, work-life balance, and security and productivity concerns. Communicating risks to the public focussed on the importance of trust, which was linked to the linked to the credibility of the communicator, with independent health professionals and experts garnering the highest levels. Trust increases when the public feels they are trusted to follow the guidance and not perceived as targeted or blamed. Here there was also the suggestion of local communication campaigns, clear communication and rationale and in channels that are accessed by different groups. The work on test and trace and adherence to self-isolation found that increase in asymptomatic testing could be improved and explored barriers (e.g., needing a collect code) and incentives. It also highlighted the confusion that

[32] This analysis was published in December 2021 in the peer review journal The Lancet Public Health, https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(21)00273-5/fulltext

may occur with cold and flu symptoms and importance of communicating why it is important to stay at home when ill.

In context of SAGE sub-group ethnicity.

Invited to comment on:

3.9. **Guidance on COVID-19: mitigation of risks in occupational settings with a focus on ethnic minority groups.**[33] This was guidance stemming from a review of disparities of risk and outcomes of coronavirus carried out by Public Health England (PHE), which found an association of ethnicity and likelihood of testing positive and dying of COVID-19. The review did not account for the effect of occupation, comorbidities or obesity. This statement recommended that all individuals should have the same approach to risk management in the workplace and recommended the reinforcement and implementation of existing workplace guidance and legislation with additional support to SMEs and sole traders, where ethnic minority groups were overrepresented. Employers as part of the statutory duties should ensure adequate risk assessment and strategies.

3.10. **Consensus statement from Public Health England, the Health and Safety Executive and the Faculty of Occupational Medicine**.[34] This consensus statement was about the best approach to reduce occupational risk for workers including those of ethnic minority groups. The statement recommended implementing and reinforcing existing HSE, government and specific industry guidance, workplace procedures and systems which help mitigate the risk of exposure to coronavirus (COVID-19) for all workers. The statement added that actions targeted at the entire workforce, rather than solely at ethnic minority groups may help reduce the risk of stigmatisation and opportunity inequalities at work. Some staff may be at greater risk of infection or more severe illness from COVID-19 due to factors such as age, sex, deprivation, obesity or diabetes and the statement recommends that individual discussions, where appropriate, should take place as part of a wider workplace risk management strategy.

[33] https://www.gov.uk/government/publications/covid-19-mitigation-of-risks-in-occupational-settings-with-a-focus-on-ethnic-minority-groups

[34] https://www.gov.uk/government/publications/covid-19-mitigation-of-risks-in-occupational-settings-with-a-focus-on-ethnic-minority-groups

3.11. **Housing, household transmission and ethnicity, 26 November 2020,[35] presented at SAGE 70.** The report built on the knowledge that households are an important contributor to transmission and analysed recent data from five population studies, ONS, REACT-Imperial, Bioabnk, QResearch and OpenSAFELY to examine the extent to which household composition (number of people and their ages) might explain how some minority ethnic groups in the UK were disproportionately affected by COVID. All studies found that household composition were key factors in terms of COVID-19 infection and mortality, even when controlling for deprivation and other factors, and primarily larger occupancy and multigenerational households. The pathways to explain these findings were less understood but likely linked to poorer housing conditions, long-term economic constraints, including differential access to social security, and job roles, which in turn were associated with increased transmission and poorer health outcomes and/or increased co-residence to pool limited resources. Besides housing conditions and care arrangements, other risks of household transmission, known to be important are: occupations of household members; familial and social connections outside the house; sharing of common spaces and facilities; the presence of comorbidities and vulnerable individuals; domestic responsibilities besides care; and intimate social relationships.

I wrote some sections and commented on:

3.12. **Factors influencing COVID-19 vaccine uptake among minority ethnic groups, December 2020.[36]** This paper examined the barriers to vaccine uptake in ethnic minority groups. Using primary care data from QResearch, it found that Black African and Black Caribbean groups were less likely to be vaccinated. Using UKHLS it also found higher levels of hesitancy amongst Black and Pakistani/Bangladeshi groups. Barriers included perception of risk, low confidence in the vaccine, inconvenience, distrust, lack of communication from trusted providers and community members. To overcome these,

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[35] https://www.gov.uk/government/publications/housing-household-transmission-and-ethnicity-26-november-2020

[36] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/952716/s0979-factors-influencing-vaccine-uptake-minority-ethnic-groups.pdf

suggestions were made for multilingual, non-stigmatising communications from trusted sources and to address religious and cultural concerns (such as whether the vaccine is compliant with the dietary practices of major faiths, or with their ethical positions around medical interventions). Community engagement was positioned as central in addition to evaluation of interventions.

5: Summary of articles, interviews and/or evidence:

3.1. See Appendix B (Excel spreadsheet) of media appearances produced by the Cision media system (tab 1) and supplemented with additional radio and TV appearances that did not appear to be picked up by the Cision system, taken from my personal agenda (tab 2).

3.2. It should be noted that since I was also on the Royal Society SET-C committee, and published multiple parallel peer-reviewed articles on COVID-19 as a scientist, many of these appearances also related to work within that committee or produced outside of SAGE.

3.3. As instructed, I always noted that I was speaking in a personal capacity. This was mostly respected by the media.

3.4. The appearances were largely about face coverings, and behavioural interventions, working from home, social distancing, changes in restrictions, confusion in relation to international travel, vaccine confidence and hesitancy, and later a focus on vaccine passports and certificates. There was also attention to work I wrote outside SAGE in articles and as part of SET-C such as sources of information and misinformation, vaccine certificates, complacency, and in 2020, our interactive dashboard and publication to isolate hospital deserts and which areas might overwhelm the NHS due to demographic (age, ethnicity, deprivation) composition of the population.[37]

3.5. I also wrote some commentaries:

- Covid passports could work – but coercion is doomed to fail, *The Guardian*, 02 Aug 2021.

[37] https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-020-01646-2

- Why suggesting mandatory Covid vaccinations is an ethical minefield, *The Guardian*, 22 Jun 2021.
- Head to Head: Would Covid passports be damaging to public health? *The Guardian*, 07 Apr 2021.
- People struggle to assess risk, especially in a pandemic, *Financial Times*, 9 Apr 2021.
- Vaccine passports are a technical and ethical minefield, *Financial Times*, 26 Feb 2021.
- Trust and transparency vital to vaccine uptake, *EasternEye*, 3 Dec 2020
- We must prevent a vaccine infodemic from fuelling the Covid pandemic, *The Guardian*, 11 Nov 2020

3.6. Additional events that I attended to provide advice were:

- Ask the Experts. Vaccine Confidence Briefing Event for Parliamentarians, 19 January 2021
- COVID-19 Cabinet Office Vaccines Task Force Teach-In with SAGE Ethnicity Sub-group, 20 January 2021
- Expert witness, Public Administration and Constitutional Affairs Committee, Subject COVID-19 Vaccine Certification,[38] 24 May 2021
- Teach-In: Social and behavioural impacts of lifting remaining restrictions, UKHSA/Taskforce/DAs, presented key evidence and advice from the SPI-B paper 'Social and behavioural impacts for lifting remaining restrictions',[39] discussed at SAGE and informed the Government's new 'Living with Covid' strategy, published on February 21st.
- SAGE/SPI-B input into JCVI Phase 2 prioritisation, produced document for this and attended meeting (see report in Annex 5).[40]

[38] https://parliamentlive.tv/event/index/91060aaa-be7f-4b56-a3b6-34f223487876
[39] https://www.gov.uk/government/publications/spi-b-social-and-behavioural-impacts-for-lifting-remaining-restrictions-10-february-2022
[40] This report was in the end not supported by SPI-B (email 15 Feb 2021 with reason given that the group did not have 'epi' expertise to review it and it would be easier to send it in my own name as author).

- Foreign, Commonwealth and Development Office, April 14, 2021, informal summary of SPI-B's headlines on: 1. Adherence (e.g., in the current context compared to March last year) 2. Vaccine confidence, uptake and strategies 3. Certification, uses and challenges.
- Cabinet Office Permanent Secretary's Briefing, arranged by the British Academy, discussing BA work on the Effects of COVID-19 on health and well-being,[41] February 26, 2021
- Additional meetings took place, but these were arranged and/or in my role as Royal Society SET-C member, representative from the British Academy.

6: 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.

The composition of the groups and/or their diversity of expertise

6.1. More diversity in topics of empirical modelling and modelling outside of one concentrated group. Modelling appeared to be within one silo of SPI-M, with, in my experience, an implicit assumption that modelling did not/should not occur in other subgroups like SPI-B. But this concentration on modelling within SPI-M, combined with the pre-established early central aims that they were given (infections, deaths, hospitalisations, protecting health care), meant that only specific topics were empirically modelled and forecasted. By virtue of this choice, it excluded alternative ways of modelling and inclusion of non-epidemiological topics and outcomes in coping with the pandemic such as behavioural, social, and also crucially, economic indicators. Although the modelling conducted by SPI-M was essential and asked core questions, and had strong expertise, there was a gap in empirical work in other key economic, behavioural and societal indicators to be examined beyond infections, hospitalisations, deaths and protecting the health care system.

[41] https://www.thebritishacademy.ac.uk/documents/3219/COVID-decade-health-inequality-implications-LCDS-Oxford-Nov-2020.pdf

6.2. The focus on epidemiological and health system outcomes virtually completely ignored the economic, social, mental health, labour market, educational consequences of the pandemic. An obvious gap that did not appear to be filled by any of the groups is the lack of attention to economic modelling and forecasts and their relationship to the introduction of NPIs including furlough, work from home (WFM), closing of schools, restricting events and travel.

6.3. As elaborated upon elsewhere in this response, there at times appeared to be a presupposition that many 'social' or 'economic' aspects were somehow 'soft' and evaded modelling or evaluation. Yet many models exist outside of epidemiology and biostatistics to understand, model, simulate and forecast behaviour. For instance, we used social network models and simulations to evaluate which types of interactions (i.e., social bubbles) would be the most effective (in workplaces, care homes, schools),[42] while others quantified the inequality in learning loss from closing schools by using pre- and post- test scores.[43]

6.4. The fine-grained demographic composition and geographical (local) context of the population also appeared to be ignored. It was clear that it was possible to predict early on that particular groups and regions would be disproportionately hit simply looking at the concentration of older ages,[44] co-morbidities,[45] and at the very local level, the intersection of large households, intergenerational households, deprivation, age and ethnicity composition, co-morbidities, certain industries and proximity to and level of care.[46] This stratification of understanding and modelling inequalities in social, economic and mortality outcomes is well established in demography, economics and sociology, which in most cases appeared to be excluded from the modelling and questions being asked.

6.5. Diversity and lack of/resistance to empirical modelling within SPI-B. In my personal opinion, more heterogeneity in disciplinary expertise and transdisciplinary expertise would have been useful for SPI-B. I joined SPI-B in

[42] https://www.nature.com/articles/s41562-020-0898-6
[43] https://www.pnas.org/doi/10.1073/pnas.2022376118
[44] https://www.pnas.org/doi/10.1073/pnas.2004911117
[45] https://www.pnas.org/doi/full/10.1073/pnas.2008760117
[46] https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-020-01646-2

January 2021, a year after the group was formed. I entered as an outsider with expertise in demography, empirical sociology, genetics and statistics into what – in my perception – seemed to be a group who knew each other well and had developed a unified stance on many matters. I was initially struck by the concentration and overrepresentation of experts from two institutions (UCL and KCL, who each had 5 members), which may have contributed to my feeling that the group already knew each other well. The majority of experts and those who exercised the most voice, were concentrated into the area of social psychology. These were well-known established experts in the field such as Susan Michie, Theresa Marteau, Lucy Yardley, Stephen Reicher, James Rubin and others, who had considerable knowledge in this area and it was logical to have a strong representation of social psychologists on an insights group on behaviour. However, it was striking that broader disciplines and approaches were not included such as behavioural economists or those who considered behaviour in context and focussed on inequalities and stratification such as demography, geography, economics and sociology. There were some members listed in the area of infectious disease modelling, epidemiology and informatics, but I do not remember active participation of these members in the period I was on this group.

6.6. For example, broader social science-based simulations and understanding could model the higher risks of repeated contact within dissimilar groups on increasing infections and deaths. This could have resulted in more concrete directives to maintain the same workers within the same shifts and settings (e.g., care homes), or groupings of bubbles and pods and schools. We published a pre-print of this model in early Spring 2020, which appeared in a peer reviewed journal in June 2020. These kind of evidence-based more targeted approaches could have averted some of the high numbers care home deaths in England and Wales care homes during the first wave, which was around 27,000.[47]

[47] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/deathsinvolvingcovid19inthecaresectorenglandandwales/deathsregisteredbetweenweekending20march2020andweekending2april2021

6.7. Coming from the outside, joining an already formed group made taking a different angle and more empirical approach challenging. For several months earlier I was also a member of the Ethnicity sub-group, which was newly established and where members conducted their own statistical modelling and accessed various types of new data to answer key questions. I had assumed this would also be the case in SPI-B. But my initial experience was that they largely did literature reviews of existing evidence, with some empirical papers included outside of the main papers.

6.8. Given that many of the questions were novel and it was my perception that many could not be answered only with literature reviews, in the reports that led, I added more primary analyses and modelling. I was told (verbally and in some emails) that SPI-B didn't do modelling and that was for SPI-M, but I argued that I felt that SPI-M did not appear to have the mandate to do any serious modelling of behaviour, impact of NPIs, etc. and this was missing. Below I provide an example in February and March 2021, which in both cases SPI-B did not want it to be part of/endorsed by them, which in both cases was intervened upon by the SAGE SPI-B GO Science office.

6.9. Any primary modelling work did not appear to be welcomed due to expertise and time constaints. For example, I was asked to represent SAGE/SPI-B and provide input by writing a paper into the JCVI Phase 2 prioritisation. We produced a document for this with primary data analysis (see report in Appendix A- Priorities for consideration of vaccination by occupation: An evaluation of mortality, infection and proximity to others) and I attended the meeting and presented it. This report was initially not supported by SPI-B (email 15 Feb 2021, from James Rubin): "Just in terms of process, are SPI-B the right group to sign a paper like that off? I am not sure how well constituted we are in terms of epi to give it a rigorous review. Is it easier (and indeed quicker) to view this as a paper from you as an author, Melinda?"

6.10. I responded 15 February 2021: "I am open as to whether it comes from me as an author with my team (which is fine) or part of SPI-B. In the ethnicity sub-group, we supported a few papers that had some similar analyses like this, but the group composition is different. The analyses are quite factual and straightforward."

6.11. Rubin, 15 February 2021 responded: "I think, as SPI-B didn't 'commission' it and given the issue around our expertise, it is probably better to view it as a paper from your team tbh Melinda. Which means you get to actually publish it, rather than waiting for approvals etc!"

6.12. Marie-Louise Taylor from the SPI-B SAGE GO-Science responded (15 February 2021): "At the risk of complicating things, I have spoken to JCVI Secretariat about this and they are keen to table this as a SPI-B paper if possible tomorrow. Apologies this adds an extra layer of review before submitting to JCVI but I'm happy to line up a couple of people who might be able to give some review later today; GJ and Patricia have volunteered to be involved and perhaps Nicola Fear might be able to help?"

6.13. Lucy Yardley then replied "Fine – I can too of course." And James Rubin also agreed saying: "Ok – we just need to be clear in it somewhere why it is a SPI-B paper. I am taking this PM off…I suspect my stats are too rusty to be of use in any case!"

6.14. A second time this occurred is with another SPI-B paper I led on Behavioural Considerations for Vaccine Uptake,[48] which had new analyses and empirical work, and appeared to be resisted by some within the SPI-B group. See email conversation below. I did not agree that SPI-B should only produce commentaries and narrative reviews and pushed for original novel analyses of behaviour and more transparency about the quality (e.g., use of detailed analyses, data Appendices, GRADE criteria[49]).

6.15. I was initially told the paper we worked on, which was primarily questions from the DHSC, would not be supported as a SPI-B paper and was first asked to 'strip out' the SPI-B references to previous reports. There was also a discussion about excluding detailed appendices, but I noted that I wanted to keep them in for transparency, particularly a description of the data and evaluating the quality and strength of data according to GRADE recommendations. This approach did not appear to be standard in the group and although there was empathy, there appeared to be a norm of excluding empirical papers developed by one

[48] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984351/S1162_SPI-B_-_Behavioural_Considerations_for_Vaccine_Uptake_in_Phase_2.pdf
[49] https://www.bmj.com/content/336/7650/924

lead or group and having them attributed to the authors only. My perception and several months experience on the subgroup, however, was that narrative reviews had been largely led and written by one or several members in a rapid manner anyhow and then positioned as SPI-B papers with less scrutiny than my work.

6.16. There was discussion about whether primary empirical modelling should be included in a SPI-B paper and the scientific members of the coordinating group seemed reticent to support the paper. On 08 March 2021, when I submitted the draft, I noted: "There was no evidence for the questions DHSC asked late last Tuesday, but the data was there so we produced it…..In the ethnicity sub-group and other sub-groups we did primary analyses but this might not be what SPI-B has traditionally done, but there really wasn't another way around it……I find that the modelling until now has been very epidemiological and health based and often ignores behavioural, sociodemographic aspects. I didn't want to give you a heart attack, so I include separately a very detailed Appendix with all methods, results and certainty of recommendations in relation to GRADE criteria, but unsure whether you want that to be submitted as well. I see that SPI-M and some of the other groups have appendices but otherwise I have no problem setting up a link (on GitHub of whatever) where people can download the Appendices."

6.17. I then received an email on 09 March 2021 from Lucy Yardely prior to our meeting where she stated (in addition to substantive comments): "I thought it would be useful to clarify ahead of the meeting that the way to present this is not a SPI-B or SPI-approved paper as such, it will be an independent paper by your group that has been discussed with some members of SPI-B (this is the precedent for other data-based papers similar to yours – SPI-B papers are consensus review papers produced iteratively by a group of SPI-B members)."

6.18. I responded 09 March 2021: "Thank you for the clarification and comments. I am fine with whatever approach needs to be taken and don't know the precedents. I was answering the DHSC commission on behalf of SPI-B and misunderstood that it was to be personal research and not a SPI-B paper. I think the problem is that I didn't realise that SPI-B did exclusively reviews only as the ethnicity and other subgroups also include primary research when review

evidence isn't available. But no worries. We produced some great stuff and I will be able to put it in a different format and find another home/sponsor today."

6.19. This was followed by an email to Lucy Yardley, Brooke Roger and James Rubin from NR at SAGE-SPI-B GO Science office (09 March 2021): "Just picking up your email chain on this as it has prompted a discussion in the team about whether Melinda's paper should be considered as a SPI-B paper or not. I know that you mentioned this in emails between you last week, and you recognised the importance of doing rapid, high quality research to meet an urgent policy need (although generally SPI-B outputs are not primary research). We think this is a bit different to the paper you (James and Lucy) wrote for the "Daily Contact Testing" as Melinda has responded on behalf of SPI-B to a direct commission from DHSC which has been through the usual SAGE commissioning process. I've checked in with the DHSC commissioners and they would definitely value Melinda's paper being SPI-B endorsed so it would be good to do this through the SPI-B CG today if we can. And although Melinda has been the sole SPI-B author on this paper, there is precedent for previous SPI-B papers being written by a single author before being reviewed and tweaked by the group. Grateful if you can consider this and also good to know what your main concerns are around this – sole authorship, quality assurance, the primary research or something else?"

6.20. On 09 March 2021 early evening James Rubin responded: "I don't think we can say this is a "SPI-B paper". There's a couple of things behind that. First, we'd have to strip out the authorship line – SPI-B papers are group authored. But you have a lot of colleagues on it who aren't in SPI-B and they presumably want and deserve to be named. I don't think we can set a precedent there. Second, it's an impressively broad paper with a tonne of fascinating analysis in it. I am genuinely in awe! But I also have to admit I haven't been able to read it fully given the timescale and I suspect that's true for many on the co-ordinating group. I got the impression in the meeting just now that we only managed to scratch the surface on it. We'd really need to give people more time to fully consider it and a chance to input and iterate, and I don't think we have time in this instance. SPI-M generally take authored papers from members of the group and then write a consensus summary of them, which SPI-B has also done

previously (e.g. my work on HCW adherence) - I think that's the best and quickest approach here. Present this as the work of Mills et al., with an option to produce a SPI-B summary in slower time if required."

6.21. In an additional email exchange with James Rubin, I expressed my frustration, since this was the second time that this had occurred with papers I had been asked to lead on and I noted (10 March 2021) that: "Just to note I find the process confusing and am not happy with how it is [has] gone and am attempting to remain professional… Perhaps later we can discuss why I/this work was treated differently to the last-minute reports I have seen that were solely written from Brooke, Mark and others at the last minute and discussed once in the group. I am failing to see why I am getting such 'special' treatment."

6.22. James Rubin responded 10 March 2021 "The issue boiled down to whether a set of complex analyses should be rightly badged as coming from "us" (which is what a SPI-B paper should be) or whether they should be from a named research team, with SPI-B then producing a commentary on them. To reassure you, it isn't special treatment – I have had my own papers go the same way (and been pissed off about it too tbh). In a way, the confusion has been that you have produced an excellent report that seamlessly weaved together the analysis and the commentary. I think we (I) haven't communicated with you at all well about this, and would like to apologise. Can I give you a call? I think we also need to think what our policy is on this for the future."

6.23. I had a call with GO Science at this point noting that I wanted to maintain a report that produced evidence as opposed to a commentary. It is unclear to me what occurred behind the scenes after that time, but the decision to include it as a SPI-B report appeared to then occur and it was allowed to appear as a SPI-B paper and I was asked to write that the work was done by the University of Oxford on behalf of SPI-B.

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

6.24. Questions appeared to come to groups using a particular form from various sources in government, including particular government departments or the Cabinet Office. Several issues arose with this. First, it was sometimes unclear to understand the question itself that was being asked, the motivations behind

it and the aim that would be achieved by providing evidence for the question. The material was often provided in a short, written document, which left the group to decipher and understand. Direct communications would have been helpful to underpin the nuances and motivation of the question.

6.25. Second, at times it felt that the question that was being asked may in some instances (but not all) have not always been the most relevant question at the time. When I felt this was the case, I raised it during discussions and included the additional question or information in the evidence produced where possible. In many cases, the additional angle and information was accepted and included. In other cases it was not included. For example, I brought empirical evidence of analyses we had conducted of a higher concentration of deaths in particular occupations, showing that they had a higher concentration of ethnic minorities and higher levels of physical proximity in occupations. For this reason, it could be important to consider prioritising these groups instead of age-graded prioritisation (see report in Appendix A Priorities for consideration of vaccination by occupation: An evaluation of mortality, infection and proximity to others).

6.26. It was also hard to get traction on the inequality of NPIs and a focus on the fact that a large group of people in society simply were unable to comply even if they wanted to. For instance, the intervention of 'work from home' did not fit a large proportion of workers. To make this point, we added an additional analysis in the advice where we showed the inequalities of NPIs and that particular groups such as women in large households, those who had to take public transport or were in close proximity to others due to their occupation simply were unable to comply to NPIs and had higher infections.[50]

6.27. Third, there appeared to be fewer proactive initiatives to ask new questions and provide evidence, but rather functioning in a more reactive manner to answer questions that were asked. There was an attempt to rectify this by sending around a list of big-questions that we thought were important to ask. Acting more reactively was in contrast to other committees where I was a member, such as the Royal Society's SET-C committee, who interacted with GO Science

[50] https://bmjopen.bmj.com/content/11/10/e054200

and others, but independently devised it's own questions and was able to horizon scan and produce scientific evidence ahead the curve. For instance, instead of asking 'do COVID-19 certificates work', in the RS report we asked in an interdisciplinary manner what 12 criteria would need to be met before they could even be introduced (e.g., benchmarks of immunity, interoperability across devices, verifiable, ethics and discrimination).[51]

The resources and support that were available

6.28. The GO-Science team were highly skilled in communicating the issues, had impressively strong organisation and timing and helped with the administrative and formatting aspects of producing the advice. As noted in response to a previous question, they were also supportive when there appeared to be disagreement within the groups. Some resources such as access to existing work or data was also provided. When it was difficult to obtain data that was required, the GO Science team were highly useful in pushing to unlock access.

6.29. In producing the actual evidence and documents, however, it was at least in my case, down to doing the work myself and where possible, involving some members in my research group to meet the very tight deadlines. Given that evidence was required often within extremely short time frames, this meant putting aside existing research and work duties and other professional and personal commitments. Many of us worked very long hours of evenings and weekends over key holidays and over a very long period of time to produce material. Given that it was unpaid work outside of existing work duties, it introduced a strain.

6.30. I would not advise, however, that this work be paid, since many experts were already working in this area it aligns with our research. The absence of payment also affords independence and removes any perceived conflict of interest.

6.31. A resource that would have been helpful is an early mapping of the data sources available and portal or way for approved researchers to access this data instead of protracted emails and meetings.

[51] https://royalsociety.org/-/media/policy/projects/set-c/set-c-vaccine-passports.pdf and https://www.science.org/doi/10.1126/science.abi5245

The advice given and/or recommendations made

6.32. When presenting the evidence, we often needed to provide low, medium and high confidence statements. It would have been more transparent if we had applied a more structured grading such as using the GRADE or other types of criteria and used a more systematic and transparent manner in engaging in literature and evidence reviews.

6.33. There was also considerable tension in needing to separate neutral scientific advice from political decision-making. There was a tension and gap between the scientific evidence that was provided with the actual measures or actions taken by the government. Our work provided the past evidence and in some cases primary analyses to underpin advice and recommendations. Most experts and reports laid out the science on that topic but did not make a judgement or stretch to policy recommendations. In some cases, there was a push to translate the evidence to more explicit and concrete policy recommendations. The scientific evidence was presented but then it necessarily had to be interpreted by the government who were operating within a more complex and broader political and economic ecosystem. For that reason, recommendations that sometimes would have seemed to be important to introduce were not adopted. This distinction between scientific advice and political governance and decision-making caused some tension and confusion and in the future, would be helpful to differentiate. In some cases, SAGE experts were attributed to pushing for a particular outcome or policy instead of presenting the evidence. This was often not the case, but clarity in this respect would avoid these types of false attributions.

The extent to which the groups worked effectively together

6.34. To the best of my knowledge, most sub-groups had cross-representation. I was on the sub-groups of ethnicity and SPI-B and represented SPI-B on the Vaccine Science Coordination sub-group. It was not my impression, however, that at least within SPI-B, there was strong cross-representation from other groups. There was representation from relevant government bodies. As noted elsewhere in this response, more empirical overlap and diversity would have

been useful such as bringing in social, demographic, economic and behavioural aspects to supplement the biomedical and epidemiological focus.

6.35. The groups seemed amiable and worked well and effectively together but at least in my experience, perhaps too well with consensus. Regular refreshing of parts of the group could be beneficial to maintain some continuity but also rotating or refreshing to avoid group think or concentration or dominance of certain people or perspectives.

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

6.36. To empirically answer this question, one would need to do a more thorough mapping of the advice provided in SAGE meetings and reports with the policy outcomes, messaging and interventions. The causality, however, would be difficult to establish since: (i) often multiple measures were suggested and introduced at once, (ii) advice came from multiple sources beyond SAGE; (iii) recommendations do not necessarily follow a tight temporal order leading to policy since policies are often lagged in time and a reaction of existing problems (e.g., infections already going up before intervention was introduced).

7: Lessons that can be learned

7.1. **Recognition of a broader spectrum of scientific evidence as valid**. The messaging of the government was often that their decisions were "guided by the science", however the evidence that provided the most weight took a particularly narrow medical and epidemiological modelling form and was thus highly socially constructed. There was almost a fetishism with accepting only particular types of evidence-based medicine such as Randomised Control Trial (RCT), meta-analyses or mathematical modelling methodologies as valid and a caricaturing of other observational, behavioural or non-medical/epidemiological evidence as invalid.[52] For instance, in the early phases of whether face coverings for the general public should be introduced, high level public figures such as Jennie Harries repeated that the evidence of their effectiveness was inconclusive. The Deputy Chief Medical Officer alleged in March 2020 in a BBC News interview, for instance, that wearing masks was

[52] https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1003266

"not a good idea" and "that people can adversely put themselves at more risk" and that masks were harmful and actually increased transmission because the virus could become trapped in face masks. Without any clear evidence, behavioural factors such as inability to wear them properly or becoming too confident with them on, were suggested to be the main reason, but there lacked any scientific basis of these assertions.[53] In a Q&A press conference session with the Prime Minister on 28 August 2020, after face coverings were introduced, Harries continued to maintain that the evidence is "not very strong in either direction" that masks prevent transmission. As knowledge evolved and was increasingly accepted internationally it was unclear why this position of a major official was not corrected.

7.2. It also fuelled polarising and emotive debates and protests about harms of face coverings for individuals and particularly children in school that were not based on any scientific evidence. The focus was often based on an assumption that individuals would take more risks or self-contaminate themselves, which lacked any evidence. England was one of latest countries to introduce face coverings for the general public on June 15 2020 for public transport and then later on 24 July 2020 for all public places. The damage and uncertainty about them and the polarisation that this created from major voices not following the scientific evidence was unhelpful. Another example is the very late recognition and even denial that the virus was via airborne transmission, which resulted in an early emphasis on surface and hand cleansing and related measures. Following the science seemed to be cherry-picked in some cases. Whereas there were no clear RCTs formite (surface) spread, for handwashing or coughing into your elbow and these were accepted. It felt that at times SAGE advisors and the "the science" was used to deflect the responsibility away from the government. Given that scientific advice was provided and then mixed into a recipe of political and economic context, it would seem difficult to separate and trace.

[53] On the BBC News interview on 20 March 2020, the Deputy Chief Medical Officer said: "What tends to happen is people will have one mask. They won't wear it all the time, they will take it off when they get home, they will put it down on a surface they haven't cleaned…. Or they will be out and they haven't washed their hands, they will have a cup of coffee somewhere, they half hook it off, they wipe something over it….In fact, you can actually trap the virus in the mask and start breathing it in." Asked if people are putting themselves more at risk by wearing masks, Dr Harries said: "Because of these behavioural issues, people can adversely put themselves at more risk than less." https://www.expressandstar.com/news/uk-news/2020/03/12/face-masks-could-put-wearers-at-increased-risk-of-coronavirus-top-medic-warns/

7.3. Given that the pandemic was a medical and public health question, it was logical that medical science and public health methodologies were seen as the gold standard. But given that many of the interventions were not pharmaceutical, but rather behavioural or what is termed non-pharmaceutical interventions (NPIs), evaluation of many of these interventions were not amenable to RCTs or meta-analyses. In essence this meant that excluding all non-RCT or meta-analyses as 'low confidence' or lack of evidence or 'not strong in either direction', implicitly suggests that this different type of scientific evidence was invalid, lower quality and by extension, incorrect.

7.4. **Setting the broader initial agenda also needs to co-produced with scientists.** The pre-supposed aim of the government was to examine how interventions and policies would impact the transmission of the virus and the consequences for the health care system.[54] By definition this already narrowed the focus of the questions that were asked of advisors by having a definition that excluded social and economic impacts or downstream effects of policies or behavioural issues of furlough, working from home, closing schools, etc. beyond virus transmission or consequences for the NHS.

7.5. By comparison, the Royal Society SET-C I sat on was an independent body of advice, which at times appeared to receive some questions from GO Science, but given their complete independence, the group of experts sometimes responded to the questions but at other times generated different questions of what they felt were the most pressing at that time. For example, a selection of reports ranged from providing a more scientific explanation of the Reproduction Number and Growth Rate as guidance for policy formation,[55] focus on the immune response, inflammation and vascular disease,[56] long COVID,[57] herd immunity,[58] the SARS-COV2 genome. [59] But the RS also welcomed and

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[54] https://committees.parliament.uk/committee/81/health-and-social-care-committee/news/157991/coronavirus-lessons-learned-to-date-report-published/
[55] https://royalsociety.org/-/media/policy/projects/set-c/set-covid-19-R-estimates.pdf?la=en-GB&hash=FDFFC11968E5D247D8FF641930680BD6
[56] https://royalsociety.org/-/media/policy/projects/set-c/set-c-immunology.pdf?la=en-GB&hash=282CEEF80BD2DB6C3825C03905FBDD55
[57] https://royalsociety.org/-/media/policy/projects/set-c/set-c-long-covid.pdf?la=en-GB&hash=AD0672CAB24E1ECD14C2B1781A793F25
[58] https://royalsociety.org/-/media/policy/projects/set-c/set-c-herd-immunity.pdf?la=en-GB&hash=2B8F6255CF6FD83CE71FC510596FBCFB
[59] https://royalsociety.org/-/media/policy/projects/set-c/set-c-genome-analysis.pdf?la=en-GB&hash=CF1883F618E851FF269487B02AB19CF8

highlighted broader historical and social science-based reports I led on behavioural knowledge, effectiveness and communications around face coverings for the general public,[60] behaviour, ethics and misinformation during vaccine deployment,[61] and criteria that would be required to introduce COVID certification.[62]

7.6. From a comparative perspective of sitting on the Royal Society Committee and SPI-B for instance, the RS committee generated different questions but was also generally one step ahead of the questions that needed to be asked. These included herd immunity, the R number, dangers of misinformation, confusion of science around face coverings and COVID-19 certificates.

7.7. One suggestion could therefore be to use the broader academic societies such as the Royal Society, British Academy, Royal Society of Engineering, and so forth to more effectively to provide advice. These groups can, however, suffer from insularity of disciplinary approaches, so cross-representation would be required. As with the RS reports, these reports would need to still pass rigorous external peer review before publication. The inclusion of a British Academy Fellow on the RS committee was welcomed by the RS members and the combination of medical, natural and social and economic scientists worked well.

7.8. **Need for transparent evaluation of whether the evidence that was used and provided translated into policy advice.** More transparency and rigorous analyses should be conducted into which pieces of evidence the government used into its decision-making and how that was aligned with the actual decision-making. It would be helpful if the actual articles and evidence used to underpin decisions could be objectively evaluated by a broader groups of scientists in open science. For example, the Swedish Public Health Agency (Folkhälsomyndigheten) posted the 36 studies that they used as scientific evidence to support their policy not to introduce face coverings. We used four different coders of the data and found that over 72% of these studies, in fact, supported and even recommended the use of face coverings. Of the ones that

[60] https://royalsociety.org/-/media/policy/projects/set-c/set-c-facemasks.pdf?la=en-GB&hash=A22A87CB28F7D6AD9BD93BBCBFC2BB24
[61] https://royalsociety.org/-/media/policy/projects/set-c/set-c-vaccine-deployment.pdf?la=en-GB&hash=43073E5429C87FD2674201CA19280A8E
[62] https://royalsociety.org/-/media/policy/projects/set-c/set-c-vaccine-passports.pdf?la=en-GB&hash=A3319C914245F73795AB163AD15E9021

do not, the reason was insufficient evidence or research not directly related to advice.[63] We also provided the transparent details and reasoning behind our coding of these studies to promote transparency. This type of more transparent, open science approach would help with trust in science of the general public and also make decision-making more transparent.

7.9. **Lack of speed and coordination in data access and management and transparency of who is able to access data.** Timely access to particularly more fine-grained disaggregated data was a serious barrier in the ability to provide timely evidence. Access to disaggregated data (by sex, ethnicity, occupation, LSOA etc.) was lacking, particularly in early phases. Disaggregated data would have helped to build a more robust understanding of risk and co-morbidities that were often socioeconomic including sex, age, occupation, size of household, occupation, ethnicity, neighbourhood. Timely and more granular high dimensional data at a local level would have led to better informed and effective local responses. Also at one point, although ONS was extremely helpful in unlocking data, in the early phases it was not allowing the detailed release and analysis of mortality data. In many instances we knew that data existed or could be linked and created, but was not released for broader use. For instance, it was initially very difficult to get death certificates linked to more non-health (but essential) data points such as ethnicity and occupational data. It seemed that PHE and ONS had data lakes where death certificates were linked to ethnicity and deprivation data by ONS. But it wasn't easily accessible or clear for quite some time how that data could be accessed. Scotland more rapidly linked deaths, hospital admissions, primary care, ambulance data and relevant socioeconomic data. But at the same time internal researchers were subsequently posting pre-prints and eventual publications using that internal data that was not made available to researchers. In trying to obtain that data, I did note this issue of unfairness on several occasions.

7.10. **Data gaps, linkage, heterogeneity and fine-grained resolution required**. Health and mortality data needs better linkage to socioeconomic and other types of data to better understand the individual, contextual environment and

[63] https://doi.org/10.17605/OSF.IO/P3D7C - accepted and forthcoming in Scandinavian Journal of Public Health

regional and population level responses. Multiple types of data from serological to transport and retail transactions were valuable but difficult to access from government or industry. More transparent and rapid access is required. Most data were not easily findable or involved lengthy or costly approval processes. Many other countries were able to collect and release data that was privacy-preserving, GDPR compliant and secure. Particularly in England, there appeared to be a lack of interoperability of data from different government departments and bodies and no incentive or resources to release them. Resources would be required to organise different data sources into secure environments for usage by a broader user groups during an emergency.

7.11. Data that was collected or released also lacked the disaggregation such as division by sex, ethnicity, co-morbidities or fine-grained nuances at the lowest geographic level. Out of this data vacuum, several innovative solutions were devised outside of the system such as the OpenSafely data.[64]

7.12. When looking at different rates, as a demographer I found it striking that the denominator was often unknown, which suggests a serious data gap. For instance, when calculating the rates of vaccine uptake across different groups, although the numerator of how many jabs had been provided was known, there was serious imprecision on the denominator of how many people were in each group (e.g., by ethnicity, comorbidity). Calculating population composition from a Census that occurs every 10 years or weaving together multiple types of contradicting data to produce the denominator is an impediment in the UK's ability to seriously and accurately evaluate interventions, uptake disaggregated by key population groups.

7.13. **Certain topics, such as excess deaths and longer-term downstream trends were ignored.** The COVID-19 pandemic triggered a large-scale mortality shock throughout the world. The mortality impacts of the pandemic have been analysed through 'excess mortality' and life-expectancy losses in cross country comparative frameworks. Excess mortality approaches compare mortality patterns during the pandemic against an expected baseline of past trends. Within Europe and among high-income countries, the UK experienced

[64] OpenSAFELY. Secure analytics platform for NHS electronic health records 2022.: https://www.opensafely.org/

one of the most significant magnitudes of excess mortality in 2020. The impact was such that in the first 20 months of the pandemic in 2020, over 63,000 more deaths than expected occurred in England & Wales alone.[65] Across the UK, all countries experienced losses in period life expectancy of nearly one year in 2020.[66] Much of these losses were attributed to deaths classified as COVID-19 among the population aged 65+. The situation improved slightly in England & Wales with a recuperation in life expectancy, but still below pre-pandemic levels.[67]

7.14. In contrast, Scotland and Northern Ireland saw compounded losses in life expectancy in 2021, suggesting that the mortality impacts of the pandemic were similar than those observed in 2022. How the pandemic altered mortality trajectories across different causes of death (e.g. cardiovascular diseases, cancers, or suicides) more broadly is less well understood. Preliminary evidence suggests that in Scotland mortality due to drug use substantially contributed to life-expectancy losses in 2020-21, for example. In England & Wales, using ONS data, cardiovascular mortality was higher than expected among men in 2020. In the future more studies should focus on the indirect impacts of the pandemic through multiple causes of death and other pathways through which the pandemic has affected population health.

7.15. It is quite time-dependent as well. We found that compared to other European and high-income countries, the UK experienced one of the most significant magnitudes of excess mortality in 2020. In the first 20 months of the pandemic in 2020, over 63,000 more deaths than expected occurred in England & Wales alone.[68] Across the UK, all countries experienced losses in period life expectancy of nearly one year in 2020.[69] Much of these losses were attributed to deaths classified as COVID-19 among the population aged 65+. The situation improved slightly in England & Wales with a recuperation in life expectancy, but still below pre-pandemic levels. Also, using ONS data we found

[65] http://dx.doi.org/10.1136/jech-2020-215505
[66] https://doi.org/10.1093/ije/dyab207
[67] Forthcoming Nature Human Behaviour, preprint: https://doi.org/10.1101/2022.02.23.22271380
[68] http://dx.doi.org/10.1136/jech-2020-215505
[69] https://doi.org/10.1093/ije/dyab207

that in England & Wales cardiovascular mortality was higher than expected among men in 2020.

7.16. **Better science communication around changing knowledge, risk and uncertainty.** An issue that plagued communication was that scientific facts and projections are often not a solid, static fact, particularly in a changing situation. Truth, particularly for novel and evolving diseases, have considerable uncertainty. One example is the changing knowledge of the mechanism of the spread of the virus. The initial focus was on handwashing and not airborne transmission and the focus on ventilation, which came considerably later.

7.17. An example was the often-used R number,[70] what would happen without any interventions, immunity and changes to human behaviour. There was a tendency and desire for a single number (often without confidence intervals), with some estimates in 2020 between 1.7 and 7.1. The estimation of R0 needs a complicated amount of information such as contact tracing infection, interviews, testing. Most of the numbers and estimates faced similar problems, meaning that it was very difficult to accurately model numbers and express uncertainty, often then being translated in public perception as analyses being 'wrong'. Although results can have a degree of uncertainty, and often many caveats with estimates, however, it doesn't mean that the results are useless and we do not know anything.

7.18. **Recognition that the pandemic was not only a biomedical, but also a social and economic problem, revealing and exacerbating existing inequalities**. Although COVID was often considered as a medical and public health issue, it was largely also a socio-economic problem. The pandemic exacerbated existing problems in the UK such as understaffed and efficient health systems, the grey, ignored area of social care and care homes, concentrated geographic deprivation and ethnic group disparities. The pandemic worsened and shone a light on these existing inequalities and problems, down to lack of ventilation in buildings. It also revealed a legacy of problems in the health system that had traditionally focussed on medical

[70] The R number or Reproduction number of a disease is the number of people that each diseased/infected person will, on average, go on to infect. It consists of two elements, the R0 (R at time zero) and R_t (R at time t). R0 is average number of people who each diseased person infects without any immunity or mitigations. . They are based on reporting and testing systems, behaviour and local conditions.

treatment instead of public health prevention measures (related to obesity and other relevant COVID co-morbidities).

7.19. The overwhelming focus on disease, vaccinations and biomedical approaches and technical solutions ignored (and continues to ignore) the disproportionate impact on certain groups due to underlying issues of deprivation, inequality, poor transport, working conditions, poor ventilation, overstrained health systems and lack of trust. The worry is that lessons will not be learned, with a continued tendency to focus only on biomedical technological seemingly 'silver bullet' solutions that seem more tangible such as vaccines, antivirals. COVID infections and mortality exposed and shone a bright light on the UK's inequality, mirrored in cause-specific mortality and disease and disability concentrations amongst ethnic minorities, areas of enduring deprivation and those in particular occupations or living conditions. Although these longer term inequalities are often recognised, more efforts could be taken to focus preventative health, better ventilation and living conditions. Resilience in the broader system is only possible by creating broader policies that prioritise revamping the health system and making it attractive for health-care workers, promoting health prevention and protecting vulnerable communities. To reiterate, more attention could have been placed on economic modelling and the potential social and economic trade-offs of the different measures instead of only the impact on infections and the NHS.

7.20. Although social science research were in many ways ignored, they were also evoked or alluded to at several times, with the source being unclear. In the early periods of the pandemic, there was often the argument that the public in the UK would not tolerate or adhere to lock-downs or wearing face coverings, or that they suffered fatigue, yet this was not linked to any clear evidence. This resulted in a delay in decision making.

7.21. **More attention also needs to be paid to knock-on effects of introduction of NPIs and measures beyond pharmaceutical and NPI interventions.** It was also striking that costly but also major behavioural labour market interventions such as furlough seemed to fall outside of the scope of the SAGE committees. There were multiple behavioural, medical and mental health outcomes and knock-on effects of introducing working from home and furlough,

such as changes in sleeping patterns, particularly of women due to unequal burden of domestic and employment duties,[71] which were considered outside of the scope of these groups.

7.22. There also appeared to be little attention to the downstream impact of how restricting visits to care homes, hospitals and key events such as funerals impacted the health and mental health of the individuals in question and their families and friends. In that sense, many of the analyses and projections seemed to be 'tone deaf' to the real stressors and issues of people on the ground.

7.23. **Shifting responsibility for public health measures to personal judgement and individual choice created confusion and division**. As measures were either slowly introduced or slowly reduced (e.g., size of meetings, face coverings), advice was very unclear and at times shifted to individuals or gatekeepers (employers, front-line staff, police). What was confusing and unhelpful for the general public was the shift to advice that many public health measures (face coverings, social distancing) were a matter of 'personal judgement' or 'individual choice', which explicitly tied individual rights and freedoms to public health measures. It also shifted responsibility and risk away from the government to individuals, but also unfairly to those who had to try to make sense of ever-changing rules and enforce public health measures such as retail and hospitability workers or the police. Previous lessons could have been learned from previous pandemics, but also former public health measures such as seatbelt use, bicycle helmet use or second-hand smoke, which had a similar choice/freedom narrative and polarised the public. For instance, second-hand smoke was seen as a matter of the smoker's freedom and choice, yet that choice inextricably threatened those around them. During a pandemic health emergency, a person's choice is not merely their own, but rather inherently linked to their community and those around them. The public health duty of care overrides any individual choice or rights in this respect and by shifting decisions to personal responsibility, falsely polarised public health measures into

[71] https://bmjopen.bmj.com/content/12/4/e055792

objective medical advice to protect the general public versus individual freedom and rights of individuals.

7.24. **Dealing with the complexity of multiple voices.** As with any scientific committee, there was often a difference in opinion on the evidence and conclusions within the committees. Although all SAGE members were instructed to say that the information they provided was in a personal capacity and did this (sometimes respected by the media and sometimes not), at times it seemed that these personal opinions did not deliver a unified message and could generate confusion. It appeared hard for the experts, public and media to separate the notion of "speaking in a personal capacity" from the knowledge that experts had in fact attended meetings and had internal knowledge.

7.25. Within science, it is healthy and common to disagree, but this can be confusing to the public during an emergency when they are looking for clear direction. There was also dissent in SPI-B, which sometimes spilled into the media. For instance, I was asked by the Guardian to provide a short opinion on COVID-19 certificates, which was related to the Royal Society Report and Science commentary I had written. However, upon publication it was positioned as a Head to Head with another member of SPI-B Stephen Reicher. I immediately emailed GOScience apologising and stating that I did not realise that it would be presented as a Head to Head of two people on the same SAGE committee. They responded that it was fine and healthy to show differing opinions in the same committee. The fact that dissenting views from very different scientific standpoints is included in committees, seems like a vital element to retain to avoid 'group think' and lack of innovative solutions.

7.26. There was also an uncomfortable BBC Newsnight TV appearance, where I was put against Mike Tidesley from SPI-M who claimed that face coverings were dangerous for children, which I refuted. Yet there was (and continues to be) no scientific evidence underpinning that claim and it did not appear to be an area in which SPI-M or he was working. I could imagine that this type of exchange between two SAGE sub-group experts was confusing for the public trying to understand how to act in an emergency.

7.27. One solution would be to retain scientific independence and speaking in a personal capacity, alongside regular main messages from the committee. Another option is to ask individuals not to speak with the media, particularly during a crisis. This, however, would be difficult to monitor and separate from their own expertise and publications, and does not fit with the incentive structure of the current research funding system, where scientists are pushed by their Universities to enter into the public discussion and translate research into impact and policy change (i.e., REF research exercise where impact is a central element).

7.28. There were also some cases where the media reported critical comments from some SPI-B members that felt they were being side-lined (17 September 2021).[72] My experience of SPI-B was that different sub-groups were sometimes created for different experts in the group to take the lead. At that time different (and perhaps) new expertise was being drawn from within SPI-B (myself included). My memory is that at least some of the individuals quoted in this article were not directly involved in the advice at this time and thus may have falsely assumed that no action or advice was being taken. This suggests more proactive communications to remind individual members that they will not always be present or involved in each study to avoid broader based public critique, which occurred in the Ethnicity subgroup.

7.29. **Other matters to note.** When SAGE minutes were published, it appeared to be the case that many names were kept confidential (hidden by a black bar), whereas the names of all scientists were always revealed. Given that certain behavioural measures evoked a highly polarised and emotional reaction from particular members of the public, some individuals and organised groups reacted with personal attacks against the experts. I received multiple emails, written letters, calls and social media attacks that were of a highly threatening, astonishingly abusive and misogynistic nature (e.g., saying they were coming to kill me, that I should commit suicide). On a minor note, Committees should also be named with public perception in mind. Non-intuitive acronyms or acronyms that may have preconceived meanings – like SPI (as in MI6 spy) –

[72] https://www.theguardian.com/politics/2021/sep/17/no-10-accused-of-sidelining-behaviour-experts-on-latest-covid-measures

appeared to be confusing for the public. Particularly having a committee focussing on behavioural interventions named 'SPI' seemed to fuel some negative interpretations and conspiracies about the committee.

8: Documents that I hold

8.1. The documentation that I hold includes the following: email exchanges regarding committee work, presentations made at SPI-B, SAGE committees, some drafts and records of comments, exchanges, edits of material added or removed during writing reports and material (i.e., track changes), and personal agenda containing records of appointments.