Witness Name: Dr Stuart Wainwright OBE
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UK COVID-19 INQUIRY

WITNESS STATEMENT OF DR STUART WAINWRIGHT OBE

Contents

Section 0: Introduction

I, Dr Stuart Wainwright OBE, will say as follows:-

0.1. I was the Director of the Government Office for Science (GO Science), a position which I held from December 2019 until June 2023. The facts in this Statement come from my personal knowledge or the records of GO Science. I am duly authorised to make this Statement on behalf of GO Science, pursuant to a Rule 9 request from the Inquiry dated 21 September 2022.

0.2. As Director of GO Science, I was responsible for running the organisation in support of the Government's Chief Scientific Adviser (GCSA) – ensuring the Prime Minister and Cabinet received the science advice they needed, and driving systemic improvements across His Majesty's Government (HMG) in how science is used.

0.3. I have a PhD in microbiology and a degree in genetics from the University of Sheffield.

0.4. I was employed within the UK Civil Service for over 20 years undertaking a wide range of strategy, science, policy and operational roles in the Cabinet Office, the Department for Business, Energy and Industrial Strategy (BEIS), the Department for Environment, Food and Rural Affairs (Defra) and outside HMG. I have extensive experience of strategy and policy development, the provision of science advice, research systems, crisis management and organisational leadership. I became the Chief Executive of the UK Centre for Ecology and Hydrology (UKCEH) in June 2023.

0.5. This Statement is the second of two statements in response to the Inquiry's Rule 9 request of 21 September 2022. It provides an overview of the advice provided to central government decision-makers by GO Science, including Sir Patrick Vallance, the Government Chief Scientific Adviser (GCSA) at the time of the UK Government's response to the Covid-19 pandemic (between 1 January 2020 and 24 February 2022) as requested by the Inquiry. In particular, I seek to address in this statement, on behalf of GO Science, questions 4 (a-c), 5, 7 (a-m), 8, 9, 10, 12, 13 and 16 as set out in the Rule 9 Request.

0.6. This statement is to be considered alongside my earlier statement (describing the role and remit of GO Science and the GCSA during the pandemic), and material already disclosed to the Inquiry which includes a chronology of key events and meetings.

0.7. Before turning to the detail of GO Science's responses to the Inquiry's questions I wish to make the following observations which are intended to assist in placing the provision of science advice by GO Science during the course of the pandemic in its proper context.

0.8. **Scientific Advisory Group for Emergencies (SAGE) minutes provide a comprehensive and contemporaneous record of science advice provided to decision-makers in the centre of government.** The SAGE minutes are in the form of a consensus statement, reflecting the discussion in SAGE meetings and based on the body of scientific evidence presented by its expert participants. Once consensus advice in the form of minutes had been prepared by the SAGE secretariat in GO Science and signed off by the co-chairs (the GCSA and Chief Medical Officer (CMO)), it was circulated to the Prime Minister (PM), ministers, Cabinet Office, Department of Health and Social Care (DHSC, the lead Government department for pandemics) and other departments and agencies.

0.9. The co-chairs would describe and explain this advice to the Prime Minister, COBR, and other Ministerial groups as required. A chronology of these meetings has been provided to the Inquiry, and the emails and briefings containing advice sent by the GCSA (based on SAGE discussions and advice) have been disclosed.

0.10. We have provided all SAGE minutes to the Inquiry, as a single searchable document (SW2/01 - [INQ000089720]). The minutes and papers discussed by SAGE are also publicly available on gov.uk. To accompany this statement, I am disclosing the Dashboard of Evidence compiled and held by the SAGE secretariat team (SW2/02 - [INQ000074973]). This is an internal working document, rather than a document of record, used during the response to track what was discussed and what evidence was provided on different themes, many of which are in scope of this request.

0.11. **Science advice evolved as the understanding of the novel coronavirus developed.** This is to be expected in the development of scientific understanding, and the scientific method itself is a process of systematic observation, formulation of hypotheses and – importantly – the testing and

adjustment of those hypotheses before establishing a conclusion (which remains subject to further testing and, where necessary, revision).

0.12. This approach (and the scientific method as a whole) means that advice inevitably builds on what has gone before, resulting in something akin to a continuous process of evolution of advice.

0.13. **Science advice also changed as both the virus and circumstances changed**. New variants were detected, and innovation in vaccines, therapeutics and treatment made it increasingly possible to mitigate the impact of the virus on both individuals and healthcare systems.

0.14. **GO Science, the GCSA and SAGE gave scientific advice, and did not formulate policy or provide operational (or clinical) responses**. Science advice was provided to decision-makers to help inform their decisions on policy and operational matters.

0.15. **SAGE participants involved in the development and provision of advice were asked and expected to provide independent, objective advice informed by their area of expertise**. Most SAGE participants were academic scientists, engineers or clinicians, voluntarily providing their time and expertise whilst employed by universities or other institutions. Specialists from across government (particularly the UK Health Security Agency (UKHSA), the National Health Service (NHS), the Office for National Statistics (ONS), and departmental Chief Scientific Advisers (CSAs)) also contributed to the development of independent scientific advice on the basis of their expertise. As described in my previous statement, policy colleagues from other UK government departments were invited to attend SAGE meetings in order to relay the most up to date advice and the discussion behind it to decision-makers in their own departments, but they did not contribute to the science advice.

Section 1: Provision of science advice

Introduction

1.1. As covered in my previous statement, GO Science provided secretariat support to SAGE throughout the pandemic which was co-chaired by the GCSA and the CMO, as well as supporting the GCSA in non-SAGE activities. SAGE was not

the only source of science advice available to decision-makers in government, and science advice was one input into decision-making – economic and other analysis and assessment were considered by ministers and policy-makers alongside science advice.

1.2. Providing science advice relating to a new virus, and at the pace required to support an emergency response presents a particular challenge. There are a number of well-established principles for the provision of science advice in emergencies (SW2/03 - [INQ000218362]) which were particularly relevant to the Covid SAGE activation.

1.3. For example, advice was provided to decision-makers as a consensus statement, reflecting the collective view reached in the meeting. Advice was provided on the basis of the scientific evidence available at the time – in a rapidly evolving situation it was often not possible or desirable to wait for better evidence to accumulate. The inevitable degree of uncertainty about the situation and the scientific evidence had to be communicated to decision-makers. For example, where appropriate, an indication of the degree of confidence in the advice was given. These 'high', 'medium' and 'low' confidence statements are evident throughout the SAGE minutes. Furthermore, as the evidence developed and improved, SAGE would update its advice as appropriate.

1.4. The process that led to the publication of SAGE minutes and papers was instigated at the request of the GCSA and the first batch of SAGE papers was published, with the support and agreement of Cabinet Office, on 20 March 2020 on GOV.UK, and the next on 30 March 2020. From May 2020, SAGE minutes, papers and participant names (with permission) were made publicly available on GOV.UK. From February 2021, GO Science published HTML versions of all minutes and key papers to increase document accessibility and make them easier to navigate using internet search engines.

1.5. At a number of points in this statement I have provided a summary of advice issued by SAGE, which I hope will be of assistance. However, my summary is not intended to be, and should not be taken as, a substitute for the full and comprehensive record provided by the SAGE minutes and papers. This statement also focusses on certain subjects at the Inquiry's request. Science advice provided through the pandemic was therefore broader than the scope of this statement.

1.6. Individual SAGE meetings usually covered a range of topics. All meetings started with a situation update. SAGE seldom considered a subject only once, some subjects arose and were discussed in relation to several different policy contexts. For example, testing was discussed in relation to case identification, self-isolation, shielding, surveillance, borders and certification amongst others. Subjects would also be considered at different points in time as knowledge and data accumulated and circumstances changed. For these reasons, it is necessary to refer to the complete record of SAGE minutes to establish a complete view of the science advice provided.

1.7. As well as making SAGE advice available to decision-makers across government, part of the co-chairs' role was to represent SAGE and present SAGE advice to the Prime Minister, COBR, and other Ministerial committees as required.

1.8. As requested, GO Science has provided to the Inquiry a chronology of meetings, and disclosed emails and briefings containing advice sent by the GCSA as well as WhatsApp messages with the Prime Minister/No.10, Ministers, Cabinet Office or senior advisers between 1 January 2020 to 26 March 2020 where advice was provided and/or key decisions were made or discussed. Details of WhatsApp groups, which the GCSA participated in with the Prime Minister/No.10 and other senior officials, their purpose, participants and date range are provided here (SW2/04 - [INQ000087185]).

Behavioural Science

1.9. The Inquiry has requested details of the commissioning and use of "behavioural management" during the pandemic. As in previous emergencies (SW2/05 - [INQ000074946]), behavioural and social science was recognised as an important component of the overall scientific understanding and advice during the pandemic response. Put simply, the effectiveness of most, if not all, Non-Pharmaceutical Interventions (NPIs) is determined to a significant extent by the behavioural response of the public, individually and collectively. Understanding what influences this response is therefore a useful input to policy design. The policy decisions themselves, including which NPIs were put in place and when, were not the responsibility of GO Science, the GCSA, SAGE or any of its subgroups.

1.10. SAGE discussions included behavioural science advice throughout the period when SAGE was active. Professor James Rubin attended the first SAGE

meeting in January 2020, and subsequent meetings, to provide social and behavioural science advice. He was joined by Professor Brooke Rogers, who attended SAGE for the first time in February 2020, at SAGE 7 (both were subsequent SPI-B chairs). The Scientific Pandemic Insights Group on Behaviour (SPI-B) subgroup was convened on 24 February 2020 to provide independent expert advice to support policy decisions relating to the Covid-19 epidemic (SW2/05 - [INQ000074946]) . It included academics from a wide range of social and behavioural disciplines including anthropology, psychology, geography, philosophy and sociology.

1.11. SPI-B was only one component of the behavioural science contribution to the pandemic response. In-house HMG Behavioural Science (in particular Cabinet Office and Public Health England (PHE)/UKHSA) and Government Social Research teams provided policy teams and ministers with behavioural science advice. Government teams also commissioned research from, for example, the Behavioural Insights Team (BIT), Ipsos Mori and Kantar.

1.12. The papers that SPI-B produced and which were discussed at SAGE meetings are available on GOV.UK. SPI-B also contributed to broader, collective pieces of work with other SAGE participants and subgroups, for example with the Scientific Pandemic Influenza Group on Modelling, Operational sub-group (SPI-M-O) on the impact of social distancing measures.

1.13. Most SPI-B papers were commissioned by either the SAGE co-chairs or the Cabinet Office C-19 Task Force (C-19 TF). A smaller proportion were commissioned by other Government departments including DHSC and the Department for Levelling Up, Housing and Communities (DLUHC), or were initiated by SPI-B itself when issues of importance were identified.

Advice relating to initial strategies

1.14. The Inquiry has also requested that I provide a description of the role played by GO Science in the provision of advice and in key decision-making relating to the government's initial strategies for community testing, surveillance, the movement from 'contain' to 'delay' and guidance and advice to health and social care providers.

1.15. The initial policy and operational strategy for the pandemic, including initial community testing and the "contain, delay, research, mitigate" strategy was developed and led by DHSC and PHE. DHSC and PHE received all SAGE minutes and papers at this time. The scientific aspects of these strategies were

discussed at SAGE during February and March 2020, and papers relating to them were presented to SAGE for scientific discussion by participants from PHE and DHSC. (SW2/06 - [INQ000087180]; SW2/07 - **INQ000119730**; SW2/08 - [INQ000074910]; SW2/09 - [INQ000087179]).

1.16. GCSA (with CMO) provided comments with respect to the accuracy and presentation of scientific advice and evidence in the Covid Action Plan on 2 March 2020, at the request of officials at DHSC (SW2/10 - [INQ000087175]).

1.17. The protocol outlining the implementation of the Covid Action Plan, including allocation of roles and responsibilities, was led by the Cabinet Office and as a result our record of the decision-making process is incomplete. According to the protocol (SW2/11 - [INQ000074979]) (shared by the Cabinet Office on 7 March 2020), SAGE assessments of the pandemic and its trajectory were due to be discussed by CMO and GCSA and fed into the process relating to the move from contain to delay. At the Cabinet Office Briefing Rooms Ministerial Committee (COBR(M)) on 9 March 2020 (SW2/12 - [INQ000056179]) SAGE advice that the "response will soon need to move from contain to delay" was presented. Further consideration of interventions took place at COBR(M) on 12 March 2020 (SW2/13 - **INQ000052484**; SW2/14 - **INQ000052482**).

1.18. The community and other testing strategy was discussed at SAGE 9 (20 February 2020 (SW2/15 - [INQ000061517],)) and SAGE 10 (25 February 2020 (SW2/16 - [INQ000061518])). The proposal from PHE and DHSC to end community testing in order to prioritise testing in healthcare settings and for outbreaks, was noted at SAGE 15 (13 March 2020)(SW2/17 - [INQ000061523]). More general aspects of the aims and use of testing were discussed in each of the first six SAGE meetings, including the need for more and better testing data (see in particular SAGE 4 on 4 February 2020 (SW2/18 - [INQ000061512]) and SAGE 5 on 6 February 2020 (SW2/19 - [INQ000061513])). SAGE advised on the importance of testing, both for case ascertainment and for surveillance of the state, and rate of growth, of the epidemic throughout the response. Excerpts relating to testing from SAGE minutes is provided in Annex A.

1.19. With regard to surveillance, discussions in SAGE in February and March led to the Office for National Statistics (ONS) offering to establish the Covid-19 Infection Survey in April 2020 (SW2/20 - [INQ000061534]).

1.20. SAGE minutes reported the emerging evidence of higher mortality in older age groups from early February 2020 (see 2.39 to 2.42). SAGE also highlighted the

risks around social care and care homes (for example in SW2/21 – [INQ000061522]) SAGE 14 (10 March 2020), paragraph 30) and the need for infection control in healthcare and other contained settings. Decisions, policies and the provision of guidance to these sectors was a matter for DHSC, PHE and the NHS.

Section 2: Understanding of the virus

2.1. Understanding of the biology of SARS-CoV-2 developed quickly and much was relatively well-established within the first six months of the pandemic – for example the viral genome was sequenced by 3 January 2020 and released publicly on 10 January 2020 (SW2/22 - **INQ000087225**). Other properties, such as R_t (see 2.13 to 2.17), the growth rate in infections, the Case Fatality Rate (CFR) and the Infection Fatality Rate (IFR) (see 2.29 to 2.32) changed over time and were monitored throughout the epidemic. PHE (now UKHSA) produced papers for discussion at SAGE during February and March 2020 updating participants on the developing understanding of the virus (For example, SW/23 - [INQ000074915]).

2.2. There was early focus in government on comparison between the existing planning assumptions (owned by DHSC) in the National Security Risk Assessment (NSRA) for pandemic flu, and the evolving understanding of SARS-CoV-2. For example, discussion of comparison table drafted by the SAGE secretariat team at GO Science on the basis of papers and discussions at SAGE 11, on 27 February 2020 (SW2/24 - [INQ000074896]). These planning assumptions included R_0, incubation period, duration of illness and infectivity, transmission, Case Fatality Rate and Infection Fatality Rate. More detail is included below. The comparison was to identify similarities to and differences from pandemic flu.

Tracking the emergence of the virus, including information from international organisations and partners

2.3. As described in my previous statement, the role of SAGE, and GO Science in supporting SAGE, was to bring together experts to discuss the latest UK and international science, data and evidence in order to advise the Prime Minister, Cabinet and Cabinet Committees. SAGE minutes, in reflecting these

discussions, provided what was in effect a summary situation update (the Situation Update section in the minutes), although that was not a formal SAGE or GO Science requirement. From February 2020 onwards, the SPI-M-O subgroup produced weekly estimates of R_t and growth rate (the first of these exhibited here SW2/25 - [INQ000074895]).

2.4. Data and evidence for the updates came from a variety of sources. Daily monitoring and situation awareness came from PHE/UKHSA which covered all health-related issues in the UK and globally. International data and evidence were particularly important in January 2020 (for example from China and later from Italy) and were received through formal channels (see 2.6) and the informal personal networks of SAGE participants and co-chairs, PHE staff and other government and academic scientists.

2.5. From January 2020, the GCSA met with his counterparts globally via videoconference, including those in Japan, Singapore, the USA, South Africa and Europe, to share information about the virus, the course of the pandemic and the impacts of interventions. The insights, evidence and data from these discussions were reported in SAGE meetings. International experts were invited to attend SAGE when appropriate (for example, South African scientists during the emergence of the Omicron variant).

2.6. It is not in the remit of GO Science, including in its SAGE secretariat role, to liaise directly with the World Health Organization (WHO) or advisors in foreign governments, although international engagement did take place (see 2.7 and 2.8). DHSC has lead responsibility for engagement with the WHO. The CMO (SAGE co-chair) represents the UK on the Executive Board of the WHO.

2.7. GCSA calls on Covid-19 with international counterparts early in the pandemic first took place on 16 January 2020, when the GCSA hosted a meeting with Chief Scientific Advisers from New Zealand, Canada, India and the US. This group was expanded to include Australia and Brazil, then Italy, Germany, Singapore, Japan and South Korea, and later Portugal, Belgium, France and Spain at meetings convened by the US on 2, 11, 18, 25 March 2020: Meetings with international counterparts (from January to end of March 2020) also took place on:

a. 24 January 2020: Kelvin Droegemeier, US

b. 2 February 2020: Juliet Gerrard, New Zealand

c. 12 February 2020: Juliet Gerrard, New Zealand

d. 13 February 2020: Takahiro Ueyama (an executive member of the Council for Science, Technology and Innovation, Cabinet Office of the Government of Japan)

e. 14 February 2020: Kenneth Mak (Director of Medical Science, Singapore) and Tan Chorh Chuan (Chief Health Scientist, Singapore)

f. 17 February 2020: Lai Fung Chan, Singapore

g. 10 March 2020: Mark Ferguson, Ireland

h. 14 March 2020: Mark Ferguson, Ireland

i. 15 March 2020: Ian Town, New Zealand

j. 26 March 2020: Chris Hui, Hong Kong

2.8. The GCSA participated in many such meetings in later months with international colleagues, including with a group of science advisers from Europe that the GCSA first convened in November 2020 and continued to meet regularly until March 2022. These group meetings were used as an informal knowledge-sharing network.

Variants

2.9. There were three dominant variants within the UK in 2020-21, Alpha, Delta and Omicron, aside from the original Wuhan strain. As new variants emerged, the ensuing waves of infections were influenced by the properties of the variants and by pharmaceutical and non-pharmaceutical interventions, behaviour, seasonality and the level of population immunity from both prior infection and, later, vaccination.

2.10. Evidence relating to variants was brought to SAGE by a number of bodies and groups including PHE (later UKHSA) who were responsible for designating "variants of interest" and then "variants of concern", and the COVID-19 Genomics UK (COG UK) consortium. In February 2020, the GCSA identified the need for a genomic sequencing programme for Covid-19 and held discussions accordingly with Professor Sharon Peacock (Director of National Infection Service, Public Health England - PHE) and, on 4 March 2020, with Professor Sir **Name Redacted** Director of the Wellcome Sanger Institute). Subsequently, the COG UK consortium (SW2/26 - **INQ000268054**) was established in March 2020 between the NHS, UK Public Health agencies, multiple UK universities and the

Wellcome Trust Sanger Institute to deliver sequencing of SARS-CoV-2 genomes.

2.11. As each new variant became dominant, this changed the epidemiological parameters and – depending on the nature of the variant – the response required. The emergence of variants is therefore key context in any assessment of the pandemic response.

2.12. The evolution from, Wuhan/wild type, to Alpha and Delta variants meant that the virus became progressively more transmissible, more severe and displayed different degrees of immune escape. Omicron was different to previous variants and was more transmissible, but in a population with high levels of immunity it presented as a less severe disease.

R and growth rate

2.13. The reproduction number (R) refers to the average number of secondary infections produced by 1 infected person. It is a ratio rather than a rate (SW2/27 - [INQ000074975]). The growth rate is the rate at which the number of infections in the population is increasing or decreasing, usually given in percentage points per day. R and growth rate are different but related ways of describing an exponential process. A growth rate of 2% per day may appear modest but "compound interest" means that high levels of infection can occur very quickly. This means that even if overall case rates are low but R and growth rate are high (as was the case for example in September 2020) large numbers of infection quickly accumulate.

2.14. It is helpful to make the distinction between R_0 and R_t. R_0 is an estimate of the number of secondary cases generated by a typical infected individual ("index case") when the rest of the population is susceptible (so at the start of a novel outbreak). This is an intrinsic property of the virus. Different variants have different R_0. The early estimate of R_0 (original Wuhan/wild type) was between 2 and 3, based on information available from China (SW2/28 - [INQ000061510]; SW2/29 - [INQ000061511]).

2.15. R_t also refers the number of secondary cases per index case but at the current time in the current population – this is the 'real world' figure reported through the pandemic and will vary according to the measures in place and the population immunity.

2.16. R_t>1 means the epidemic is growing; R_t<1 means the epidemic is shrinking. R_t depends not only on the intrinsic properties of the virus but also on the level of immunity in the population and the NPIs in place – so for a given variant, R_t can be close to R_0 in a naïve population (i.e., one with no prior exposure) with no restrictions or below 1 for the same variant in a population with prior exposure, vaccination and/or NPIs.

2.17. An estimate of R first appeared in SAGE minutes on 28 January 2020. From 29 May 2020, estimates of R_t and growth rates, produced by SPI-M-O on the basis of estimates from several participating research groups, were published weekly by GO Science on GOV.UK. Understanding and communication of disease transmission rates is usually the responsibility of DHSC and PHE/UKHSA, who took over responsibility for publishing R_t and growth rates from January 2021 onwards.

Transmission (including aerosol, surface)

2.18. How (and where) transmission of SARS-CoV-2 occurred was an area of particular focus throughout the pandemic response.

2.19. The early position, based on both first principles and observation of other respiratory viruses such as SARS-CoV-1 and influenza, was that aerosols, droplets and fomites (contaminated surfaces) could all be involved but the relative importance of each was unknown and greater understanding developed slowly over time.

2.20. A review of available data was carried out by PHE (now UKHSA) and discussed at SAGE meeting 8 on 18 February 2020 (SW2/30 - [INQ000074898]). The Environmental Modelling Group (EMG) was established in April as a sub-group of SAGE to provide science advice on modes of transmission. The secretariat for EMG was provided by the Health and Safety Executive (HSE).

2.21. The first paper from EMG (produced jointly with NERVTAG) was discussed at SAGE meeting 25 on 14 April 2020. This paper focussed on aerosol dispersal and environmental spread of pathogens, identifying evidence of relevance to the SARS-CoV-2 virus (SW2/31 - [INQ000189678]).

2.22. The understanding of transmission developed through the pandemic response, with a number of papers produced for discussion at SAGE by EMG, NERVTAG, PHE and others. A summary of discussion of airborne transmission at SAGE is provided in Annex B.

2.23. The particular challenge around 'high risk' (in terms of transmission) environments was recognised by SAGE early in the pandemic, for example consideration of transmission risks associated with prisons and contained environments at meeting 7, on 13 February 2020 (SW2/32 - [INQ000061515]). Further dedicated, substantive discussions on high-risk institutional settings and high-connectivity occupations took place on 28 May 2020 (SW2/33 - [INQ000061547]). The EMG Transmission Subgroup was established in January 2021 to examine further the evidence around transmission in real-world settings, including where transmission was happening.

Asymptomatic transmission

2.24. One area of uncertainty around both the virus itself and the developing response was the relationship between observable symptoms and infectiousness, specifically whether individuals could be infected without displaying symptoms (be asymptomatic); whether asymptomatic cases were infectious to others; and whether infected individuals were infectious prior to the appearance of symptoms (pre-symptomatic transmission).

2.25. The extent to which asymptomatic and pre-symptomatic transmission occur, and whether testing can detect asymptomatic cases or those in the pre-symptomatic phase, affects how easy it is to isolate infectious individuals and therefore contain the virus.

2.26. The initial position in January and February 2020 (SW2/28 - [INQ000061510]) was that although there was limited evidence of asymptomatic transmission in the data being received from China, early indications implied some was occurring. PHE (now UKHSA) developed papers referencing asymptomatic transmission for discussion at SAGE in January and February 2020 (SW2/34 - [INQ000074909]; SW2/08 - [INQ000074910]). These papers included reference to asymptomatic cases identified by RT-PCR testing. SAGE first advised that some asymptomatic transmission was occurring in January 2020 (SW2/34 - [INQ000074909]; SW2/23 - [INQ000074915]).

2.27. In April 2020, the SAGE secretariat drafted a paper, which was used to support a briefing for the Secretary of State for Health, summarising the effectiveness of viral testing in asymptomatic individuals and confirming that RT-PCR tests do detect asymptomatic cases (SW2/35 - [INQ000087177]).

2.28. A summary of discussion of asymptomatic transmission at SAGE is provided in Annex C.

Death rates

2.29. Early indications of the pandemic estimated that Covid-19 had a lower mortality rate than SARS, but there was too little reliable data in January 2020 to reliably quantify the precise rate. During the early SAGE meetings, there were several discussions about the Case Fatality Rate (CFR) and Infection Fatality Rate (IFR)[1], which were part of the considerations for the Reasonable Worst-Case Scenario (RWCS) planning assumptions.

2.30. The first SPI-M-O consensus statement, discussed by SAGE on 4 February 2020 (SW2/25 - [INQ000074895]) included consideration of CFR. Evidence from China at the time suggested that the average CFR was very unlikely to be higher than 3%, but more precise estimates were not possible.

2.31. A paper produced by the SAGE secretariat in February 2020 (SW2/36 [INQ000074987]) comparing the then-current understanding of the Covid-19 Pandemic with the NSRA 2019 Pandemic Influenza planning assumptions (owned by DHSC) was discussed at SAGE 13. There was agreement that for planning purposes the assumed CFR (2-3%) was reasonable. The fatality rate for the overall infected population (identified and unidentified cases, IFR) had not been estimated in the pandemic flu planning assumptions, and it was considered on the basis of emerging data that it should be assumed to be close to 1% for Covid-19.

2.32. The lack of data from China hampered understanding of Covid-19 because the number of cases outside Wuhan was not well reported. The understanding of morbidity associated with Covid-19 improved as more evidence on the virus's long-term effects emerged, both for those who initially self-isolated at home and those who were hospitalised.

Population immunity, herd immunity and re-infection

2.33. Population immunity and herd immunity are longstanding epidemiological and immunological concepts. When a virus encounters a naïve population, it initially spreads with $R_t=R_0$, (so if $R_0=3$, each case seeds 3 others). Assuming infection results in some degree of immunity, the number of people who are immune gradually rises and the number who are susceptible falls such that each infected person passes on the infection to fewer people – i.e. R_t falls. When R_t reaches

[1] The IFR is the percentage of people who die as a result of infection, the CFR is the percentage of individuals with confirmed cases that die. Not all infections will be confirmed, so the total number of infections include both undiagnosed and asymptomatic individuals which are not accounted for in the CFR.

and then drops below 1 – i.e. each case begets less than one new case – the herd immunity threshold (HIT) has been crossed and the spread of the virus gradually slow to a halt.

2.34. Immunity levels in the population can sometimes be raised above the HIT by vaccination, indeed this is generally an objectives of mass vaccination campaigns (for example for measles, rubella etc). In the above example, if two-thirds of the population has received a vaccine that prevents infection (i.e. causes sterilising immunity), the epidemic will stop. In practice things are seldom this binary but even if the HIT is not reached, population immunity arising from vaccination or prior infection would usually also be expected to reduce the severity of subsequent infection even in situations in which it may not completely stop viral transmission across the population.

2.35. The simplified scenario above assumes lasting and effective immunity from a single infection. Many infectious diseases never reach the HIT or do so only transiently. This can be because of waning immunity, whereby the nature and strength of individuals' immunity declines over time such that it no longer prevents reinfection, or immune evasion, whereby the virus changes sufficiently to evade prior immunity. In the case of vaccination campaigns for viral infections, such as measles (for which the vaccine produces long-lasting, sterilising immunity), outbreaks can occur when vaccination rates fall below the HIT.

2.36. A critical set of unknowns at the beginning of the epidemic concerned the nature and duration of the immune response to infection with SARS-CoV-2. There were many aspects to this, for example: would a single infection lead to sterilising immunity (whereby the recovered individual cannot be reinfected with the virus)? If immunity were not sterilising, would reinfections be asymptomatic but still infectious to others? Would immunity last indefinitely or wane over time? If immunity wanes, would protection against severe disease last longer than protection against reinfection? Would the virus be able to evolve to escape prior immunity? The same questions applied later to immunity resulting from vaccination.

2.37. These questions concern the developing understanding of the virology of SARS-CoV-2, and were considered by SAGE from the outset, for example, on 23 February 2020 it was noted that "it doesn't appear that the virus is currently mutating" (SW2/37 - [INQ000061514]). These topics were discussed and revisited often by SAGE, such as at SAGE 26 on 16 April 2020, which considered

a paper by PHE on the immune response and the potential for reinfection (SW2/38 - [INQ000194034]).

2.38. Whilst there are no references to 'herd immunity' in SAGE minutes, the level of immunity in the population, the effects of immunity on both transmission and disease severity, the potential for waning immunity and the degree of immune escape by emerging variants were discussed extensively by SAGE, including in March 2020 when there was consideration of population immunity in relation to the early response to the pandemic (SW2/39 - **INQ000212040**; SW2/40 - [**INQ000222002**]).

Identification of at risk and other vulnerable groups

2.39. For operational purposes, the identification of individuals at high risk in relation to shielding was carried out by NHS England and devolved authorities. Guidance relating to this identification was developed by UKHSA and DHSC. SAGE provided scientific advice on the developing understanding of the virus, and the impact on vulnerable groups.

2.40. The understanding of the impact of Covid-19 on at risk and vulnerable groups developed through the pandemic, and was considered frequently by SAGE. Some groups were at increased risk of infection, for example because of employment-related exposure; others were at increased risk of poor outcomes (hospitalisation and death) or Long Covid once infected, which was often associated with a mix of health, demographic and socioeconomic factors (age, obesity, pre-existing conditions, ethnicity).

2.41. Increasing risk of poor outcomes with age was identified early in the pandemic, as initial data indicated that the mortality curve of the virus mirrored the planning assumptions for pandemic influenza (SW2/18 - [INQ000061512]; SW2/41 - [INQ000087192]).

2.42. Data and analyses considered by SAGE came from a variety of sources, particularly ONS, PHE/UKHSA, OpenSafely and CO-CIN (the COVID-19 Clinical Information Network). CO-CIN was established in February 2020 (SW2/42 - [INQ000061519]) to catalogue data from laboratory confirmed cases of Covid-19 admitted to UK hospitals. CO-CIN data indicated increased mortality in Black ethnic groups compared to White ethnic groups in April 2020 (SW2/43 - [INQ000074906]). There was a substantive discussion on Ethnicity at SAGE 40 (SW2/44 - [INQ000120526]), and the Ethnicity sub-group was established in August 2020 (SW2/45 - [INQ000074981]).

Section 3: Non-Pharmaceutical Interventions (NPIs)

3.1. The Inquiry has requested a description of the role played by GO Science in the provision of advice and in key decision-making relating to the imposition of non-pharmaceutical interventions (NPIs).

3.2. Responsibility for decision-making, policy development and operational delivery of NPIs sat with Cabinet Office, DHSC, UKHSA and other departments or local decision-makers depending on the nature and scope of the measures.

3.3. NPIs are part of the standard repertoire of public health responses to infectious diseases. Interventions are introduced to do either one or a combination of the following: to reduce the number and/or frequency of contacts (e.g. by working from home); to reduce contacts between infected people and others (e.g. self-isolation); or to reduce the risk of infection occurring in the presence of an infectious individual (e.g. mask-wearing, 2 metre rule). The Environmental Modelling Group (EMG), a sub-group of SAGE, provided advice to SAGE which often referred to the 'hierarchy of control' in regard to environmental risks, including a paper in May 2020 to inform the developing approach to managing risk (SW2/46 - **INQ000212024**).

3.4. This request specifically refers to a number of measures – working from home, self-isolation and periods of self-isolation, social distancing, and closure of schools. Advice from SAGE was occasionally provided on one of these in isolation, but they were more usually considered as a group of measures. I have provided further information relating to facemasks and international travel separately in paragraphs 3.9 to 3.16 respectively.

3.5. The fact that NPIs were imposed and lifted in packages makes it difficult to ascertain the precise impact of individual measures. Part of the reason for the clear gaps of four weeks or more between steps in the 2021 Living with Covid roadmap, was to allow time for the effects of changes in the removal of packages of measures to be assessed before moving further. Moreover, context is critical – just because an intervention, or a group of interventions, worked once does not mean that it would have exactly the same impacts when circumstances have changed.

3.6. SAGE discussed and provided advice on NPIs throughout 2020, 2021 and early 2022 reflecting the state of the epidemic at the time and the resultant alternating periods of tightening and loosening restrictions. These periods of the pandemic in the UK can be characterised approximately as follows (these are general observations rather than a description of SAGE advice at the time):

a. **Pre-lockdown** – Jan to March 2020: understanding the epidemiological dynamics of the epidemic in the UK and the magnitude and packages of NPIs that would be needed to halt and reverse exponential growth.

b. **Spring 2020** – April to June: monitoring the progress of the epidemic and providing advice to support the development of plans to exit or ease lockdown (plans published in May and July).

c. **Summer 2020** – June to August: assessing the effects of gradual release of restrictions nationally (but with local lockdowns in some areas) with numbers rising slowly.

d. **Autumn 2020** – September to November: steeply rising number of infections through September and October led to discussion of scientific advice on proposed policy interventions including circuit-breaker (and mass testing), tightening of restrictions, 3-tier system and ultimately second lockdown at beginning of November.

e. **Christmas 2020** – December: exit from second lockdown into 3 (later 4) tier system, planning for Christmas, the detection and dominance of Alpha variant.

f. **January to March 2021**: third lockdown and preparation for stepwise lifting (Roadmap). The assessment of the potential effects of vaccine rollout and a gradual shift from NPIs to PIs.

g. **March to July 2021**: steps 1-4 of Roadmap alongside Delta variant (from May) – assessment of the effects of Delta and vaccination.

h. **July to November 2021**: high levels of infections but high levels of vaccine protection.

i. **December 2021 to January 2022**: Omicron, planning for Christmas, Plan B through January and debate over additional measures.

j. **January to March 2022**: Omicron BA.1 and then BA.2.

3.7. The possible impact of interventions to delay any (then) future UK outbreak of Covid-19 was discussed at SAGE 4, on 4 February 2020 (SW2/47 - [INQ000087430]). Discussion of measures to limit transmission were discussed at SAGE through February 2020, with a substantive discussion of NPIs (including the observed impact in Hong Kong, Wuhan and Singapore) at SAGE 10, on 25 February 2020 (SW2/16 - [INQ000061518]). SAGE subsequently developed and provided a range of different types of advice relevant to NPIs throughout the pandemic response, based on the circumstances and requirements of decision-makers at the time (see phases of the epidemic below), including but not limited to:

a. The epidemiological impacts of NPIs based on modelling, most obviously for lockdowns and packages of measures and later how variants, vaccines and natural immunity (and waning of immunity) changed this picture.

b. Other epidemiological advice, for example where transmission was actually occurring and the impact of different testing strategies.

c. Specific technical questions (such as the scientific evidence for the distance travelled by aerosols and droplets), and questions around application (so for example comparing efficacy of facemasks in the laboratory with the impact on real-world transmission).

d. Evidence on risk factors for poor outcomes, on the characteristics of viral variants and on vaccine effectiveness and how this might impact NPI effectiveness.

e. Advice on behavioural considerations, and communication of measures, either free-standing or incorporated into epidemiological or other advice.

3.8. This range of advice is reflected in the summary of SAGE advice and discussion of social distancing between January and December 2020, provided in Annex D. SAGE discussions included consideration of the wider impact of NPIs, in particular closure of schools. A summary of SAGE advice and discussion of school closures is provided in Annex E.

Face coverings

3.9. Early NERVTAG advice presented to SAGE reflected the uncertainty around efficacy of face coverings, noting the lack of good evidence for an effect (rather than evidence against an effect) particularly in real-world settings (SW2/18 - [INQ000061512]). It noted that the effect was likely to be better for preventing

spread from an infected individual than for protecting an uninfected wearer from becoming infected. The NERVTAG work also raised an operational consideration, the possibility that promoting general mask-wearing could cause shortages in healthcare, which would be counterproductive.

3.10. A large number of papers discussed at SAGE make reference to face coverings and face masks, primarily in relation to transmission of the virus. Understanding of the potential benefits of face coverings became clearer through the first six months of the pandemic response, with SAGE advising on 21 April 2020 (SW2/48 - [INQ000061535]) that on balance, there was evidence to recommend the use of cloth masks in certain higher-risk settings, as a precautionary measure where they could be at least partially effective. As the evidence developed, mask-wearing – specifically the wearing of a high-quality, well fitted mask – became one of the core NPIs that featured repeatedly in SAGE advice, partly due to the limited (but non-zero) negative impacts.

3.11. There was recognition of potential negative impacts of mask wearing, particularly on early years development in children (SW2/49 - [INQ000074945]).

3.12. A summary of SAGE advice relating to facemasks is provided in Annex F.

International travel, border controls and repatriation

3.13. Public health and science advice relating to international travel and border controls was largely provided by PHE/UKHSA. SAGE gave two key pieces of advice, which were then restated at various stages during the pandemic, including in response to new variants.

a. Border measures need to be very rigorous and fully adhered to in order to have any significant impact beyond causing a minor delay in infection entering the UK (SW2/32 - [INQ000061515]; SW2/50 - [INQ000061526]).

b. The risk is highest when travellers are arriving from a country with a higher prevalence of infection than that in the UK at that time (SW2/51 - [INQ000061550]).

3.14. Additionally, in January 2020, SAGE supported NERVTAG's position that temperature checking at ports was unlikely to be effective (SW2/52 - [INQ000061509]).

3.15. No scientific advice in relation to repatriation was requested or discussed at SAGE.

3.16. A summary of SAGE advice relating to international travel and border controls is provided in Annex G.

Statement of Truth

I believe that the facts stated in this witness statement are true. I understand that proceedings may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief of its truth.

Signed: Personal Data .....

Dated: 31 August 2023