Witness Name: Dr Brendan Collins

Statement No: 1

Exhibits: 28

Dated: 8 November 2023

UK COVID-19 INQUIRY

WITNESS STATEMENT OF DR BRENDAN COLLINS

I, Dr Brendan Collins, will say as follows:

I provide this statement in response to a request under Rule 9 of the Inquiry Rules dated 13 June 2023 and referenced M2B/TAG/BC/01.

Introduction

1. I will start by saying a bit about myself then talk about modelling and the Covid-19 response.

2. I am a health economist with skills in economic modelling, big data, report writing, running projects, managing teams and research funding. I have taught at the University of Liverpool for around 13 years, mainly on the Master of Public Health (MPH) course, including previously leading a module on Health Policy, Governance and Economics.

3. In terms of public health work around infectious diseases, I have been involved in work around influenza, HIV, and foodborne illnesses during my time working in local

authority public health teams in Liverpool, Wirral and East London, working as a public health information specialist, analyst and health economist. During the swine flu outbreak in 2009, I did shifts of managing the anti-viral collection point (AVCP) in St Catherine's Hospital Wirral, which I volunteered to do when I was an NHS Band 7 senior analyst.

4. The majority of my work has been modelling non-communicable diseases like cardiovascular diseases and cancer, but I have been involved in some simple models of infectious diseases like human immunodeficiency virus (HIV) when I worked in East London in 2010-2012. I have also been involved in an outbreak investigation with what was then the Health Protection Agency, mapping clusters of meningitis cases in Wirral in around 2010. I was on a National Institute for Health and Care Excellence (NICE) public health advisory committee (PHAC) for three years from around 2013-2016 who looked at increasing flu vaccination uptake for NICE guideline NG103, amongst other topics.

5. I had no work experience of coronaviruses before January 2020, though I was aware of SARS-CoV-1 (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome), and aware of coronaviruses being common causes of colds.

6. Since 2006, I have worked in health-related roles in the NHS, local government, academia, and national government. My undergraduate degree was in Psychology and Neuroscience, and I have a MSc in Public Health (Analysis), a postgraduate certificate in health economics, a teaching qualification (postgraduate certificate in academic practice) and a Doctorate (PhD) in management studies, which was around cost effectiveness of public health programmes.

7. As an academic, a key publication I co-authored was around return of investment of public health programmes (cited 416 times according to Google scholar), which I exhibit as **M2B/TAG/BC/01/1-INQ000239579**, dated 29 March 2017. I have also been involved in modelling impacts of food system changes on cardiovascular disease (CVD) and diabetes in the UK and US. These have contributed to policy discussions on topics like reformulation of foods that are high in salt in the US, the sugary drinks industry levy, and the 9pm watershed for advertising foods that are high in fat, salt and sugar (HFSS). I also produced a paper on health economics and big data in 2016 which has been cited 75 times according to Google Scholar.

8. Outside of academia, most of my time was working in the NHS and local government, and a lot of the work I did during this time is not published online.

9. As mentioned above I have served on a NICE public health advisory committee (PHAC). In addition, I served on a National Institute for Health and Care Research (NIHR) Health Service and Delivery Research (HSDR) funding committee. I have reviewed grant applications for funders including Health Data Research United Kingdom (HDRUK), NIHR and the European Commission. I am on several study steering committees. I previously had an honorary contract with Public Health England which was around local applications for the global burden of disease (GBD) data where I produced a report looking at spend versus disease prevalence across different disease areas.

10. I was appointed as Head of Health Economics (Grade 6) in the Welsh Government in January 2020, initially based in the Health and Social Services Finance team in the Health and Social Services Group. I was appointed competitively and chose to do the role initially on a three-year secondment from University of Liverpool. The role was initially around modelling efficiency of the health and social care system in Wales, looking at:

    a. Transformation programme, health and social care spending, shift of services (e.g. from hospital to community);
    b. Prevention;
    c. Resource allocation;
    d. Value based healthcare;
    e. Primary care;
    f. NHS investing in the Welsh economy; and
    g. Economic advice.

11. My role has slowly evolved since the pandemic and my job title has changed to Head of Health Economics, Advanced Analytics and Policy Modelling to incorporate what my team does.

12. I was seconded within Welsh Government (a secondment within a secondment) to the Technical Advisory Cell (TAC) on around 20 March 2020 as they were looking for people with experience of disease modelling. My role evolved to be around being the

conduit for modelling, and commissioning modelling from Swansea University, but with a continued focus on health economics and health inequalities.

13. The first versions of models that had been apportioned for Wales had been produced before I joined TAC, and there was a process where modelling gradually moved from being undertaken by Public Health Wales (PHW) to being undertaken in the Welsh Government.

14. I also attended Technical Advisory Group (TAG) meetings and became a member of TAG from around March 2020, mainly to talk about modelling but also other issues that I had expertise in such as evaluation, evidence review and health inequalities. TAG typically met twice a week during the first months of the pandemic, reducing to once a week later on.

15. I was for most of the time period from when the groups were established (30 March 2020 for national modelling forum; 14 May 2020 for policy modelling subgroup) chairing the policy modelling subgroup and the national modelling forum, with Craiger Solomons chairing these groups sometimes, usually if I was not available. I deputised for Jonathan Price (Chief Economist) as chair of the socioeconomic harms subgroup (first meeting 23 July 2020), so I was deputy-chair of this group. I exhibit its terms of reference as **M2B/TAG/BC/01/2-INQ000239532**, dated 3 September 2020.

16. The purpose of the national modelling forum was to agree consistent and coherent methods and messages around Covid-19 models for use in Wales by the Welsh health services. It was attended by senior planning officers and analysts from Health Boards including the Welsh Ambulance Trust. It had quite a wide membership (I would guess around 50-70 people at the peak of the pandemic) and was a dissemination and discussion group for sharing after new modelling scenarios had been produced.

17. The policy modelling subgroup coordinates modelling to support Welsh Government policy and decision making and intelligence, such as Reasonable Worst Case (RWC) modelling scenarios and other data-driven surveillance activities. It was chaired by myself and attended by Professor Mike Gravenor and colleagues from Swansea University, and other academics in Wales who were working on Covid-19 related questions. It has a smaller membership than the national modelling forum (around 10-20 people attending) and includes a lot of people from the Welsh Government team as well as representatives from PHW. It was more of a working group around agreeing

and producing the model scenarios which would then be shared with the national modelling forum and other groups, but we would still accept and act upon comments from the national modelling forum.

18. My exposure to Ministers was minimal for around the first 9-12 months of the pandemic, then I was gradually brought into more discussions with Ministers – mainly the First Minister and the Minister for Health and Social Services, in terms of the modelling position. Such discussions would typically take place prior to the formal Cabinet meetings and would be on Microsoft Teams. These discussions were generally at times when the CMO would be providing his update to Cabinet, which usually coincided with the 21 day review cycle in Welsh Government. Sometimes I would present at these pre-Cabinet discussions, as mentioned, in relation to the modelling position. I am not aware if these discussions were minuted.

19. I occasionally attended other TAG subgroups (e.g. Virology and Testing, Children's etc) depending on my availability and where modelling was being used – we had **Name R** **Name** from our TAC modelling team attend the risk communication and behavioural insights (RCBI) group as it was important to consider behavioural insights in any mathematical modelling and we had regular conversations with **Name** from that group.

20. I think that the approach of TAG providing advice to the Chief Scientific Adviser for Health for Wales (CSAH) (Dr Rob Orford) and the Chief Medical Officer for Wales (CMOW) worked well and we had constant dialogue. I think the approach worked well in terms of providing advice to Ministers. We worked well with PHW Communicable Disease Surveillance Centre (CDSC) and they provided a lot of the data we used for modelling, either in-house or commissioned from Professor Mike Gravenor and his group at Swansea University, or SPI-M-O (Scientific Pandemic Infections group on Modelling) academic modelling groups.

21. I think that TAG and its subgroups took a lot of notice of international perspectives, for instance we were constantly monitoring data for other European countries to look at trends in cases, hospital activity and particularly when we considering the likelihood of a second wave after the first wave had subsided in Summer 2020. We were looking at policies from different countries and how effective they were. I was constantly looking at trends from other countries and estimated Rt numbers over time. TAC had an international subgroup stood up on 15 September 2020 chaired by Dr Robert Hoyle.

22. I was not involved in scientific advice before the pandemic so I don't know what the processes were for commisioning, e.g. from the Welsh Government Office for Science. Before March 2021, TAC did not have a formal commissioning process for TAC advice but would take commisions from a range of groups and individuals.

23. Welsh Government published TAC summaries and other outputs on the Welsh Government website as they were produced. TAC responded to requests from Ministers and policy officials from different departments in the Welsh Government (e.g. health, education etc). From March 2021 TAC had a pro forma that was completed. Aside from this, TAC members and subgroups could also 'follow their nose' and produce analysis that they thought was important, without needing a formal commission. For instance, we produced the paper on social value of a Covid-19 case without it having a formal commission, which I exhibit as **M2B/TAG/BC/01/3-INQ000239572**, dated 20 August 2021.

24. I agree with the statement from Dr Chris Williams[1] that processes were initially less well developed, then became more formal as time went on. I think this was in part because TAG was being asked for advice on a lot of detailed policy questions and could not respond quickly enough to the demands.

25. I think having robust prioritisation processes meant that we were spending our time on the most important questions, and not on more trivial questions or those that could be decided by policy makers themselves without needing advice from TAG.

26. I agree with the statement from Professor Robin Howe[2] about policy owners commissioning advice and difficulties sometimes with turning a policy question into a science question. Part of my role was to act as a conduit to turn policy formulations into modelling scenarios, and in the opposite direction, to explain model outputs to policy makers and I think we did quite well at this.

27. In general I think the questions asked of TAG were the right ones, and Ministers and policy officials in the Welsh Government had a good scientific mindset. I think sometimes the expectations from what modelling could provide were too great, for instance being able to model the difference between complex formulations of schools

[1] INQ000183834
[2] INQ000183865

being open certain days a week or having separate cohorts which we were being asked a lot around January 2021.

28. I do not feel TAG were limited by the framing of questions or commissions; we were encouraged to also use our own instincts if there was something that warranted investigating, even if it had not been commissioned; subject to workforce capacity and data limitations. We were able to provide advice on things that had not been specifically commissioned and were able to refine questions. Part of my role and others in my team was to turn questions from policy makers into mathematical models.

29. I agree with Dr Chris Williams[3] that sometimes the same or similar requests might be given to different groups and for future pandemics it would be good to have better co-ordination of data, intelligence, research and modelling requests. But I don't think this was a major issue, and often it is good to have triangulation of results between different groups, particularly if results have been generated very rapidly and with incomplete data or a lot of assumptions. This was the approach that SPI-M-O (Scientific Pandemic Influenza Group on Modelling, Operational sub-group) would have, where often several groups would answer the same or similar questions.

30. TAC / TAG tried to have feedback loops from policy makers to ensure that advice was being used; for instance TAC officials would listen to Welsh Government Cabinet discussions to understand how Ministers were using the advice; this was also to ensure TAC / TAG were focusing on the most important areas to influence policy.

31. I always tried to inform the policy modelling group about how the work had been used, for instance the modelling of the October 2020 firebreak, or scenarios for the Omicron wave in winter 2021-22. Often policy decisions were made very quickly so we did not always inform people on the groups before they had been made, but we would inform them of how work had influenced these decisions. The socioeconomic harms subgroup produced some broad documents and maybe we should have done more to inform the group how these were used to inform policymaking, but sometimes it is not possible to pinpoint how one document informs policy when there are lots of potential influences. We always tried to thank members for their input and tell them how it had been used.

[3] INQ0000183834

32. In terms of the interaction of TAG with SAGE, I think the TAG chairs are best placed to answer this. My interactions with SAGE were minimal, limited to observing a small number of meetings, usually when the TAG co-chairs were not available. I was not there to observe whether TAG chairs had enough opportunity to provide challenge. In terms of subgroups, I attended SPI-M-O meetings and chaired our Wales policy modelling subgroup, and we had a four nations (England / UK, Wales, Northern Ireland, Scotland) modelling group that met from around Spring 2020 to around Spring 2022 during the pandemic, with a revolving chair, that SPI-M (Scientific Pandemic Infections group on Modelling) secretariat attended and took back questions to SPI-M-O where there were specific questions identified by devolved governments. I think there was sufficient communication but it would have been good to have a more clear relationship with the modelling groups who provided modelling for SPI-M-O so that Wales and other UK nations were routinely included – this happened a lot of the time but not all the time. For future pandemics, I think it may be useful to have a memorandum of understanding that Wales and other devolved administrations get access to all relevant SAGE subgroups including access to papers.

33. I agree with Dr Christopher Johnson[4] that information sharing is key in a pandemic and I think in future there needs to be a robust process for sharing information and intelligence with partners, but overall I think that information sharing in Wales worked well, given the challenges of quickly standing up data collection and sharing processes and structures. We had a lot of meetings with PHW that I was involved in, including HPAG (Health Protection Advisory Group), Covid-19 intelligence cell, TAG and subgroup meetings, and Strategic Coordination Groups (SCGs).

34. For the subgroups I was involved in (policy modelling, national modelling forum, socioeconomic harms), I felt like there was a lot of challenge and where I was chair, I deliberately tried to include different voices to avoid groupthink. I think there was always more we could do to optimise the balance of voices on the group and have challenge from different areas – I think we should have had more expertise on the group around social care for instance.

35. We had quite a few behavioural scientists on TAG and its subgroups, including some very eminent in their field and who were also on Independent Scientific Pandemic

[4] INQ000183826

Insights Group on Behaviours (SPI-B), including Professor Ann John who became chair of SPI-B.

36. I think people on TAG are experts in their fields and we had clear roles of people to ask specific questions, but we didn't want to limit people only to their known field of work.

37. As someone who was involved inside the Welsh Government I thought the resources provided to TAG members were sufficient but I am sure that people outside of the Welsh Government might have had a different experience. I was very aware that often they were not given much time to read papers before the meeting, but we would invite comments after the meeting as well.

38. For future pandemics I think it would be good for Welsh Government analysts to work more closely with data owners such as Public Health Wales and Digital Healthcare Wales (DHCW) (formerly NWIS) to have direct access to data to inform modelling and decisions. Whilst I would not say that issues were necessarily caused as a result of not having direct access to data during the pandemic (because in general PHW and DHCW were (and still are) quick in responding to data and intelligence requests from Welsh Government) having direct access to data would, of course, allow us to access it at a quicker pace overall. In addition, having direct access to data would allow us to look in a more granular way at testing data, or to look at data by occupation, deprivation, ethnic group or other vulnerable groups like prisoners, homeless people etc as potential questions arose about what was happening in such areas with the pandemic. For example, having data such as the number of confirmed cases of Covid-19 in deprived areas from the beginning of the pandemic could, in my view and for example, have given us more of an understanding of health inequalities at an earlier stage. Another example is occupation data in people hospitalised with covid-19, which could be used to better inform modelling and decisions as to the allocation / distribution of PPE in the future. This is not of course to suggest that PHW / DHCW had all of such data to begin with (and in general data was understandably sparse at the beginning of the pandemic) but it could be that this is an area for improvement, and that such data could be tested and analysed to better inform policy decisions in the future. I exhibit as **M2B/TAG/BC/01/4-INQ000177534** (dated 1 December 2022) the DHSC's "Technical report on the COVID-19 pandemic in the UK" which makes recommendations around data. For instance in Chapter 4, within the section entitled "Reflections and advice for

a future CMO or GCSA" it is stated at Point 2 (see page 158) that "Data sharing and linkage is essential from the outset."

39. I think it is important to have data to try to model the balance of harms – direct and indirect health harms, economic harms, educational harms etc. Whilst I think we were limited by data and capacity during the pandemic, we tried to do this and published our findings. For example: "Five harms arising from COVID-19: Consideration of potential baseline measures", dated 9 July 2021 which I exhibit as **M2B/TAG/BC/01/5-INQ000239550**; and "The potential risks and benefits of removing restrictions in a phased approach to mitigate the impact of harms from Covid-19 in Wales", dated 5 March 2021, which I exhibit as **M2B/TAG/BC/01/6-INQ000239546**. I think some of the criticism of the emphasis on modelling in the pandemic is not only around the uncertainty of modelling, but also that it was nearly always modelling the direct Covid-19 harms only, not modelling economic, educational harms or displaced NHS activity. In Welsh Government we attempted to include this in decision making, for instance in our policy modelling paper for December 2020 and January 2021 we estimated the monetary benefits and gross value added (GVA) losses for different scenarios of restrictions. I exhibit this as **M2B/TAG/BC/01/7-INQ000066298**, dated 18 December 2020. There was also a United Kingdom Research and Innovation (UKRI) funded research project led by Dr Alma Rahat from Swansea University around the balance of harms which was a longer-term project but will hopefully report some results in 2023 or 2024.

40. I was not involved in any WhatsApp or other messaging groups that discussed the pandemic or Government business and I did not know of any such groups.

Early stages of the pandemic

41. I first became aware of Covid-19 in early January 2020 with reports from China of potential new respiratory illnesses – I think this was from the World Health Organisation.

42. I was not involved in Covid-19 work until March 2020.

43. I did not liaise with UK counterparts until I joined TAC / TAG in March 2020. After this time, we had regular contact with SPI-M secretariat, and colleagues in Scotland (e.g. Mel Giarchi) and Northern Ireland (e.g. Declan Bradley).

44. I did not have any contact with international organisations before March 2020.

45. Before March 2020 I was focused on other work and understanding how Welsh Government worked, although I had some very limited email contact with academics about potential economic impacts of the pandemic – Professor Rich Smith from Exeter University who had been involved in the economic impacts of the pandemic preparedness work in the 2010s.

46. I was not aware of discussions around asymptomatic transmission, until I produced the first Covid-19 model on 25 March 2020, when we assumed 50% of infections were asymptomatic. I exhibit as **M2B/TAG/BC/01/8-INQ000239483**, a report entitled "Modelling Primary Care Cluster Vulnerability to Covid-19", dated 1 April 2020 (version 4), which said:

> *There is debate around what proportion of cases are symptomatic. For Iceland, around 50% of tested individuals were symptomatic, whereas in Italy, around 6% were asymptomatic, 9% had few symptoms and 45% had mild symptoms. Some evidence from China and the Italian town of Vo suggests a higher proportion of asymptomatic cases.*

I was not aware of a time when we thought there was *not* any asymptomatic transmission.

47. My involvement in TAC / TAG came through my Welsh Government role rather than through my University of Liverpool post. I became more involved in Covid-19 work when **Name** a trainee GP and trainee public health consultant, contacted me asking to do a model of primary care impacts (at primary care cluster level) which I put together based on the NHS England scenarios – which were based on the early Imperial scenarios. This was how I got involved in TAC / TAG and a few days later, Craiger Solomons came on board as well. Craiger and I jointly led the analytics and modelling team as it developed. I think we worked together well as Craiger had more experience of working in Government and with Knowledge and Analytical Services (KAS) in the Welsh Government, and I had more experience of being in academia and more technical modelling knowledge. But I think it is true to say that we both had a steep learning curve in the first few weeks, but would call upon experts in academia and Public Health Wales to fill gaps in our knowledge. Soon **Name Redacted** who was an analyst from KAS, and a small team (typically 5-8 people) of other analysts, data

scientists and researchers came in to support us, often working very long hours. Our email and file storage systems within Welsh Government were very slow and difficult to work with when working from home on multiple documents and presentations at the same time, which made things difficult sometimes – some of these issues have since been improved. When Craiger was no longer in the role, Name Redac stepped up to be my deputy until she left Welsh Government in May 2022.

48. TAG would aim to reach a consensus on their advice. There was a lot of debate about some issues, for instance, face coverings for the general population.

49. I was not involved in discussions around large events in March 2020.

Infectious disease modelling

50. As stated earlier, I am not an expert in infectious disease modelling. My expertise is in health economics and data science. But I will briefly outline some of what I know about infectious disease modelling.

51. Infectious disease modelling is used to predict and explain trends in infectious disease epidemiology, and to estimate the effects of interventions. For instance, to understand what factors predict the spread of infectious diseases, or to understand the seasonal cycles for some infectious diseases, to estimate the serial interval (the time between symptom onset of a primary and secondary case) or the R0 number, to understand the impact of mutations in infectious agents, or to estimate the impact of interventions like case isolation or vaccines.

52. Infectious diseases involve an infectious agent interacting with a host. The process of developing infectious disease models is highly iterative and may take years and involves identifying a question, looking at existing knowledge, choosing model structure and methods, model quantification, model validation, prediction and optimisation, decision making, and model transfer.

53. The most commonly used infectious disease model is a compartmental model, where hosts exist in one of a set of (normally mutually exclusive and collectively exhaustive) compartments. The most simple of these is a SIR (susceptible – infected – recovered) model. This type of model can be 'solved' using simultaneous equations. This can be made more complex with additional compartments for hospitalised, deceased,

reinfected, vaccinated, etc. In terms of health economics, costs of treatment, as well as productivity losses and informal care can be added to different parts of the model. Estimates of quality adjusted life years (QALYs) can be added as well. Quality adjusted life years are a summary measure of length of life and health-related quality of life that are used for prioritising health investments, for instance by NICE.

54. During the pandemic, I was responsible for adding health economics outcomes (e.g. costs of admissions, quality adjusted life years, etc) to the Swansea University model. I completed a similar task for a model of mass testing in Merthyr Tydfil in around December 2020. This was published in an academic paper entitled "Cost-effectiveness of a whole-area testing pilot of asymptomatic SARS-CoV-2 infections with lateral flow devices: a modelling and economic analysis study", dated 22 September 2022, which I exhibit as **M2B/TAG/BC/01/9-INQ000239580**.

55. Having my expertise in TAC meant we were well placed in Wales to include economic outcomes in our models. To my knowledge, other models that were produced for SPI-M-O and SAGE did not typically have these kinds of outcomes. Ideally we would have included more sensitivity analysis for outcomes where we were more uncertain; for instance the QALY losses for long covid were very uncertain. We would have ideally included more costs, for instance productivity losses, informal care costs, and possibly indirect health harms – the costs of displaced NHS activity.

56. A paper we produced on average social cost per Covid-19 case (exhibited above as **M2B/TAG/BC/01/3-INQ000239572**) was shared with colleagues from SAGE which I think was influential in understanding how the average social cost had changed over time. The value of a QALY makes a huge difference to this cost estimate – UK Treasury value QALYs at £70,000 (recently uplifted from £60,000) whereas NICE recommend NHS treatments when the cost per QALY is between £20,000 to £30,000 (although the NICE threshold is higher than this in some situations).

57. Another commonly used model is an agent-based model. Agent-based models include interactions between individual agents (for example, humans, and sometimes interactions between pathogens like viruses or vectors like mosquitoes). Agent-based models may produce more reliable results because they better represent the transmission dynamics for infections, especially where mixing between groups is not homogenous and patterns of behaviour vary. So an agent-based model is particularly useful where a disease is most common in certain groups (for instance a certain age

group) or spread in certain settings. For instance, in the Mpox (previously known as monkeypox) outbreak, which started in Europe in Summer 2022, much of the initial spread was between men who have sex with men, so an agent-based model that accounted for contacts within this group and then the potential of spread from a smaller group to the general population, would possibly work better than a compartmental model. But it is also possible to produce a good compartmental model for one subgroup of the population. It is also possible to add health economics outcomes to agent-based models.

58. During the Covid-19 pandemic, data on mobility (for instance from Google or mobile phone networks), and data on mixing (from the CoMix social contact survey) was useful in informing models, to understand where people were spending their time and how they were mixing. Data from contact tracing was also used for this. There is potential to use novel data like web symptom searches or even online Yankee Candle reviews – if people cannot smell their candles it might indicate anosmia, a symptom of Covid-19.

59. Models typically have a set of input parameters which will vary depending on how the model is structured but will commonly include inputs such as population size, R0, serial interval, attack rate, duration of immunity after being infected, etc. It is possible to carry out structural sensitivity analysis where the structure of a model varies and see how this effects results, or to try to model the same outcomes and time period with different types of models or different software (e.g. R, SIMUL8, Excel).

60. When carrying out modelling I have generally referred to ISPOR (The Professional Society for Health Economics and Outcomes Research) guidance on modelling (for instance Briggs et al., "Model Parameter Estimation and Uncertainty: A Report of the ISPOR-SMDM [Modelling] Good Research Practices Task Force-6" (dated 2012) which I exhibit as **M2B/TAG/BC/01/10-INQ000239581**.

61. Probabilistic models have an element of uncertainty for input parameters so that results can be presented with uncertainty intervals or prediction intervals. The model may be run multiple times (e.g. 1000 times), each time randomly sampling from the distributions, to give a range of results. So a probabilistic model might have a probabilistic sensitivity analysis and say that in two weeks, the number of infections would be 3000, with a 95% uncertainty interval of 1800 to 5000. For economic models this may report the probability of an intervention being cost effective based on different

levels of willingness to pay (e.g. willing to pay £10,000 or £20,000 or £30,000 per quality adjusted life year gained) – which may be shown on a cost effectiveness acceptability curve (CEAC).

62. Probabilistic models require data on the distribution of different variables – for instance secondary attack rate, R0 etc. Ideally this comes from primary data (e.g. from hospitals or contact tracing) or it might come from expert opinion which might be elicited using methods like DELPHI methods. Early in the pandemic, there was a lack of such data. So it can be argued that producing probabilistic models at this time was very difficult. However a counterargument may say that this is precisely when probabilistic models should be used; to make it clear that the uncertainty of the outputs was extremely high.

63. Some models will include parameter uncertainty and stochastic uncertainty. Stochastic uncertainty is the random variability when an experiment is repeated under the same conditions. Even with perfect information, there remains an amount of stochastic uncertainty. Stochastic models are particularly important for outbreaks with small numbers where the impact of chance occurrences might outweigh the impact of variation in better-known parameters (e.g. Cooper et al., exhibited as **M2B/TAG/BC/01/11-INQ000239582**, dated 1999).

64. In terms of showing uncertainty, I think tornado charts which are used a lot in health economics are a good way of indicating which input parameters are responsible for the most uncertainty, although they are only based on one-way sensitivity analysis. This may then guide 'value of information analysis' to understand the economic value of having more precise data about a potential input parameter, which may guide investment decisions about commissioning research. Also as a method, Cholesky decomposition looks at how different input parameters are correlated, which may reduce the uncertainty; whereas often it is assumed that input parameters are independent, which may inflate the uncertainty.

65. Deterministic models have a fixed value for each parameter. If you rerun a deterministic model, you get the same results every time. They do not produce uncertainty intervals but uncertainty can be explored through scenario analysis, so there might be a scenario with R0 = 2.2, one with R0 = 2.4, one with R0 = 2.6 etc. The results are simpler to interpret than probabilistic or stochastic models but can possibly suggest an artificial sense of certainty that the results are the only possible results. The word deterministic in describing models only means that they are based on fixed

parameters, it doesn't imply a belief that the world is deterministic or imply anything about the relationship between actions and outcomes.

66. In terms of computer processing time, deterministic models are generally a lot faster to run, so for already quite complex models, this may be preferable, especially if results are required quickly, as was the case during the pandemic. Although it is generally quite easy for academics in the UK to access very powerful computers so processing time is less of a reason these days. However, probabilistic / stochastic models certainly take a lot longer to develop and validate than deterministic models and may be more likely to contain errors simply because they may have hundreds of input parameters and distributions.

67. During early stages of a large disease outbreak, there will be a first few hundred (FF100) type study – as happened with Covid-19, that describes symptoms and outcomes, that would be useful for providing input parameters for modelling. For instance as described in this paper, entitled "Epidemiological and clinical characteristics of early COVID-19 cases: United Kingdom of Great Britain and Northern Ireland", exhibited as **M2B/TAG/BC/01/12-INQ000239583**, dated 30 November 2020.

68. I do not think that the adaption of SPI-M-O models for Wales based on UK data early in the pandemic particularly increased the uncertainty for Wales, because at that point in time, the uncertainty around key model parameters like R0, Rt, serial interval, asymptomatic cases, infection-hospitalisation-rate (IHR), infection-fatality-rate (IFR), proportion of cases requiring ventilation etc was much greater than any difference that would be caused by differences between Wales and the England or UK population, such as age, deprivation, rurality etc. As more certainty emerged about other model parameters, then it made more sense to have Wales-specific models, and it became more important when Wales was going to pursue different policies than England and had a different proportion of the population who had been infected. In this I agree with Professor Gravenor's statement[5] .

69. The Inquiry has asked about TAC advice summaries in 2020, in which several state that there was evidence of small variations in Rt between different nations of the UK, and that there was more uncertainty in the estimates for Scotland, Wales, and Northern Ireland, partly due to the smaller number of cases and deaths compared to England.

[5] INQ000183861

Rt is the effective reproductive number, or the expected number of new infections caused by an infectious individual in a population where some individuals may no longer be susceptible. If Rt is greater than 1, then the epidemic is growing; if it is less than 1 then it is shrinking. So estimating Rt is important during a pandemic where infections can lead to severe disease and death. There are different ways of estimating Rt, using different data sources. We would rely on the consensus estimate of Rt that was produced for SPI-M-O by a range of academic modelling groups but there were times when we thought this did not reflect what we were seeing, for instance not being fully corrected for different time lags for different data sources which would bring the Rt estimate nearer to 1. So in general I felt like the Rt estimate would be too low when we were on an upcurve, and would be too high when we were on a down curve. But I did not feel like this caused us particular problems or changed our decision making as we were always using a range of data at any time, not simply the Rt estimates. The Rt estimates produced for SPI-M-O would be based on a range of data including cases, ONS (Office for National Statistics) infections, hospital admissions, deaths, and CoMix social contact survey data.

70. Because there were generally fewer cases and hospital admissions (in terms of absolute numbers) in Wales than in England, the estimation of Rt was always subject to more uncertainty than the England estimate. This is because there will always some random noise (stochasticity) alongside the measurable trends in outcomes.

71. PHW also produced an estimate of Rt using hospital admissions that was useful because it was usually more recent than the SPI-M-O estimate so would give an early signal if pressures were falling or increasing. Hospital admissions are more likely in older age groups so if transmission was increasing more in younger age groups, as often happened at the start of a wave, this might not be reflected well in an estimate of Rt based on hospital admissions.

72. Sometimes when looking at model scenarios, we would look at a very crude estimate of Rt which was basically the difference in cases (or other outcomes) over seven days divided by the cases five or six days earlier, where five or six days was a rough estimate of the serial interval.

73. The ONS survey started in Wales in June 2020 with first report on 7 August 2020 and provided richer data on incidence and prevalence of Covid-19 so this was useful in estimating Rt and had a good sample size for Wales.

74. Models should not be relied upon to provide accurate forecasts or predictions, particularly during a pandemic with a novel pathogen. I agree with the aphorism "all models are wrong but some are useful" – I think that models during the pandemic were useful, both in informing policy decisions and in helping the NHS and other partners to prepare. Without mathematical models, people would still have mental models of what they thought might happen – mathematical models simply allow us to make our assumptions explicit and discuss them and find consensus where possible, and test them with sensitivity analyses. Models aid policy decisions both in terms of increasing protections or imposing restrictions when cases are increasing rapidly, but also estimating that we are close to the peak, and thus identifying a situation where restrictions may not make much difference to the epidemic curve and we should wait it out.

75. The Inquiry has asked if I agree with Professor John Watkins' statement that TAG policy decisions were driven by modelling scenarios, as if they were predictions, rather than rational evaluation, based on broader views, around infectious disease epidemiology, immunology, viral genetic drift etc – I do not agree with this statement. Firstly, TAG only provided advice, we did not make policy decisions. Secondly, TAG advice was based on a range of data and modelling and considering a range of harms – not simply Covid-19-related harms, and advice was not simply based on modelling, which was always presented as being uncertain, and was always presented as scenarios rather than predictions. Modelling was used most often when cases were increasing; even without modelling, there would most likely be a policy response considered when cases were increasing rapidly. Professor Watkins was on our policy modelling subgroup and provided really useful input and challenge, but he was not on the main TAG so maybe Professor Watkins had a slightly distorted view of advice processes because I would mainly feed back to the modelling group on how modelling had informed advice rather than the whole process. We are really grateful to Professor Watkins for his contribution to the group.

76. So to summarize; I don't think there was an over-reliance on modelling during the pandemic, certainly not within Welsh Government. I think that models should have ideally included wider impacts beyond direct harms more than they did. I think there were times when modelling got things wrong, particularly during the Omicron wave, when most of the scenarios from SPI-M-O were much more pessimistic than what actually happened and this may have contributed to imposing restrictions in Wales that were ultimately not fully necessary. But this outcome might simply be because we got

lucky that Omicron was less intrinsically severe than previous variants – it is not always the case that severity is inversely correlated with infectiousness. The predictions were correct in that Omicron definitely infected a huge proportion of the population, and some of the concerns were not simply around admissions and deaths but around the number of public sector workers who might be off sick at the same time, increasing indirect harms. It is easy to say what the correct decisions are when looking backwards in time.

77. I was not involved in the decision to use the Professional Head of Intelligence Assessment (PHIA) probability yardstick in advice given to the Welsh Government, but I think it is useful for decision makers, in suggesting how certain we are about different statements in scientific advice. There is still an element of subjectivity in how we use this, and we would generally have several people to look over and see if they agreed with any individual assessment with the PHIA yardstick.

The timing of the first national lockdown

78. I think the first national lockdown was necessary. I think it would have been better to introduce it a bit earlier and this may have saved lives but appreciate it was a radical step for a society that had not had a lockdown before, and it was not in pandemic planning. It was a complex process ensuring that it could be implemented and policed, including providing economic support for people like the furlough scheme. I think lockdown was necessary to buy some time to understand what was happening and to provide time to develop mass testing and in the longer-term, vaccines. The lives saved by protection measures were saved because of the rapid development of vaccines, as well as to a lesser extent, better treatment of severe Covid-19. If we were still in a position now in 2023 with no vaccines or effective treatments, then it could be argued retrospectively that lockdowns were not the right policy, because it is likely that a high proportion of people have been infected at least once with Covid-19 by now, although there would still be the effect of flattening the curve and avoiding overshooting the herd immunity threshold due to rapid transmission.

79. I think it was necessary that a four nation approach to the first lockdown was taken; there were benefits of a four nation approach to restrictions – people in Wales get a lot of their news from English media, and having a consistent approach meant that the virus was being suppressed in all four nations at once. It also prevented people travelling to places with less stringent restrictions.

80. I am asked by the Inquiry about a TAC CMO briefing note (dated 20 March 2020), in which TAC suggested that there was an increased risk of NHS capacity being breached. I was not involved in the TAC CMO briefing produced on that date.

81. I was not around enough senior level conversations to be able to comment on the desire of Welsh Government officials or Ministers to avoid the first lockdown as I only joined TAC around that time. They were definitely keen to avoid future lockdowns. From our TAC perspective we knew that a lockdown was a radical step to take, but in my thinking, was necessary to save lives and prevent the NHS from being overwhelmed.

82. I am asked by the Inquiry when (if at all) myself or my team first modelled a lockdown in Wales before 23 March 2020. We did not model a lockdown ourselves in Wales before 23 March 2020. In terms of initial modelling of the 23 March 2020 lockdown, we took the Imperial College London modelling (Ferguson et al., exhibited as **M2B/TAG/BC/01/13-INQ000239509**, dated 16 March 2020) and apportioned it for Wales only based on different scenarios of 25%, 50%, 75%, 100%, of the size of the reasonable worst case.

83. As far as I know, there was agreement between Wales TAG and SAGE in terms of their advice about the need for a lockdown. I think initially the talk was for a lockdown for London, then this moved to a national lockdown, as fears about the doubling time across the country increased.

84. I wasn't involved in TAC / TAG until a few days before the first lockdown was implemented. I think the plan was to introduce NPIs as necessary but the plan changed when it was realised that cases were doubling much more quickly than previously thought – I think it was **NR** from Manchester University who first noticed this.

85. I think it would have been better to implement the first lockdown sooner but I understand to an extent why this did not happen; it was a radical step which changed the structure of society, and there was uncertainty at that time around the scale of what we were facing in terms of Covid-19 harms. I cannot precisely quantify how many lives might have been saved by implementing the lockdown earlier; we also had shielding, older people being cautious, and more deaths in the second wave (around November 2020 – February 2021) than the first wave.

86. Overall I agree with the former Minister for Health and Social Services in Welsh Government, Vaughn Gething, that an earlier lockdown would have saved lives, but it is difficult to quantify how many lives. There is a paper by Knock et al., exhibited as **M2B/TAG/BC/01/14-INQ000239584** (dated 22 December 2020) that estimates that lockdown one week earlier in England would have saved around 21,000 lives in England in the first wave; some of these people may have died from Covid-19 in the second wave but these people would still have gained six to nine months of life.

April 2020 onwards

87. I think our aims in managing the pandemic after the initial lockdown were clear to TAC and TAG in terms of trying to keep Rt below 1 (i.e. stop the epidemic from growing), reducing mortality, and reducing inequalities. As lockdown was released, testing and contact tracing were stepped up. Our objectives became clearer over time as we moved to the 'Four Harms' which became the 'Five Harms' when a fifth cross-cutting harm of inequalities was added.

88. I don't think the idea of 'behavioural fatigue' featured in our thinking for Wales. At the time it was refuted by behavioural scientists, but I think some of the thinking behind it may have some merit as an idea even if the term 'behavioural fatigue' was not used by behavioural scientists and it did not have a theoretical basis. For instance, I think there is evidence that the longer restrictions lasted for, people's mobility increased which may indicate a level of fatigue with adhering to restrictions, but we cannot be certain of whether that increased activity was permitted within the restrictions or not – it might have been an increase in permitted activity.

89. I was not involved in advice around discharging asymptomatic patients to care homes in March and April 2020.

90. I do not think TAG were consulted about 'Eat Out to Help Out'. I think 'Eat Out to Help Out' should have not been implemented or it should have been restricted to outdoor dining only. I do not think it made a huge difference to the second wave, with cases being quite flat in a lot of places during August, and I think some of the effect of 'Eat Out to Help Out' was moving people from having meals at weekends to during Monday to Wednesday when the policy was in effect, which may have spread out demand rather than increasing aggregate demand.

91. TAC's list of circuit breakers / early warning indicators from July 2020 is shown in this report published online on the Welsh Government website, exhibited as **M2B/TAG/BC/01/15-INQ000228030**, dated 10 July 2020.

92. I understand modelling advice from TAC has been shared with the Inquiry previously. This includes modelling of lockdowns and other restrictions, including local restrictions, closure of schools and educational settings, modelling of contacts around election time, and modelling of the Wales Test Trace Protect (TTP) programme. Later models included different scenarios around vaccine effectiveness and uptake.

93. The Inquiry has drawn my attention to (and asked me to comment upon) a TAC advice summary (dated 11 September 2020) in which advice was given by TAG that cases were increasing (in a similar way to February) and that action should be taken to prevent significant harm arising from Covid-19 (or another full lockdown), and that the SAGE estimate for the R number for Wales (between 0.7 and 1.0), was lower than the actual R number at the time.

94. In September 2020, we thought that the SAGE estimate of the R number was lower than the true R number in the population because cases had accelerated since the SAGE estimate was produced. More broadly, the SAGE estimate was a weighted average of estimates based on cases, hospital admissions and deaths. Hospital admissions and deaths were lagged indicators that typically followed increases in cases, but also a higher proportion of cases were initially in younger people who would be much less likely to be hospitalised or die; so were not reflected in those data. What followed in October – December 2020 was that cases moved from being in younger people to being in older people who were at higher risk of severe outcomes.

95. We discussed the return of university students after summer 2020 and potential for increased transmission but did not publish any modelling on this. I think an academic group working with SPI-M might have produced something on this. Later in the pandemic, Thomas Woolley and NR from Cardiff University produced modelling around transmission in education settings including universities which was shared with policy makers, which I exhibit as **M2B/TAG/BC/01/16-INQ000239585**, dated 30 November 2021.

96. The Inquiry has also drawn my attention to further TAC advice summaries (dated 18 September 2020, 25 September 2020, and 2 October 2020) and asked for my

comments. At the time the TAC advice was produced in September (including the advice given on 11 September, discussed above) and October 2020, I was not briefing senior decision makers and Ministers as much as I was later in the pandemic, so I do not have a good idea of how seriously decision makers were taking the situation. As far as I know (e.g. from feedback from Rob Orford and Fliss Bennee) Ministers and Directors General were taking it very seriously and that was reflected in the decision to implement the firebreak on 23 October 2020, which I can imagine was a difficult decision for Ministers to take before UK Government had announced or implemented a second lockdown. I think that the situation in September to October 2020 was getting worse but then it was compounded by the emergence of the Alpha (B.1.1.7 or Kent) variant which contributed to the second wave ultimately being worse than the first wave in terms of hospital activity and deaths.

97. To aid clarity, it is worth saying that around this time, a firebreak lockdown was sometimes referred to as a 'circuit breaker' by SPI-M and SAGE but we also had our own set of indicators we called 'circuit breakers'.

98. We asked Professor Gravenor and his colleagues at Swansea University to model a firebreak lockdown in early October 2020 and they provided initial model results on 14 October 2020. These were published on the Welsh Government website in our 'firebreak' paper, dated 19 October 2020, which I exhibit as **M2B/TAG/BC/01/17-INQ000239571**.

99. I think the Welsh firebreak and third national lockdown should have been implemented sooner. The October firebreak lockdown in Wales was very effective – you can see this clearly in the data. It would have been more effective if it was longer or if the restrictions after it ended were stronger, or if the firebreak lockdown was implemented at the same time across four nations. The following is based on my understanding of what happened, but I am a Grade 6 so was not there for the most senior level conversations. I think some of the debate around imposing the firebreak and the length of it was around financial support for individuals and businesses. For instance, the UK Prime Minister only announced an extension to the furlough scheme on 31 October 2020, the day it was due to end, which was after the Wales firebreak had started and Welsh Government had been clear that it would be implemented only for the time period stated and would not be extended – Ministers did not want to break their word on this. So as far as I understood things at the time, it was really difficult to impose restrictions on a Wales-only basis for any length of time without this kind of financial

support and there was a lack of communication about policy intentions from UK Government.

100. I think around this time it was difficult to get people's hopes up too much about vaccines, but vaccine development and trials was moving at a rapid pace so maybe more information should have been shared on this – that we were close to having a vaccine programme to reduce deaths.

Socioeconomic harms

101. The socioeconomic harms subgroup had its inception meeting, at which we discussed the proposed terms of reference and the proposed membership of the subgroup, on 23 July 2020. There was another inception meeting on 11 August 2020, and the subgroup's first substantive meeting took place on 29 September 2020. The subgroup was chaired by Jonathan Price, the Chief Economist in Welsh Government, and as I explained above, I acted as the subgroup's deputy, and chaired meetings when Jonathan was unavailable. The subgroup took commissions from TAG and reported back into TAG. The terms of reference set out who was invited to the subgroup, previously exhibited as **M2B/TAG/BC/01/2-INQ000239532**. This group was by no means the only group of people who were looking at wider harms in Wales, and 21 day review advice was often published with impact assessments or assessments of wider harms. The 21 day review refers to the typical cycle at which decisions on protection policies were made by Welsh Government during the pandemic; so typically TAC / TAG would input into these decisions with the most recent data and modelling.

102. Much of the socioeconomic harms subgroup's work fell into 21 day reviews as well as subject specific reports.

103. The main reports to which the subgroup contributed are as follows:

    a. Five harms arising from COVID-19: Consideration of potential baseline measures, dated 9 July 2021, previously exhibited as **M2B/TAG/BC/01/5-INQ000239550**;
    b. The potential risks and benefits of removing restrictions in a phased approach to mitigate the impact of harms from Covid-19 in Wales, dated 5 March 2021, previously exhibited as **M2B/TAG/BC/01/6-INQ000239546**; and

c. High level summary of evidence on costs and benefits and potential mitigations for measures to address Covid-19 in Wales, dated 25 November 2020, which I exhibit as **M2B/TAG/BC/01/18-INQ000066302**.

104. These reports include qualitative estimates of the harms of different measures – it was not always possible to quantify them. Some of the impacts were quantified for England in this paper by DHSC and ONS which has since been updated, exhibited as **M2B/TAG/BC/01/19-INQ000239559**, dated 26 September 2021.

105. There was also a SAGE report on harms of NPIs that myself, Fliss Bennee and others in Wales contributed to, exhibited as **M2B/TAG/BC/01/20-INQ000239586**, dated 21 September 2020.

106. I think there was possibly a lack of timely, Wales-specific data to consider socioeconomic harms of NPIs, although we did have good data on some issues, for instance school absences. A lot of economic data is produced annually or quarterly so it is hard to line up next to mortality data, but there is some timely proxy data like credit card spending. In general, my modelling and advanced analytics team were focusing more on the epidemiological data, whereas other parts of Welsh Government would focus more on economic, housing, education, and other data.

107. The discussions from the socioeconomic harms subgroup informed TAG advice in relation to restrictions and was often used in TAC advice, including the advice prepared for 21 day reviews, but to my knowledge, the socioeconomic harms subgroup was not regularly, formally commissioned to provide specific input into 21 day reviews or to look at the impact of protections before they were implemented – these decisions were often made quite quickly and at a different rhythm to the meetings of the socioeconomic harms subgroup.

108. In terms of impacts on vulnerable groups and people with protected characteristics, my view is that the socioeconomic harms subgroup and TAG more widely attempted to make decision makers aware of these in our advice. Our capacity to do this was limited, considering that we were a relatively small team, but we tried to cover the biggest impacts that were observed during the pandemic. This was in contrast to SAGE, the work of which was very much focused on the purely epidemiological outcomes, rather than broader harms – I don't know if UK Government Cabinet Office or UK Treasury were looking at broader socioeconomic outcomes, but I did not see

these outputs. In terms of our work, I would refer, by way of example, to the papers on health inequalities that TAC produced: "Coronavirus (COVID-19) and Health Inequalities", dated 19 October 2020, which I exhibit as **M2B/TAG/BC/01/21-INQ000239542**; and "Science Evidence Advice Coronavirus (COVID-19) and Health Inequalities", dated October 2022 which I exhibit as **M2B/TAG/BC/01/22-INQ000239587**.

109. It is also worth noting the PHW Welsh Health Equity Status Report Initiative (WHESRi) report on Covid-19, entitled "Placing health equity at the heart of the COVID-19 sustainable response and recovery: Building prosperous lives for all in Wales", dated 2021, which I exhibit as **M2B/TAG/BC/01/23-INQ000239588**.

110. I was involved, as an advisory contributor, in the production of this report, which sought to map the wider social, economic and environmental impacts of Covid-19 in Wales, and to consider some of the key policy and mitigation measures that had been put in place in response. The socioeconomic harms subgroup had insight into the work that was being carried out by WHESRi while the report was still in production, through my own involvement as well as that of the other Welsh Government officials who also acted as advisory contributors to WHESRi, including the Head of Health Inequalities and Healthy Communities, **NR** who was a member of the subgroup. At the subgroup's meeting of 29 September 2020, **Name** presented on the policy analysis work that had been carried out as at that date, and I exhibit a copy of the PowerPoint presentation as **M2B/TAG/BC/01/24-INQ000353518** (dated 29 September 2020). I also exhibit the PowerPoint presentation from the subgroup's meeting on 10 May 2021, which summarised the findings of the published report, as **M2B/TAG/BC/01/25-INQ000353517** (dated 10 May 2021).

111. I also remember vividly a presentation that **Name** from the Welsh Government's Knowledge and Analytics Service (KAS), gave at the subgroup's meeting on 19 October 2020. This presentation summarised the work that KAS had carried out at that date to collect data about the size and characteristics of groups vulnerable to the impact of Covid-19. I exhibit it as **M2B/TAG/BC/01/26-INQ000350820,** dated 19 October 2020. This was certainly very influential in my thinking around the impacts of the pandemic on vulnerable groups.

112. There was also a presentation at the subgroup's meeting of 12 July 2021 by Professor Stephanie Van Goozen of Cardiff University on the psychosocial effects of the

pandemic, specifically the mental health impacts on vulnerable children and families. I exhibit a copy of that presentation as **M2B/TAG/BC/01/27-INQ000350821**, dated 12 July 2021.

113. It is also worth noting the report of the First Minister's Black, Asian and Minority Ethnic Covid-19 Advisory Group, which I exhibit as **M2B/TAG/BC/01/28-INQ000066078**, dated September 2021.

114. I tried to be the conduit between different groups so that the policy modelling group and the socioeconomic harms subgroup knew what each other were working on. Aside from the examples given above, it was not always possible to precisely estimate the socioeconomic harms of different strategies around NPIs. This was partly due to data and capacity; I feel like we did as much as we could, but we could have definitely done more with more data and more people working on it. It would have been good to have a group working on this with UK Government or on a four nations basis.

115. In terms of inequalities, PHW were also producing data on inequalities, but it would have also been good to try to model future inequalities in Covid-19 outcomes as well as describing them retrospectively – the Swansea University models were generally produced at age and local authority level, but were not necessarily robust enough to be used at that level, but gave reliable estimates when aggregate up to a Wales level.

Other matters and lessons learned

116. In future I think ideally having integrated models that include educational, economic, mental well-being and indirect health harms of different strategies is needed for decision making – possibly using methods like multi criteria decision analysis (MCDA), or distributional cost effectiveness analysis to balance value for money and equity impact of programmes to aid decision making.

117. I think TAG and subgroups should have published their advice earlier – same with SAGE. This would have aided transparency and public engagement.

118. Off-the-record technical briefings were attended by people like Rob Orford, myself and other analytical colleagues, and PHW colleagues, and often had a mixture of answering questions on the current situation, as well as explaining new pieces of work, for instance when we published our cumulative incidence paper. I think it worked well

for getting the key messages across for complex pieces of work and to give journalists the chance to ask questions. It was also useful for times like when the Omicron variant emerged, and there was a lot of uncertainty or there was a lot of emphasis being placed on data from South Africa, when we could not be certain that we would see the same picture in the UK.

119. In general I think that Governments should be more technocratic and use science more. But I think there is a potential danger of politicians saying they are 'following the science' because science is always evolving, and there is often a political decision to be made, which may be balancing some considerations that are not explicitly included in the science; and also depends on risk appetite. It could be argued that Welsh Government at times were more risk-averse than UK Government. Politicians often will be judged by their rivals, by the media, and by the public, on what happens at the end of it, rather than whether they took the best decision at the time, based on the range of possible outcomes. But sometimes the optimal decision does not produce the best outcome, and sometimes a politician takes a risky decision but gets lucky that they avoid a bad outcome. If we want to avoid and mitigate future pandemics, we need to have an honest conversation about what level of risk we can tolerate, balancing different objectives.

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**

(Brendan Collins)

Dated: 8 November 2023