Witness Name: Professor Thomas Richard Connor
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UK COVID-19 INQUIRY

WITNESS STATEMENT OF PROFESSOR THOMAS RICHARD CONNOR

I, Thomas Richard Connor, will say as follows: -

Introduction, background, qualifications and experience

Introduction

1. This statement is provided by me, reflecting on my time working as part of the Technical Advisory Cell / Technical Advisory Group over the course of the COVID-19 pandemic.
2. The request for evidence asked for a number of my reflections on the Technical Advisory Group (TAG), its processes and where there may have been issues. In order to help identify how we can collectively do things better in the future, I have tried to provide as much detail as possible on my views and the basis for them. It is important to note that these are my personal views, and in some areas (such as government structure and policy) I am not an expert, but I have, in the hope it is useful, provided my perspective based on my experience of the events identified.

Qualifications and experience

3. I am a scientist who is expert in the area of bioinformatics, pathogen genomics and genomic epidemiology. I have a background in pathogen genomic research and the translation of research approaches into clinical services. I have been involved in the publication of almost 100 scientific papers, which have collectively been cited more than 15,000 times, according to Google Scholar.

4. Bioinformatics is, loosely, the use of computational and mathematical approaches to answer biological questions. It communicates how I work, and points to some of my expertise. In terms of the specific questions I am interested in, I have previously described my research as focusing on examining variation across microbial populations, which has enabled me to examine questions that focus on understanding the epidemiology and evolution of microbial pathogens.
5. I have always worked across a range of different pathogens, as my interest and expertise are in examining the underpinning mechanisms of evolution and the generation of diversity within a population – and those processes are universal. Generally, my work is carried out in collaboration with others who have expertise in a range of areas, and like many bioinformaticians my role in research is often working as the 'glue' that sticks projects together.
6. I hold a BSc in Biochemistry and Genetics from the University of Nottingham and an MSc in Bioinformatics from Imperial College. I completed my PhD at Imperial College (Department of Infectious Disease Epidemiology) in the area of population genetics and molecular epidemiology in 2010, before moving to the Wellcome Sanger institute, to work on projects related to pathogen genomics. Following this, in 2012, I moved to a permanent academic position in Cardiff.
7. From the period of May 2016 up to the 1st of February 2023 I worked on secondment (starting at 20% of my contracted time, and rising to 80% by August 2019) for PHW, leading the bioinformatics activities for pathogen genomics. Over the course of the pandemic, I operated on a 90% secondment to PHW.
8. At the start of the pandemic, I therefore led both a research group within the University, who focused on the analysis of pathogen genomic data, as well as leading the bioinformatics activity within PHW in relation to pathogen genomics.
9. From March 2020 I led the SARS-CoV-2 genomics work in Wales.
10. In addition to this I have significant expertise in cloud computing / computational infrastructure. I have worked as co-technical lead for the MRC-funded CLoud Infrastructure for Microbial Bioinformatics (CLIMB) project since its inception in 2014 and designed and led the deployment of a range of other computational infrastructures within Cardiff University.
11. While working for PHW I led the development of, or wrote myself, all of the bioinformatics pipelines and processes that underpinned the pathogen genomics services that were in place within PHW prior to the pandemic. This includes the

Influenza pipeline, which had been setup to be a generic viral pipeline that could be used in the event of a pandemic and was developed by bringing together expertise from PHW and from my Cardiff University team.

12. My expertise can be summarised, therefore, as a deep theoretical and practical understanding of the genomics, epidemiology and evolution of microbial pathogens, significant expertise in bioinformatics combined with the experience and knowledge that comes from playing a key/leading role in the development and introduction of accredited pathogen genomics services into the NHS.
13. I have published widely, with research outputs spanning multiple pathogen species, including work that is very highly cited. In 2022 I was included in the global highly cited researchers list, which is a list of the top 1% of researchers globally based on citations.
14. Work I have been involved in which examines questions of public health importance include:
    a. Analyses/studies examining pathogens as a researcher;
        i. Using genomics to examine and investigate the transmission of seventh pandemic *Vibrio cholera* **[EXHIBIT TRC/01 INQ000228186]**
        ii. Using genomics to examine the transmission of *Shigella* species (examining outbreaks in the UK **[EXHIBIT TRC/02 INQ000228187]**, internationally in the MSM population **[EXHIBIT TRC/03 INQ000228188]** and internationally in the Orthodox Jewish population **[EXHIBIT TRC/04 INQ000228189]**, and examining global population structure **[EXHIBIT TRC/05 INQ000228190])**
        iii. Using genomics to characterize key lineages of *Klebsiella* on a global scale **[EXHIBIT TRC/06 INQ000228191]**
        iv. Developing a genotyping system for *Salmonella* Typhi **[EXHIBIT TRC/07 INQ000228192]**
        v. Analysis identifying a correlation between recombination rate and antimicrobial resistance in *S. pneumoniae* **[EXHIBIT TRC/08 INQ000228193]**
        vi. Analysis examining transmission between humans and animals in *C. difficile* **[EXHIBIT TRC/09 INQ000228194, EXHIBIT TRC/10**

INQ000228195] and analysis to dissect the global epidemic of 027 *C. difficile*. **[EXHIBIT TRC/11 INQ000228212]**

vii. Analysis examining the population structure of Enterotoxigenic *E. coli*, identifying global patterns of spread and identifying unexpected population structure – creating opportunities for vaccine development and control. **[EXHIBIT TRC/12 INQ000228231]**

viii. Examining the population structure of *Neisseria*, particularly the Meningococcus **[EXHIBIT TRC/13 INQ000228242].**

b. Research work in the area of method development or R&D which is of relevance;

i. VAPOR – software to form part of pipelines for viral genomics, built originally for Influenza, but designed to be generalizable across viruses **[EXHIBIT TRC/14 INQ000228249]**

ii. CLIMB – national e-infrastructure that provides a computational environment for undertaking microbial bioinformatics analysis and sharing microbial data **[EXHIBIT TRC/15 INQ000228250]**

iii. hierBAPS/BRAT – Bayesian approaches to examine and identify population structure from genetic/genomic data and to identify the presence of homologous recombination **[EXHIBIT TRC/16 INQ000228251]**

iv. Gubbins – software to identify homologous recombination from genomic data, and enable the production of more accurate phylogenetic trees **[EXHIBIT TRC/17 INQ000228252]**

c. Public health / analysis carried out as part of service delivery within PHW, in my role as bioinformatics lead:

i. *Mycobacterium tuberculosis* – the analysis of genomic data for TB outbreaks and the production of summaries describing these results, utilizing software pipelines developed/deployed within PHW. In some cases, this data was developed into a larger report (e.g., **[EXHIBIT TRC/18 INQ000228253]**).

ii. *Mycobacterium chimaera* – The analysis of samples linked to a global outbreak of infections from Heater/Cooler Units. The analysis

involved identifying if samples we had sequenced were potentially linked to the outbreak using genomics.

iii. Influenza analysis/surveillance – I led the development of the bioinformatics elements of the Influenza service, which is the platform that generates our routine genomic-based surveillance data for influenza. I have also been involved in work to analyse Welsh influenza samples (e.g., **[EXHIBIT TRC/19 INQ000228254]**).

iv. *C. difficile* – I led the development and deployment of a set of systems to enable the genomic characterization of *C. difficile* in Wales. This sees all toxigenic *C. difficile* cases in Wales being sequenced, and then this data being used for further investigations and analysis. I have undertaken a range of analyses personally, looking at the larger population structure of the population (e.g., as presented at the ClostPath conference **[EXHIBIT TRC/20 INQ000228255]**), as well as supporting the development and training of staff to interpret the data generated as part of Infection Prevention and Control processes.

v. Analysis of minor variants for HIV – I have undertaken a range of routine analyses to examine HIV samples that have moved through the pipeline and require some sort of follow-up; including quality control issues, the sequencing of low copy-number samples and the investigation of minor variants.

vi. I undertook a detailed genomic analysis of *E. coli* bacteraemia in Wales, which formed a section of a larger PHW report, part of which was subsequently published as a preprint **[EXHIBIT TRC/21 INQ000228256]**.

15. Prior to 2020 I had no specific experience working with Coronaviruses, however, as stated above, my expertise is generally not organism-specific, but relates to understanding the fundamental mechanisms and processes that drive evolution and epidemiology, and applying this to examine organisms as part of a team with diverse expertise. The examples above demonstrate the range of organisms that I have worked on, all of which are linked by the thread of examining their biology through the lens of genomics. Although my experience with Coronaviruses was

limited at the start of the pandemic, I am an expert in genomics and its use to examine pathogens, as well as having significant expertise building clinical services that operate to ISO 15189 accreditation standard. As far as I am aware, my pathogen genomics and genomic epidemiological expertise were the basis for my invite to join TAG. My recollection is that my contributions to TAG predominantly focused on genomic epidemiology, insights from genomics and other genomics aspects, or related areas.

Background to joining TAC/TAG

16. When I was invited to join TAC/TAG, TAC ("Technical Advisory Cell") was the term that was used to describe the group. At a later point, a distinction was made between TAC (as the group of civil servants within Welsh government who ran the meetings/had a coordinating role) and TAG ("Technical Advisory Group") which comprised the 'experts'. Although when I was invited to the group it was referred to as TAC, for the avoidance of doubt, I was very much part of the group of experts (TAG) throughout. For the remainder of this document, I will use TAG in reference to the group, noting the background above.
17. Prior to joining TAG, I played a key role in planning out the sequencing of the first Welsh SARS-CoV-2 isolates in early March 2020 and performed the bioinformatics analysis to assemble the genomes for those first samples. This included-
    a. The early sequencing used reagents and equipment sourced from my Cardiff University research group, using ARTIC primers provided by the group at the University of Birmingham that developed them, who are longstanding collaborators of mine.
    b. Following a request **[EXHIBIT TRC/22 INQ000228257, EXHIBIT TRC23 INQ000228259]** and approval from PHW GOLD, the team within PHW sequenced the first Welsh SARS-CoV-2 samples within 24 hours **[EXHIBIT TRC/24 INQ000228260].**
    c. A week later, I was present at the meeting at Wellcome that planned out and established the COVID-19 Genomics UK consortium (COG-UK) **[EXHIBIT TRC/25 INQ000228261, EXHIBIT TRC/26 INQ000228264, EXHIBIT TRC/27 INQ000228265]**. As part of this I presented an outline proposal for sequencing samples in a tiered (local first, with central

capacity) way **[EXHIBIT TRC/28 INQ000228266],** which formed the basis of the plan adopted by COG-UK.

d. Subsequently, I contributed a document, figures and ideas that summarised the model I was proposing **[EXHIBIT TRC/29 INQ000228267, EXHIBIT TRC30 INQ000228269]** following the discussion at Wellcome. This, in addition to ideas I contributed with respect to the digital systems that would be needed (based on MRC CLIMB) then formed part of the proposal that was submitted for funding for that COG-UK [**EXHIBIT TRC/28 INQ000228266 as above].**

18. The establishment of sequencing of SARS-CoV-2 in Wales, followed by the establishment of COG-UK, led to significant (media and Welsh Government) interest **[EXHIBIT TRC/31 INQ000228270, EXHIBIT TRC/32 INQ000228271, EXHIBIT TRC/33 INQ000228272]**. With the establishment of SARS-CoV-2 sequencing capacity as part of COG-UK in Wales, between the 23rd and 24th of March, there were a number of discussions (both via email and on the phone/skype) relating to genomics including with Michaela John of Genomics Partnership Wales and Chief Scientific Advisor for Health, Dr Rob Orford. Following these discussions, I was sent the formal invite to join TAG on or around the 25th of March 2020 **[EXHIBIT TRC/34 INQ000228273, EXHIBIT TRC/35 INQ000228275].**

My role in PHW, and an introduction to the Pathogen Genomics Unit and Clinical genomics infrastructure within Wales

19. Prior to my secondment with PHW, in early 2016 PHW procured a set of MiSeq sequencing instruments, servers and storage, with, as I understand it, the stated intention of developing pathogen genomics capabilities, focused on HIV and Tuberculosis/Non-tuberculous Mycobacteria (TB/NTMs) in the first instance.
20. Dr Sally Corden (the then head of the PHW Molecular Unit, and, from 2018 the Head of PenGU) recognized the need for bioinformatics expertise to develop the pipelines and processes to deliver the required clinical services. I had previously worked with PHW to perform sequencing and analysis of *E. coli* bacteraemia samples, and so, being a pre-existing collaborator, and one of the few people in Wales at that time with bioinformatics experience focused on pathogen genomics,

I was approached by Dr Robin Howe, to see if I would be prepared to join PHW on secondment to develop the bioinformatics for pathogen genomics within PHW.

21. Having joined PHW in 2016 on a 20% secondment, I was integrated into the nascent pathogen genomics team, which had been developed from the PHW Molecular unit, which had been built and run by Dr Sally Corden.
22. Together we developed a set of modular end-to-end processes that were designed to enable us to sequence HIV and TB/NTMs, but which would be flexible enough to enable other organisms to be added as required. Although not part of the formal 'pandemic planning' of the organization, we felt that this was a prudent way to develop the service, as the modular system would allow us to respond to incidents, scale up capacity and simplify the development of new services.
23. In 2017 Welsh Government launched its Genomics for Precision Medicine strategy, which bought together planning for human and pathogen clinical genomics services, and created a body 'Genomics Partnership Wales' (GPW) to oversee the delivery of the strategy **[EXHIBIT TRC/36 INQ000228276].**
24. In 2018, following the formation of GPW, the Pathogen Genomics Unit (PenGU) was formally launched. PenGU was setup as a specialist unit within the Microbiology division of the Health Protection and Screening Services directorate. PenGU was envisaged from the start to be an 'All-Wales' resource – providing services that cover the whole population of Wales.
25. PenGU comprises an integrated team of bioinformaticians and laboratory staff, with PenGU providing core sequencing and bioinformatics services to a set of 'workstreams' which were focused on developing and delivering services for particular organisms/groups of organisms.
26. PenGU works closely with relevant specialist laboratories within PHW to deliver each workstream. Organisms included in work delivered by PenGU prior to the pandemic included HIV, TB/NTMs, *C. difficile*, Influenza, Enterovirus, bacteria associated with antimicrobial resistance ('ESKAPE pathogens'). In all cases, I had led the development of (or directly developed myself) the bioinformatics systems for analysing these data. Most workstreams are accredited to ISO 15189 standard, and I led the accreditation efforts for the bioinformatics elements of the service. Prior to the pandemic, PenGU operated with the expectation of sequencing and analysing 8-10,000 pathogen genomes per year.

27. Following the sequencing of the first Welsh SARS-CoV-2 genome by PenGU on the 6th of March 2020, PenGU scaled up sequencing of SARS-CoV-2 positives in line with increasing numbers of positive samples being generated by testing in Wales. The PenGU lab team continued to work with the wider PHW laboratory network to ensure samples flowed into the sequencing pipeline, and, working as part of COG-UK, the bioinformatics team analysed and uploaded sequence data for integration at a UK-wide level **[EXHIBIT TRC/37 INQ000228277]**.
28. The types of analyses undertaken on the genome sequence data generated were extremely varied. They included summaries of cases based on genomic clustering, outbreak analyses, analyses undertaken as part of COG-UK along with summaries and summary statistics generated from genome data (e.g., numbers of clusters based on genomics, sequencing coverage across the country). Updates were shared with TAG, along with summary information and the results of commissioned analyses. Data flowed into many other parts of the public health system in Wales, including to health boards, incident management teams and staff such as the Healthcare Epidemiologist network who were responding to the pandemic at a hospital level. PenGU also sequenced samples from patients from other parts of the UK, either to provide additional capacity within COG-UK, or as the sequencing centre that was sequencing positive cases identified at the Lighthouse Lab based at Newport in Wales, from January 2021 onwards. Data generated by PenGU therefore also flowed beyond Wales, to other parts of the wider public health system in the UK.
29. The increase in sequence data generation by PenGU was significant. By March 2022, PenGU was sequencing over 7,000 genomes per week (the majority of which were SARS-CoV-2, noting that the non-SARS-CoV-2 services continued to be provided by PenGU throughout the pandemic), which were generated by a lab team of 14 and analysed by a bioinformatics team of 8 staff **[EXHIBIT TRC/38 INQ000228278]**.
30. I provided leadership for the SARS-CoV-2 genomics work in Wales and provided the key link between TAG and the genomic data, analysis and insights we were generating (both within Wales specifically and as part of collaborative work in COG-UK and other research collaborations), especially prior to the emergence of Alpha in late 2020.

31. Following the emergence of Alpha, while we continued to generate the data, the reporting of variants became integrated into routine reports delivered by the PHW Communicable Disease Surveillance Centre (CDSC). CDSC reported variant data (derived from our genomic work/results) to TAG as a regular item in TAG meetings following the emergence of Alpha.
32. Following the emergence of Alpha, I continued to provide my expertise to TAG, and undertook a number of analyses in addition to feeding into discussions related to genomics, such as analysis introducing the concept of recombination to the group **[EXHIBIT TRC/39 INQ000228279]**. I also fed into a range of other Welsh and UK groups in this time period.

Participation in TAG and its subgroups

33. My first TAG meeting was 27th of March 2020. This was my first involvement in any group providing direct advice to the Welsh Government with respect to SARS-CoV-2.
34. I participated in most of the TAG meetings that took place following my first meeting through to the end of the period in question (30th May 2022). I believe there were something like 149 TAG meetings in the period. As I don't hold records of my attendance, I asked Welsh Government to provide information that they held on attendance. Based on the information provided by Welsh Government, reading over meeting notes and my own recollection, I would estimate that I attended 110-130 of those meetings (a more accurate number is not possible as Welsh Government did not record attendance at all of the TAG meetings over the specified period).
35. In addition to TAG, my genomics expertise saw me receive invites to additional TAG subgroups, which I attended to varying extents.
36. The policy modelling subgroup was the first group I was invited to join, on or around the 1st of May 2020. My engagement with this group was predominantly in 2020, with my attendance reducing in 2021 following the emergence of Alpha. In total, I estimate I attended 15-25 meetings of this group. As part of this group, I provided insights from our genomic data, which could be used to inform the development of models (e.g., information on the number of imports into Wales derived from genomic estimates – such as those published in **EXHIBIT TRC/40 INQ000228280, EXHIBIT TRC/41 INQ000228281, EXHIBIT TRC/42 INQ000228282**). With the

standing up of the UK Health Security Agency (UKHSA) Variant Technical Group (VTG) in late 2020/early 2021, the need for my specific involvement in the policy modelling subgroup decreased, as key information and other estimates were available from this group, or from the VTG technical reports.

37. I was asked to join what was first called the 'Testing', and subsequently became 'Viral Testing" subgroup (VT-TAG) on the 18th of June 2020. I estimate, based on my recollection and records supplied by Welsh Government that I attended 22-30 of the ~35 T-TAG/VT-TAG related meetings that took place between 18th June 2020 and 28th April 2022. I was present in VT-TAG based on my clinical pathogen genomics, bioinformatics and population genomics expertise, as well as my experience building ISO accredited clinical services. My role within VT-TAG was similar to the main TAG group, although with the advent of VT-TAG, some discussion that had previously occurred in TAG took place in this forum instead, before consensus documents were presented in TAG for approval.
38. I was invited to join the TAG Environmental (TAG-E) subgroup in October 2020, and from my notes/recollection attended 8 meetings in total, with 7 of those being between October 2020 and the end of January 2021, on a bimonthly basis. There may have been a few other occasions when I attended the group and my attendance wasn't noted, but my main engagement was in this time period. I provided genomics expertise, in particular in relation to the potential application of genomics to questions of transmission and to its use for environmental questions (e.g., wastewater sequencing such as covered in our paper published with colleagues including some from TAG-E **[EXHIBIT TRC/43 INQ000228283]**).
39. I was invited to some of the early TAG Children and Schools subgroup meetings in the Spring/Summer of 2020 **[EXHIBIT TRC/44 INQ000228284]**. I don't have records of this, but I believe I attended fewer than 5 meetings in total for this subgroup. My main involvement was around preliminary discussions about the use of genomics to examine transmission in schools. As this was not feasible in early 2020, due to the logistical practicalities of getting suitable samples for sequencing, my attendance at this group was not required, and so I ceased attending these meetings.
40. In addition to my attendance at one or more early TAG Children and Schools meetings, there were a small number of emails, specifically asking for input on genomics-related matters **[EXHIBIT TRC/45 INQ000228287, EXHIBIT TRC/46**

INQ000228288, EXHIBIT TRC/47 INQ000228289] with respect to Schools. Other than these limited interactions, I don't recall providing any direct advice or being actively involved in discussions/advice in relation to children and schools, although I do recall at least one conversation about the type of study one might want to put in place to examine questions of the role of schools in wider community transmission, which possibly took place as part of TAG discussions.

41. Based on my limited attendance and involvement, I have no specific knowledge of the analysis generated and advice considered/generated with respect to children by the TAG Children and Education subgroup. I remember mention of aspects of advice at TAG itself covering this area but cannot recollect any details.

Views on TAG and how it functioned

Decision making and transparency

Transparency

42. From the point at which I joined, the Terms of Reference (TOR) that were provided **[EXHIBIT TRC/35 INQ000228275 as above]** reflected the view that TAG should reach decisions by consensus.
43. When I joined TAG, the group was relatively small, and the TOR were relatively basic.
44. As the pandemic developed through April 2020, I recall a wider discussion in the media (traditional and social) focused on SAGE and its transparency. In Wales, we were also considering the transparency of advice in TAG, and what should/should not be shared with the public. This was discussed by TAG, and the notes of the discussion from the 27th of April 2020 **[EXHIBIT TRC/48 INQ000228291]** reflect my recollection of the discussion and decision that was made.
45. At the time I was personally keen to try and maximise transparency, and I was fully supportive of the measures proposed. It was suggested that TAG might not publish names of members **[EXHIBIT TRC/48 INQ000228291 as above]**; my personal view was **[EXHIBIT TRC/49 INQ000228292]** and is, that the full membership of TAG should be published, and that advice and analysis generated by TAG should be made available to the public as it is generated.

46. Following the meeting of the 27th of April 2020, TAG also agreed to adopt Chatham House rules, with a specific aim of this enabling free discussion, with the aim of removing concerns over 'later consequences', which could have been inhibiting to discussions.

47. Although my personal view on advice generated by TAG and its subgroups is that this should be shared openly, I think it is also very important that free discussion is able to take place within the group. It is also important to note that while I am very supportive of a transparent approach, I also recognize that some data sources or records of the discussions at the time may not have been easily shared, as these discussions frequently included information that was sensitive or, sometimes, could include information that could lead to the identification of individuals.

Transparency, considerations for consensus approach and advantages of consensus approach

48. TAG provided advice to the Welsh Government based on consensus among its attendees, and I think it worth starting to outline my views on this approach by highlighting the simple fact that in early 2020 there was a significant amount of noise, and information was being generated around the world which was of varying quality. There was no guarantee that anyone could arrive at a scientific advisory meeting having all the facts, and there was so much going on, it could not be assumed that any one expert would have a comprehensive view on their own area, let alone the whole strategic piece. My impression of the challenge for Welsh Government was how to provide a forum where different expertise and perspectives could be bought together and integrated to provide coherent advice and analysis.

49. Clearly, there are different ways to approach the problem, but my understanding of the point of consensus discussions is that they provide a place to bring together information and provide a forum for views to be developed and for views to change. Coming into a discussion, everyone may not have all the facts – through a consensus approach, involving discussion by experts, there is an opportunity to overcome some of these issues and arrive at a settled position, that the group is willing to put its collective names to.

50. I believe a consensus approach makes particular sense when the role of the group is to review and comment on analysis or information that comes from elsewhere.

Further, I think that this approach also has a number of other advantages that make it a good fit in Wales, where the pool of experts and civil servants is much smaller than in England, for example.

51. When I joined, TAC/TAG also felt like a new construct that was developing as it went along, rather than working from a playbook in the way that SAGE seemed to – as SAGE had detailed information/pre-existing guidelines, and a team that (from the outside) seemed to know how it was meant to function and where it sat within the response.
52. I think the approach adopted by TAG underlined a commitment to understanding the different perspectives from different expert areas, and while there may be some who felt that their area could have had more air time, my impression was that the consensus process that was adopted was quite effective at enabling experts to have their say, and to develop an agreed position that the group could collectively endorse. I certainly felt that TAG provided me with the time/space when required to enable me to cover information and analysis with respect to genomics.
53. In my personal view, this was partly founded on the fact that the collective group of TAG and TAC had a good set of internal relationships. Discussions were generally good natured, respectful (although there certainly were discussions which got heated at times), and I found other members of the group to be collegiate.
54. I personally felt that the co-chairs (Dr Rob Orford and Fliss Bennee) did a really good job in some very hard circumstances, and one of the positives from my time in TAG were the interactions with many committed and brilliant people, both in the form of my fellow 'experts' and the civil servants who were part of the meeting. I think that there were times, when the way in which we worked together was very smooth, and I was struck by a strong sense of the group pulling together as 'team Wales' to support the pandemic response. Although many of my memories of the pandemic are upsetting, my memories of the people I worked alongside in TAG, PHW and COG-UK are, and remain, positive.
55. Working collaboratively/collectively is also an important check against people pushing a particular perspective without evidence – although in my view this is a theoretical advantage as I didn't see any evidence of this within TAG.
56. The collaborative/consensus approach also provides a way to pool expertise and views, which was especially important when knowledge was lacking early on, or

when dealing with complex questions that spanned many different areas of expertise. The consensus approach, and discussions that elicited provided a route for challenge of thinking/advice which, combined with the broad range of experts involved, I think worked well.

57. One obvious challenge with the consensus approach is that I think it is harder to create an impression of transparency compared to an approach where the inputs are reports with a set of advised actions in them, which come pre-formed to the meeting. In the latter case, one can share the reports and short notes on what was decided from those, and that provides a simple linear process. In a consensus approach, I would say that one would expect opinions to change, noting that an implicit assumption in the presentation of comprehensive reports with advice is that those reports have been through a process of thought, discussion and editing; in TAG the meeting/discussion/reaching consensus was part of the process to get to that 'final' product.
58. I also think it important to understand that discussion, review and integration of new evidence and a reformulation of ideas and positions is part of the scientific process. What comes to TAG may be analysis or information rather than advice. True 'advice' that comes to TAG may change (and should be open to challenge), based on the discussion. To my mind TAG was never a place where information or advice came just to be rubber stamped, and I think one of the strengths of the group was the collective contributions to documents that would go out of the group, in order to improve them.
59. Thus, in my view the development of documents and advice was part of the TAG process – my impression of SAGE, as an outside observer, is that this is a key difference between SAGE and TAG. For TAG the exact shape/content/scope of analyses/interpretation that would come out of the group may not be known until after the consensus discussion, with consensus documents often being edited/commented on extensively before being 'finalised'. In comparison, for SAGE, I got the feeling from the outside that it received reports and 'answers' to its questions, and that much of the key discussion, critical analysis and thought formation with respect to those answers would have happened prior to the report being submitted to SAGE. In one sense, the consensus approach adopted by TAG had elements of feedback built in, which was probably beneficial for some types of work undertaken by the group.

60. Thinking more generally around transparency, and the challenge of consensus and undertaking science in public, there are tangible theoretical risks with sharing data/analysis as it is generated including;
    a. Misrepresentation of analysis/results, including targeted attacks on analyses or the individuals who have carried them out in the media/social media.
    b. Challenges from the misrepresentation of scientific uncertainty.
    c. Challenges stemming from changing views and the evolution of views. As more data is generated, one must expect people's views to change, and this is to be expected. I feel pretty strongly that advisory groups like TAG must, as a priority, make an environment where advisors/experts feel free to change their views as the data changes/evolve. The ability to re-evaluate and adjust one's position is critical; and it is something that should be expected and welcomed in the context of scientific advice. I sometimes feel as though there is/was an expectation that experts should 'know' the answer to questions with respect to SARS-CoV-2. This position perhaps reflects a lack of understanding of where we were at the start of the pandemic - dealing with an organism that is newly jumped across into humans, with limited biological data of any sort combined with a significant amount of noise generated by groups from around the world all racing to understand what we were seeing. In that situation, we were all learning, and seeking to apply that information to support the pandemic response, and so I would say the larger issue isn't that opinions formed, and decisions made, in good faith based on information at the time were wrong - the bigger issue would be if views and actions didn't change as we learnt more about the virus and the way in which it was behaving. As it was, I think this is more of a hypothetical consideration, but is one that should be part of any thinking with respect to designing a better system for the future.
61. Ultimately, we have to accept that as we generate data, we will learn more and need to revise previous ideas. That is how things are meant to work – and, I think, did work, although clearly there is a need now to understand if this happened fast enough or not. Ideally, the system should be setup to facilitate the revision of ideas as part of the advice process, and now, post-pandemic is probably a good time for government and those with expertise in this area to identify a set of

recommendations that is clear for the future. In my personal view, the combination of a consensus approach to outputs, and commitment to sharing advice as it was generated, as adopted by TAG, was a good compromise.

62. The way that the system was setup, combining consensus and Chatham house rules meant I felt free to speak, and also meant that I felt as though I would be heard. The issue with recording who said what is that this is not crystal ball gazing, it is science. Scientific advice should derive from data – and that data isn't perfect, and will change over time. I would agree that it is worth understanding when and why people's views may have changed, as this may point towards gaps in data/knowledge that could be prepared for. At the same time, my experience from the pandemic is that we had a significant number of learning experiences, where the virus did something which we found surprising. I remember being particularly surprised at the size of growth advantage estimates from the D614G mutation, and similarly, the growth advantages identified for Alpha, Delta and Omicron; all of which seemed enormous compared to the type of selective advantages seen in other places/organisms. These changes in viral behaviour each required a reassessment of the data, and a change in perspective.
63. Following on from the considerations with respect to transparency, I emerge from the pandemic with a newfound appreciation of the complexity of the system around advice and policy. It seems clear to me, as a non-expert in government, that it is important that the system understands how things are supposed to operate, who does what, why and when, but also takes into account uncertainty. From my perspective, it wasn't always clear to me that the system knew the answer to these questions. Questions that occurred at the time, or since, in relation to this include;
    a. What were the routes by which TAG advice were disseminated to other parts of the system in Wales?
    b. What was the correct route for Welsh Government to seek information/advice from members of TAG?
    c. How should advice/information flow sideways between groups within government?
    d. How does government deal with variable and sometimes contradictory information from multiple sources?
    e. Where there is uncertainty in remit/role of groups, who decides and directs them?

f. Who has responsibility for ensuring that different groups generating data/advice are appropriately connected across the wider system?
g. What are the accountability routes of the various groups that existed, and where did TAG fit?

As an expert operating within TAG, these examples illustrate the limits of my understanding of the lines of responsibility for the group and where advice was going. It is also worth noting that my role as an expert doesn't require me to completely understand how all the pieces of the wider system fit together, but as discussed below, the uncertainty does create challenges for experts as professionals and individuals.

64. Further, as an individual providing analysis/evidence/advice I need to know that I am going to be supported, and I also need to know what is wanted. My perception of many requests and discussions within TAG was that information was needed rapidly, because decisions needed to be made rapidly. In this situation, I think government is implicitly making a choice – asking its experts to provide timely (or any) information based on what we see which may facilitate rapid action. This choice carries with it the implicit caveat that the information may also turn out to be incorrect or to be misinterpreted in the longer run. I am not sure if this was ever explicitly acknowledged and understood by all the key actors involved.
65. As it is, we aimed to provide advice and information that was as high quality as it was possible to make it, within the timescales that we were given. Again, theoretically, a consensus approach, bringing together many experts and perspectives provides an opportunity to identify obvious issues and potentially to ask pertinent questions.
66. Beyond the question of revisiting the evolution of information, analysis and 'advice', I think there is also the more practical consideration in terms of the effort that needs to be expended for the external release of data/analysis vs its internal use. There is a big difference between collating a set of results (graphs, figures, with limited/no text) and explaining/presenting it to a group compared to preparing a document for public consumption that would also require the inclusion of a detailed explanation of what the data shows, includes the information/references to contextualise that information and explains the document to an external audience. Typically, many of the science publications I have been involved in pre-pandemic took years to write, edit, finalise and submit. Even during the pandemic, the generation of

publications from results that were presented in places such as TAG took months of dedicated effort to take through to submission and publication.

Disadvantages of consensus approach

67. I personally believe that there are also potential disadvantages of a consensus approach. In a group setting, if there are strong views in one direction, then it may not be possible to reach a consensus, as presenting a minority view may not be possible. I don't recall any specific discussions where a consensus couldn't be reached. Further, as not everyone in the room is an expert on the area under discussion, there is the potential for style to dominate over substance. Even in the absence of strong views, converging on a consensus may still be challenging when there are many diverse perspectives from different fields, as standards of evidence etc. may be different between experts.
68. Consensus discussions should create a situation where people are able to take part in the discussion if they are in the room, however, in these discussions, people may have an equal 'voice', even though they are not expert in the area. That may impact the quality of advice given, and requires careful chairing.
69. Consensus could slow things down – if everything that is presented has to be discussed, then that may reduce agility. In situations where issues are contentious, the group may not be able to share a view, which impacts the quality and timeliness of advice. Different fields may also have different standards/practices, which may also create barriers to delivering advice rapidly.
70. A lack of knowledge/information may slow the response – one of the particular issues over the course of the pandemic was the timeliness and quality of available data. If data and analysis aren't available, then in a consensus group people may feel unable to act/comment, which may then slow down the generation of useful advice/insight.
71. Where you have a very diverse range of areas being covered, consensus discussions in a group will mean that some experts won't need/want to be involved. In a pandemic, where you have experts that are also playing a role in the response, consensus approaches therefore end up using valuable time by keeping people in meetings where they aren't able to comment.

Fit of the consensus approach to TAG's activities

72. Ultimately, my personal view is that considerations about the appropriateness of the TAG approach are probably best considered in the context of the outputs of the group. I recall several broad types of output that I may have commented on, or had input into from the group, namely;

    1. Advice to ministers etc. (ministerial advice notes, 21-day review etc.); generally, these were put together by the civil servants in TAC, and TAG was invited to comment/edit/etc. following discussion. **My personal view is that these types of outputs were clearly a good fit with a consensus approach, as these are fixed and have time for the 'process' to take place.**
    2. Papers presented to the group, often derived from analyses or research results as part of ongoing activities/in response to outside information. The ones I recall best tended to be analysis or situation awareness, such as the RWC modelling, or the COG-UK/related genomics analysis and updates I provided or contributed to (e.g., **EXHIBIT TRC/50 INQ000228293, EXHIBIT TRC/39 INQ000228279 as above**). To my mind these were about delivering timely information/understanding, or information that fitted in with decisions that needed to be made. **I recall that these were sometimes commissioned, although in many cases they were highlighted by members or someone from TAC invited them to be presented. In some cases, they were taken from something that had been seen elsewhere, published etc. Again, in my view the consensus approach includes discussion of these in an open forum, and I think that was appropriate.**
    3. Papers commissioned by TAG providing advice/guidance. There were papers that were commissioned/identified by TAG, often within subgroups, which then had to go through TAG for approval. In the case of some (such as the places of worship paper – **[EXHIBIT TRC/51 INQ000228294]**), these were done because it was needed and was

requested/came out of discussion within a given subgroup. In the case of others (e.g., the testing technology assessment guidance **[EXHIBIT TRC/52 INQ000228295, EXHIBIT TRC53 INQ000228297]**), they were put together in response to a perceived need or issue identified by members of TAG or by a subgroup. **In my personal view, in these cases consensus was critical to developing these (as papers were often collaborative efforts within a group), and I certainly recall some discussions where issues were identified, and that could then feed into the final outputs for approval.**

4. Routine updates of information (e.g., PHW sitreps) provided for information. **In my personal view Consensus was less important here, as these were more about providing a baseline of information. I think ensuring TAG is up to date is important to inform discussions, but also wonder if TAG is the appropriate forum for the level of detail some of the sitreps covered. I am also not clear on the other routes by which information from PHW was flowing into Welsh Government, and if this may have created unnecessary duplication.**
5. Commissioned research/analysis specifically requested by TAC to look at a particular question. **My personal view is that consensus discussions provided a useful way to explore these types of outputs, and I remember in particular lively discussions around the questions with respect to the COVID-19 evidence centre.**
6. External papers (e.g., from SAGE) – which were shared with the group, but not presented by a particular individual. **As in the case of other material, I personally believe that discussing the implications in external papers (such as those presented to SAGE) in an open group/forum, with a view to considering the Welsh dimension is appropriate.**

73. The breadth of papers/content presented in TAG were quite wide ranging, and only a subset of these would be what I would define as 'advice'. My general feeling, considering all of the above, is that the consensus approach was a good fit to what TAG did, and to the people who made up the group.
74. I do think there is a challenge in the use of terminology – as to me (and I suspect many members of the public) the process of seeking 'advice' would imply asking someone what they think you should do. I think in the context of TAG, while this was done, I think in many cases TAC/TAG also operated as informational air traffic control, bringing together information and expert opinion for situational awareness and understanding. Out of that, specific questions and advice arise – and so there was advice provided, but I think a key part of the function of TAG was to be found in taking diverse and complex information, and making sense of it, to better inform what needed to be done. In that case, the impact and utility of TAG goes beyond 'advice' and probably needs to be properly considered within the context of the larger system, which I am not able to do – as I am neither an expert in governance, or feel as though I have an overview of what the wider system within Welsh Government actually 'looks' like.
75. I think out of this does come an issue to feed forward – namely the breadth of what TAG was covering, and the range of things it was required to consider. In a personal sense, this meant that I didn't feel that I had sight of the full process. While I was aware of things like the 21-day reviews and briefings to ministers (when we were asked for input), I didn't have a full overview of all of the information that went to ministers or what the other parts of the system were doing. I think having that perspective (articulated in a clear way, for everyone to understand) would be helpful as a starting point in future emergencies. I think it also is important that as a situation evolves, that the information describing roles/where things fit also evolves, so people are clear on who is meant to be doing what, and how the process is intended to operate.
76. In a more general sense, thinking as an academic and as an employee of PHW, I think in future it would also be helpful to separate out the required functions of 'advice' (including analysis/information provision, identification of questions, synthesis of multiple sources of information and the generation of suggestions for action/policy) and to be clear on what structure/group does what, and have that

clearly understood by everyone. I continue to hold the view that Wales is fortunate in that its small size and potential for agility mean that it can implement structures that would not work as well at a UK level. I think it is worth identifying how to use some of Wales natural advantages to inform our planning, rather than simply treating Wales as a mini-UK – and implementing versions of UK structures in Wales. My impression in March 2020 was that TAG was 'Welsh SAGE'; but my view now was that it was something quite distinct, but I don't know if that was ever properly/formally described.

77. In particular, my perception of SAGE and its associated subgroups was that it was intended to bring together experts as required to generate and provide coherent scientific advice to UK Government. That advice had a very specific end point, sitting within a clear structure. My understanding was that following SAGE meetings other processes would take the information/advice and generate some sort of action. Based on what I knew of SAGE and its participants, the work that was undertaken by SAGE experts included synthesis of information (e.g., interpretation and consideration of results from academic papers) and the generation of results and analyses (e.g., the COG-UK analyses/results, or summary papers prepared by groups such as Imperial College) either for information or in response to live questions from SAGE. In comparison, I think TAG was more focused on interpreting evidence and information from multiple sources, rather than necessarily being a place that commissioned work to generate multiple analyses *de novo,* although TAG certainly did do that as well. I think the makeup of experts in the groups was also different, with my perception being that TAG was more weighted to practitioners than researchers, while SAGE was the opposite. More significantly, in terms of differences, on multiple occasions TAG and its subgroups developed documents that were then published as 'guidance' or 'advice' by Welsh Government under the TAG area on the Welsh Government website (e.g., **[EXHIBIT TRC/107 INQ000228204]**, **[EXHIBIT TRC/51 INQ000228294]**). While it is the case that SAGE meeting papers were published, I don't think I recall guidance documents being released by SAGE in the same way. As a result, my view now is that TAG was quite distinct in terms of makeup, form and function to SAGE, and was, as a result, more complimentary to SAGE than my initial impression had suggested.

78. Beyond a lack of knowledge about exactly where advice/output went after it left TAG, I also wasn't always aware of how the advice had impacted policy. In my case that may partly be because there was never any room to pause. My experience of TAG and the pandemic was very much a case of moving from one urgent thing to another, with very little opportunity to appreciate any of the impacts of my work – and it is quite possible that once my bit was done, I was already into something else and so had limited time to look and see what the outputs were. I also wasn't sighted on the relationships with ministers (as my interactions as part of TAG were with TAC/civil servants, rather than politicians). As I wasn't sighted on the communication of information to ministers, I also can't comment on the extent to which the TAG/TAC setup may slowed the communication of information or advice to ministers.
79. Beyond the consideration of evidence and information from the UK, TAG was also a place which, from an early stage, considered the international perspective. I particularly recall dedicated work that was undertaken/led by Dr Robert Hoyle to consider the international perspective and collate information for discussion in TAG. With respect to genomics specifically, I certainly also remember discussing early genomic results within TAG – for example the work done in the US looking at transmission in closed settings, which was referenced in at least one consensus report (reference is in document in **[EXHIBIT TRC/54 INQ000228298]**). Global sequence data was also considered within TAG over the summer of 2020 (as part of work to understand the reimport of cases), and the international perspective was increasingly important as new variants arose from the end of 2020 onwards. As the importance of variants became more significant following the identification of Alpha in the UK, I also remember the results of sequencing and genomics research from elsewhere in the world being discussed in TAG (e.g., escape mutants and the outputs of the Genome 2 Phenome consortium).

Reflections on commissioning process and formulation of questions

80. While TAG covered a lot of ground, I think this also created issues of its own. I felt as if one specific issue was the formulation of questions for TAG. I remember thinking on occasion the asking of questions and formulation of some statements/discussion was a problem, simply because the questions/basis for discussion seemed to come from people who didn't fully understand the biology

they were asking about (e.g., in **[EXHIBIT TRC/55 INQ000228299, EXHIBIT TRC/56 INQ000228300]**). In particular, when we were thinking about the evolution of variants and forecasting (e.g., **[EXHIBIT TRC/57 INQ000228302]**), I remember feeling as though some of the questions that were coming to us to answer weren't the correct ones, and sometimes documents were provided that had many issues to consider in terms of their focus and the types of question they were asking/answering **[EXHIBIT TRC/58 INQ000228303]** - although it is also worth stating that those areas are highly technical and complex, and that the consensus route provided a way to comment on substantive issues.

81. I think this points at a possible question in relation to commissioning, which in TAG, I felt was quite often based on questions from government/things the Minister or CMO needed, things that came up in discussion, or things that came out of other groups such as SAGE where there was a question of what the 'Welsh' dimension might be. Those may well be appropriate (and they certainly make sense to me when thinking about my understanding of the original objectives of the group), but I think it would be worth re-evaluating this, to make sure that things weren't being missed, as this approach is actually quite reactive. I think we, collectively, could have done a better job of using experts to proactively identify issues that needed to be dealt with, beyond the topics that were already being discussed.
82. It was certainly the case that I often felt as though questions/agenda items were very much set by TAC/Welsh Government, and although there would be follow-ups and some topics would be returned to, often something would be discussed and that would be it. Looking back, I think that there were times when we weren't asking the right questions at the right time. It is also worth saying that while hindsight may now identify questions that we could have asked earlier, it is also important to note that these may not have been obvious at the time, or they may not have been the most obvious questions at the time. One of the issues is that within TAG, much of the focus was on answering questions that were urgent **now**. While that reactive approach is understandable, I think a real challenge comes as it doesn't really allow for horizon scanning, to look for things that need to be anticipated. I think there are several examples of questions from my area of activity that illustrate the point including;
    a. The evidence for chronic infection as a mechanism for the generation of variants. It seems likely that chronic infection played a role in the

development of both the Alpha **[EXHIBIT TRC/137 INQ000320593]** and Omicron variants, however, infections in this patient group is not something that was being specifically looked for or examined at the time in forums such as TAG – mainly because of a lack of data from chronically infected individuals.

b. Following the discovery of D614G in early 2020, which conferred a large growth advantage, the focus in the Autumn of 2020 was very much on travel and imports of cases into the UK, with some work that was also looking for certain key (predicted) mutations. However, at this point we weren't really looking for lineages with 'constellations' of mutations until the identification of the Alpha variant.

c. There were multiple occasions when travel/questions around travel were urgent considerations for advice (e.g., over the summer of 2020, Post-Alpha easing of restrictions, the import of Delta into the UK and the import of Omicron into the UK), however, in all of these cases, I don't feel like collectively we were asking the right questions ahead of these events, or in their immediate aftermath to inform future action.

83. The process of specifically commissioning questions also seemed to have several possible original starting points (e.g., suggestions from the group/out of discussions, questions from ministers, questions from advisors, advice/questions asked in other groups), which is understandable, but sometimes meant that valuable context was missing. Having access to papers (e.g. from SAGE) was helpful in this respect, but, particularly where a question had a genesis in a different advisory group elsewhere in the UK, I think it would have been very useful for those groups to have contained multiple (scientific/clinical) representatives who also sat on TAG to ensure that things weren't lost in translation – or to enable the process of analysing data to be kicked off more quickly. I suspect there are a number of semi-documented examples of this in the TAG papers, but a good example from early in the pandemic was that the questions around modelling/forecasting (out of SPI-M/SAGE) which initially we couldn't answer in Wales partly resulted in the development of local modelling **[EXHIBIT TRC/59 INQ000228308]**, which evolved into the policy modelling subgroup in Wales.

84. It is also the case that members of the group were able to suggest where consensus papers or other outputs may have been required. I think this was an

implicit option, and I can recall at least one occasion when, in response to debates around the scaling up of testing and many companies advancing their own diagnostic platform, we offered a paper without being specifically commissioned to produce it **[EXHIBIT TRC/52 INQ000228295 as above]** which included information to inform those wider discussions and properly contextualise them in the full diagnostic laboratory process. However, this was very much the exception, in terms of 'advice'. In contrast, my experience of sharing analysis and information was more even in terms of the balance between requests for information and proactively providing updates/information as it was generated, even if it wasn't specifically requested.

85. In terms of specific focus, I think having a focus on Wales was good, and I think this made a lot of sense, for a lot of reasons. For example, my recollection was that early modelling (e.g., from SAGE) was England-centric – which is unsurprising as many of the key groups undertaking the modelling had worked with PHE for a long time and had built models based on PHE data. Similarly, a lot of the analyses to SAGE were England-centric (done by PHE/UKHSA or English universities in the golden triangle, using PHE/UKHSA/NHS England data). Certainly, there were questions of 'but what does this mean for Wales' with respect to the different demographics, economic issues, measures of deprivation etc here. As I understood it, at least part of what TAG had been set up for originally was to assess things going to SAGE to see what they might mean for Wales. What happened from this was that there was then a lot of asking questions from Welsh data, based on observations/analyses that had been presented to SAGE.

86. I think that in one sense we got lucky, as we have some very good people (e.g., Prof. Mike Gravenor, colleagues within PHW) who were able to rapidly set up Welsh epidemiological models, or Welsh specific data feeds, which allowed us to work more pro-actively. However, in an ideal world, there would have been more coordination from the start, and this would have built on existing capacity within the Welsh public health and academic system. It is my professional view, both as an academic and in my PHW role that this is something that needs to be considered in the future, as part of future pandemic planning. I think Welsh Government needs to have some idea of who 'their' experts are across key areas, and to know that there is investment in baseline analysis and data capabilities that can be activated at the start of a pandemic. Wales doesn't have entities such as

the Health Protection Research Units in England, and I think that this did create a gap early on in the pandemic response.

87. I also don't know what information flowed from TAG to SAGE, and while I know about some of what SAGE was discussing and asking for (from my involvement in the COG-UK work), it wasn't always the case that TAG would pick up on things that SAGE was evidently concerned about (e.g., I remember nosocomial transmission being something SAGE was very interested in, in late March 2020 but, although there were some discussions in/with TAG **[EXHIBIT TRC/60 INQ000228309]** I don't recall extensive discussions on the topic – although I think Wales would have been a good place to look at this, on account of differences in the system in Wales).
88. More broadly, I think there is a question of whether TAG was the appropriate avenue for all of the questions that were asked. In some cases (e.g., VT-TAG/TAG examining questions relating to testing), I would have thought that the request for advice/information would have more naturally gone to PHW directly (e.g., questions around testing frameworks), rather than asking a PHW member of TAG to produce a paper for consideration. Again, this relates to roles of advisors and organisations and the function of advice, as well as demonstrating why it is important to provide clarity for participants with respect to the basis on which they were involved in the group.

Specific reflections on weaknesses of the TAG structure

89. I think, on reflection, that because TAG was quite reactive (which was very much a strength, particularly early on), one of its weaknesses was that it didn't necessarily clearly articulate and follow through on particular lines of question or enquiry. We didn't (that I can recall) maintain a list of questions or commissioned work or identified issues which we regularly referred back to or tracked through to completion in a formal way. Reading back through emails I do see some TAG emails that included an action log, but I get the impression this was held by TAC, and not necessarily surfaced in TAG consistently. So, while tracking of actions was done, on reflection I don't think it was appropriate for some tracking (e.g., of questions) that might have been needed. While we had larger papers that were written, they tended to be very broad, which again would have been good to map against an active set of queries/questions. Theoretically, TAGs breadth and the

overall structure may have meant that we could theoretically have missed things – although I don't think I can identify anything obvious in my area that stands out as being 'missed', which TAG alone could have been expected to spot.

90. While I think there were some good feedback loops for the generation and improvement of advice/information as part of the consensus approach, I don't think that there were sufficient feedback loops to/from government, and from those who were making use of the information generated. I recall areas such as mask wearing being controversial (for a number of reasons) and these produced some heated discussions within TAG. However, I don't recall much outside 'challenge' which would have been helpful. I also don't think that some of these discussions – including the commissioning/focus of the questions, the management of the discussion and then the drafting of advice – were as slick as they could have been.
91. One of the challenges with feedback loops and the TAG structure itself is that it includes a mixed range of backgrounds - researchers, public health professionals, clinicians, etc. – with civil servants who were responsible for, or part of various policy areas. This meant that TAG may well have provided a convenient route for people in Welsh Government to get information, but I don't think that needs/requirements necessarily flowed back, and I certainly don't feel as though I have an accurate idea of where the information we presented was used/shared within the wider structures within Welsh Government. I recall that TAG, as well as other meetings such as the Variant Technical Group, at times ended up with quite a few 'observers', from the civil service, and I think it is important to understand what the feedback routes were meant to be, to iterate over questions and inform the development of information/analysis/advice – as I don't really understand what they were.
92. The other question that is very much in my mind around feedback loops and commissioning was the challenge of overcoming issues such as groupthink and identifying questions that challenge our preconceived view/original perception. In one sense, as a researcher, I am going to ask questions of data, and if I found something interesting, I would share that with TAG (e.g., when we picked up recombination in the wild). However, I don't think I ever worked from a position of trying to predict what questions Welsh Government might want to ask, because I had no perception of what they were unclear on or really needed advice about. I think there is also a real risk with TAG identifying questions to ask, in the sense

that this is a little like marking one's own homework – it will always be guided by the interests and experience of those on the group. I don't know how this can be overcome, but I think as part of the Inquiry it would be useful to understand the ways in which Welsh Government thought questions should be composed and how it decided where those questions had to be asked. I don't know how this was done, but I think it could be an important part of future planning.

93. Alongside the question of feedback loops (and TAG's breadth as well as any articulation of a system and how things are meant to fit together) is the challenge of Wales being a smaller system compared to, say, England. Within Wales it is important to understand that on account of the smaller system, many people wear multiple hats, and undertake roles which would be filled by multiple people in other places. This means that many of the experts in TAG were balancing operational and strategic activities and were often engaged by many parts of the system, as well as doing their day jobs. This breadth of activity is probably one of the reasons why TAG was able to cover the breadth that it did, but it is important to understand for future planning, as while one could look to implement a complex structure at a UK level, with many different groups covering various aspects of the response, the impact in Wales would be that individuals would suddenly find themselves very stretched across a range of groups that fits with the complexity and size of workforce in England which is not replicated in Wales.
94. I also felt that at times there was, on occasion, a lack of coordination across the response more generally; with the same question being asked by multiple people from different places. I think this was more of a problem from individuals in Welsh Government seeking answers from different people/colleagues in PHW, particularly with respect to new variants etc, but in terms of 'advice' and TAG, I think this also relates to structure, and where/how advice is sought and where it comes from. What is the canonical source of 'truth' for Welsh Government; how are the various information sources integrated and fed on? Over the course of the pandemic, I fielded questions (directly or indirectly) from a number of different stakeholders, most often by email. At times (for example, when a new variant was identified), there was a propensity for multiple people, independently, to get in contact with me or my team to seek information.
95. As the data became more easily available, I think there were also cases where the requests became quite highly technical to deliver – and we were being asked to

produce outputs that required enormous amounts of resources. I remember discussions around analyses of the 5-mile rule in Wales, which evolved into an analysis of imports of cases into Wales (some preliminary results and thinking evidenced in **[EXHIBIT TRC/61 INQ000228310, EXHIBIT TRC/62 INQ000228312]**), running over the summer of 2020. This involved multiple members of my research group, and generated data which was ultimately available when we were then requested to put together a paper, with a ~1 week timescale, on genomic insights **[EXHIBIT TRC/63 INQ000228313, EXHIBIT TRC/64 INQ000228314]**, in the autumn of 2020. Had we not been working on a range of research questions, our ability to put together the 'genomic insights' paper would have been very constrained, and the data/analysis itself would have been of markedly lower quality. As it was, the analysis was probably the summation of something like 2-6 person months of time, and many thousands of hours of processing time on what is effectively a 'supercomputer'. I think this is a good example of the level of input required to service some of the requests that came through – all of which had to be managed without dedicated funding to do so. I am not sure that these challenges were ever fully appreciated by Welsh Government.

96. Alongside this, I think there is also an important issue in terms of scope and role of each individual and organisation that is part of TAG. I was both an employee of Cardiff University and was seconded to PHW. My understanding was that I was involved in TAG as an individual with specific professional expertise, but clearly, it cannot be ignored that I had a role in PHW and a role at the University. In many instances, activities within TAG actively relied on those links to develop advice. There are likely to be instances where I provided information to TAG, or commented on advice, where the same information or comments on the same advice were provided by other colleagues in PHW in other forums. When a group such as TAG is stood up for a short term, it is easier to brush over these issues – however, in a multi-year engagement, I think the question of scope, role, and my accountability to my employer(s) who are also providing data and advice as part of the response in some capacity is really important. I am still unclear on this issue now, and while I don't think it led to things being 'missed' it probably did create extra work, and made some of the more intense times much worse for me personally, when I was under pressure as part of my job within Cardiff University (e.g., supporting the CLIMB COVID system **[EXHIBIT TRC/65 INQ000228316]**),

PHW (which was both operational and strategic), and was also under pressure to input into the various advisory groups where I had a role.

97. One of the other issues that we encountered on occasion, particularly early on in the pandemic, was a blurring of lines between advice and policy (e.g., **[EXHIBIT TRC/66 INQ000228317, EXHIBIT TRC67 INQ000228319]** was considered by T-TAG, but is very operational, **[EXHIBIT TRC/68 INQ000228320]** is also moving across into the operational/policy rather than simply being 'advice'). In discussions it was, at points, easy to go from advice into policy, and there were occasions both in meetings and in text where this issue or a risk of blurring policy/advice was identified (e.g., **[EXHIBIT TRC/69 INQ000228321, EXHIBIT TRC/70 INQ000228323]**). I think this is partly because of the makeup of the group – with many people who had operational roles outside of TAG, but it is also important to note that this issue was perceived by members of the group at the time, and commented on when people felt that things had drifted too far from advice and into policy.

98. I think there are a few areas to consider in light of this observation. Overall, I think on some level the split between TAC, which comprises civil servants, and TAG, which comprises the expert advisors makes sense. In my mind, this could provide a valuable vehicle for commissioning, and also ensure that policy is separate from advice. However, I think there are some questions around the implementation – which I have no specific view on, but include for consideration by the Inquiry. Firstly, how does the involvement of government civil servant advisors in discussions impact the advice that is being generated? Secondly, is it appropriate for civil servants with a policy brief to be actively involved in discussions of advice with experts asked to provide that advice? How do you balance the expert advice coming from TAG with analysis and advice coming from organisations such as PHW? Whose responsibility is it to referee and manage this?

99. I believe speed was part of the reason for any blurring of advice and policy. I hadn't been involved in any prior pandemic planning, but at times it felt like Welsh Government as a system didn't really know what to do, and sometimes I think this came across in discussions as just wanting a solution from the experts in the room. I think this points to questions about preparedness, and I wonder if people were less prepared than they could have been because a pandemic was perceived to be a low probability event. On a societal level, I read a blog by Professor Gordon

Dougan **[EXHIBIT TRC/71 INQ000228324]** who commented that we in the high income west have forgotten what it is like to suffer from large scale outbreaks and epidemics. I wonder how much that plays into our thinking as a society about spending money on public health – focused on the cost now, rather than understanding it partly as a critical insurance policy against risks in the future.

100. More generally I think it important to pay tribute to the work done by members of TAG and TAC, who like me were also having to deliver work operationally/in other areas at the same time as generating results/data to provide advice, or, in the case of TAC colleagues, were having to undertake a host of other functions to communicate advice on, run the meetings etc. From my perspective, there were times when there were a lot of questions etc in flight, and there didn't seem to be brilliant coordination across the different groups to manage the asks of experts, and this was a shame, as I think it made things harder than they should have been. This is particularly problematic where staff are filling many roles, as this will contribute to stress and exacerbate risks related to single points of failure that cannot be easily fixed in an emergency.

101. In addition, I am not sure that overall support with mental health and consideration of impacts on scientists providing advice was as well considered as it should have been. In some respects, TAG and other advisory groups sit in an interesting space – they will place significant and sustained demands on many staff who don't work for them. Again, I think this links back to the question of on what basis are you part of TAG, and who is it who should be looking after/considering the impact of the activities on you as a person. As a Cardiff University employee there are schemes such as an Employee Assistance Program in place, but support is ultimately quite limited, and TAG was something that was in many ways outside of what would be expected as part of my normal employment. For NHS staff there is now support such as Canopi available, but again, some of these are for after your mental health has already been harmed, and they are often not open ended, but limited in duration. For myself, it still isn't clear to me that TAG and many of the parts of the wider system really took responsibility for some of the impacts on the people who were central to their activities and success.

Other groups and communication routes for advice and how they functioned

My roles

102. My primary routes for engagement with Welsh Government were via groups such as TAG, which were formally established with interactions happening via formal meetings. I had few other communications with Welsh Government (none with ministers, and few with civil servants) outside of formal meetings. These communications were generally either by email or phone call. Over the course of the pandemic, I can't recall being involved in any WhatsApp or similar groups with Welsh Ministers or other senior Welsh Government civil servants.

103. I was involved in a range of groups/activities/meetings in relation to the pandemic response. Some of these were broadly aligned to TAG, provided specific routes to Welsh Government for advice which may be parallel to TAG or provided data that would feed into TAG and SAGE.

104. The Welsh Government Variants and Mutations of Concern oversight group provided a place to coordinate information and response to Variants and Mutations of Concern (VAMC). It covered some of the ground that was also covered in TAG, however it was far more focused on policy and action, rather than advice. There was overlapping membership between TAG and VAMC, although I don't think there was a formal link between the groups. There were certainly occasions (e.g., with wastewater analysis) where the same topic was covered in both groups separately.

105. Looking at my outlook calendar, the first VAMC meeting I was invited to was on the 10th of February 2021.

106. The meetings began at a frequency of once every week, before dropping to a rate of one meeting every two weeks. I attended most of the meetings held by the group, would estimate that this would be in the range of 20-30 meetings in the indicated period. My role was to provide expertise with respect to the genomics of SARS-CoV-2 and to provide information/advice in relation to SARS-CoV-2 variants, supporting relevant workstreams as required.

107. I was invited to attend a couple of the SAGE Transmission subgroup meetings, to represent COG-UK, following a nomination by Professor Sharon Peacock. I attended fewer than 5 meetings. I was invited based on my role/membership of COG-UK. I believe my role would have been to provide advice, with respect to genomic data on transmission.

108. I joined the UKHSA Variant Technical Group (VTG; originally the 'technical coordination meeting for new variants') and Horizon Scanning Group, which came

into existence following the identification of Alpha. The group was analysis focused, providing advice in the form of risk assessments and technical reports, which were shared with and considered by TAG and the VAMC Oversight Group.

109. I was invited to join VTG, growing out of my role/ membership of COG-UK and early work on the Alpha variant – the first meeting in my outlook calendar was on the 4th of January 2021. I attended most of the meetings from its inception in 2021 through to the end of the specified time period (30 May 2022). Initially the meeting was twice a week, dropping to once a week later. VTG included representation from a number of TAG members (including the TAG co-chairs and Dr Chris Williams from PHW in addition to myself) who acted as a route to feed relevant information back to TAG, where required.

110. I was present to contribute to discussions relating to variants, including offering my opinion/being involved in decision making on whether to classify variants as 'of concern' or 'of interest' based upon risk assessments of the available data. I was explicitly present as one of the representatives of PHW/Wales, as the lead for the SARS-CoV-2 genomics activities in Wales.

111. I was present in the Horizon Scanning group to help join up horizon scanning activities across the UK, answer questions/look into questions relating to Welsh cases and provide a Welsh perspective. I ultimately handed this work off to a member of my PHW team. This group wasn't about 'advice' per-se but does feed into the activities of the main VTG. The first Horizon Scanning meeting in my diary looks to be on the 22nd of January 2021. Horizon scanning reported to VTG, and there was no formal link to TAG.

112. With the development of genomics for SARS-CoV-2 across the UK public health agencies, and the decision taken by PHE to end sequencing activity by the COG-UK network in the first half of 2021, there was an obvious need to marry up strategic thinking and advice with respect to SARS-CoV-2 sequencing activity. To this end, Professor Yvonne Doyle convened a group to undertake work in relation to genomics strategy. I played an active role in the main group, as well as leading the data/bioinformatics working group, developing several documents/advice that were shared with the group.

113. I was invited to join by email on 14/12/2020, following a discussion with staff working for Professor Yvonne Doyle. I attended all of the main advisory board meetings held in the specified time period. Meetings were monthly. I also attended

working group meetings related to bioinformatics/data (which I co-chaired) taking place on a weekly/fortnightly basis when there was work to perform. I was present to help represent PHW/Welsh SARS-CoV-2 genomics activity, expertise and experience. I believe my name may have been passed to UKHSA (PHE as was at the time) by Welsh Government. Other members of TAG also attended the advisory group, providing an informal link.

114. I was a core member of the group that planned and designed the COVID-19 Genomics UK Consortium (COG-UK), and I played an active role in multiple groups that made up COG-UK including the data working group (which covered infrastructure and processing), the mutation group and the analysis team (which wrote the reports that went to SAGE and TAG). I also sat on the COG-UK steering (management) committee, providing representation for Wales as part of the operation of the consortium.

115. As part of COG-UK I co-led key parts of the technical work with respect to the core CLIMB COVID platform, generated analyses for inclusion in COG-UK reports, identified potential areas of activity for inclusion in reports, identified research areas and questions, and contributed to the drafting of COG-UK analysis reports. I was a founding member of the group, in March 2020. The COG-UK groups that had a direct role in analysis/advice were the analysis group and the steering group.

116. For the COG-UK analysis group, I attended most of the weekly meetings from March to September/October 2020, and then subsequent meetings through to May 2021, which were more intermittent. I would estimate that there were at least 20 of these meetings that I attended. This group was focused on writing the COG-UK reports for submission to SAGE.

117. For the COG-UK steering group, I attended most of the monthly meetings through March 2020 – June 2021, I would estimate that there were 10-12 in total, allowing for holiday breaks etc.

118. I acted as the main conduit between COG-UK and TAG. COG-UK reports were submitted to SAGE, and so TAG would have received them through that route, albeit without any comment/other information. I also shared COG-UK reports with TAG directly and provided additional context and explanation where required. COG-UK also provided other outputs (such as the COG-UK coverage reports) which, although not being directly applicable to advice/decision making, were used

by decision makers, as they provided valuable information on sequencing coverage, helping to establish the confidence around conclusions from the sequence data.

Reflections on linkage and the flow of data and advice from other groups to TAG

119. It is my perception, looking back, that there were definite issues in terms of the flow of data and information between different groups that provided 'advice' with respect to TAG. To me, the position of other UK groups was never fully clear with respect to TAG, and my experience of information/advice flow was that it tended to be one way (from groups to TAG), often facilitated by a member of TAG who sat on those groups. I suspect that some of these issues may have stemmed from a lack of clarity around lines of responsibility and reporting.

    a. In the case of COG-UK, for example, I was the primary link between TAG and the consortium, and so while COG-UK papers flowed to SAGE (and then on to TAG), I was the one who would introduce/lead the discussion at TAG of papers that had a particular significance to Wales, and was also the one to provide updates and answer questions on the data that COG-UK was generating. In this sense, the route for COG-UK to feed into the pandemic response in Wales was via me and there was limited resilience if I had been ill and was therefore unavailable to provide that expert link between groups - to flag issues or explain results. This is partly reflective of the lack of pathogen genomics/genomic epidemiology experts in Wales/PHW, but as a result I was, in effect, a single point of failure. In the opposite direction, there were limited mechanisms for TAG to ask questions of COG-UK. COG-UK was setup to some extent to take direction from SAGE, but the formal route for devolved governments to ask questions of COG-UK (and other national studies/consortia) was, and is, unclear to me. COG-UK is one example of TAG being a receiver of analyses/information, and not necessarily being able to set the agenda for research being undertaken.

120. In several significant cases (COG-UK/SAGE, VTG/NERVTAG, Four Nations COVID-19 Genomics Strategic Advisory Board/UKHSA) I was part of groups which sat within a reporting structure that went to an entity/group which

was either England-centric or was setup by the Westminster government. In the case of COG-UK in particular, despite my extensive involvement, I was never quite clear on the relationship with SAGE (it was suggested that COG-UK would be setup as a SAGE subgroup, though didn't ultimately happen [**EXHIBIT TRC/72 INQ000228325, EXHIBIT TRC/73 INQ000228327, EXHIBIT TRC/74 INQ000228328, EXHIBIT TRC/75 INQ000228330]**), and the relationships with the devolved governments, which while very good and collegiate, weren't formalized, to my knowledge, in a plan that placed COG-UK into the context of the wider response.

a. With respect to these outside groups, these differing structures also may have created barriers to the flow of data and analysis. I recall from discussions with respect to COG-UK and CLIMB COVID in late 2020 that Devolved Government data wasn't necessarily available to SPI-M **[EXHIBIT TRC/136 INQ000320592]**. This points to the larger issue of a lack of appropriate data sharing frameworks, which is a problem that remains unresolved.

121. This lack of clarity around accountability and governance, combined with the question of my own authority to act (as an individual, PHW employee, academic researcher) also created issues around information sharing. In a situation where urgent information is wanted, it wasn't always clear what I could share, and where I may need to go to get permission to share information, which was often only useful if shared in a timely way. I remember a particular early analysis we did looking at hospital transmission within one Welsh Health Board; some of the analysis we did on this initially was potentially useful (and we shared a summary as part of a COG-UK report [**EXHIBIT TRC/50 INQ000228293 as above**] but it wasn't clear who I had to talk to in order to get permission to share detailed information with SAGE or TAG.

122. I also experienced challenges with coordination between groups. I recall occasions when, during the weekly analysis meetings in the early part of the pandemic, COG-UK developed a set of questions **[EXHIBIT TRC/76 INQ000228331, EXHIBIT TRC/77 INQ000228333]** and was also asked specific questions deriving from SAGE meetings. However, most of the outputs of COG-UK were driven by researchers asking and answering questions of the data. While COG-UK had a route for SAGE to request analysis, it wasn't clear that such a route

existed for devolved governments. It is worth noting that while COG-UK received significant funding for sequencing of samples, it was mostly voluntary, with the majority of costs for staff time and the analysis work not being covered by the consortium itself. This also meant that there was limited ability to commission work directly. COG-UK itself was an incredible achievement – but it was also very much built on the back of established infrastructure and a research community that is world leading, and able to lend its support to a national effort.

a. It is also important to point out that groups across different organisations (e.g., the UK COVID-19 Genomics Strategic Advisory Group [led by UKHSA], the Variants and Mutations of Concern group [led by Welsh Government], the UKHSA Genomics Operations Group, the Test, Trace and Protect Programme Board [led by Welsh Government] and COG-UK [led by Cambridge University and PHE]) could all make decisions that would have an impact on the generation of genomic data, and therefore the advice/information that flowed to TAG. Much of the coordination between groups would come through participation of key people – but I don't recall seeing these links documented, and so can't be sure that there was adequate air traffic control to ensure that everything was always joined up.

123. In contrast to COG-UK, my personal perception was that TAG-E highlighted the challenges faced when there are key questions (e.g. effectiveness of mask wearing, environmental and ventilation measures, modes of transmission, impact of barriers and screens) but where the existing research community is not as large or as well funded as the microbial genomics community. I would say there were several cases that I recall where there were cases highlighted in TAG-E that suffered from being covered by research in only a limited way, prior to the pandemic (for example, environmental determinants of flu transmission have been looked at, but in a relatively small number of papers). It felt to me as if TAG-E had a real problem in the sense that while there were interesting and important questions to be asked (for example around the impacts of screens and visors for dispersion of the virus in the environment), there were both pre-existing knowledge gaps, and no money to address these questions in the short term either.

124. One place where I think capacity was rapidly built was in the policy modelling subgroup. I remember frustrations in relation to the accessibility of modelling early on and remember being involved in discussions with

Supercomputing Wales around the implementation of epidemiological models that could be tuned for Wales. There are good reasons why one might wish for specific modelling for Wales. There are a range of factors that one may wish to model specifically which could inform the response and planning in Wales including our geography, transport routes, direction of disease spread (generally east->west rather than south->north), population demographics (e.g. Wales has a higher proportion of its population that is over the age of 65 than either England or Scotland, based on the 2021 census), comorbidities, measures of economic and social deprivation and the impact of the porous border with England. I would argue that models that are better adapted to the population/place they propose to model are ultimately more useful to inform potential decisions. Additionally, having the ability to model COVID-19 in Wales on demand is also useful to ensure that relevant data is available when it is needed.

125. Early on I think that ensuring that Wales had a suitable model/set of model data was certainly a challenge, and I recall the significant amount of work by a range of colleagues to test, develop and apply existing models to work for Wales. In this case (research) funding was secured for some of this work, which is positive and demonstrates the system working in this instance - but again, there was a period at the start of the pandemic when people involved were having to work without funding to undertake work that was of national importance.

126. It is important to note that a significant amount of the advice and analysis generated by academics and consumed by TAG and its subgroups will have been generated by staff who were not funded to work on this area of activity. Some of those staff will almost certainly have been funded by charitable funds or funds that are partly derived from industry. I certainly had staff within my research group who were operating on funds from a range of sources, who spent significant amounts of time on SARS-CoV-2 work, to generate analysis and data for TAG. While the value of this is unarguable, this had a knock-on effect on my academic research (and the careers of the staff working on those grants), and I don't think that this was ever satisfactorily managed by Welsh Government.

127. I think the challenge of this is also amplified by membership across multiple groups simultaneously. This was partly an issue of growth and evolution of TAG over time, and as the value and importance of genomics became more widely understood, the number of groups that needed genomics input increased. I ended

up in many of the groups that I did partly to shield my team so they could get on with their work, already under significant strain, but this also points to the core issue in terms of capacity and investment in areas like genomics in research and public health research in Wales. As with reagents and equipment to increase testing capacity – in a pandemic situation local capacity with respect to expertise and advice is critical, because local nuance can be hugely important in analysing data and providing appropriate analyses. It is also the case that in a pandemic, governments need to have local capacity available to provide advice, because everyone else is also going to be looking inwards to their own community of experts to guide their response. In my view as an academic, it is critical in future that Welsh Government specifically considers the sort of public health advice and other research expertise that we may need in a pandemic and ensures that there is adequate capacity in the academic system in Wales to provide it.

128. There is a natural challenge in that Wales is much smaller than England, and the public health research space lacks entities such as the English Health Protection Research Units which provide readymade links (with things like data sharing agreements) that can be built upon in the pandemic. Clearly, there is a finite pot of money, but after our experience in the pandemic, I think it would be prudent to ensure that key expertise is available in Wales (in public health, research and, if possible, industry) to support future pandemic responses in Wales.

129. In addition to the broader strategic challenge, it is my professional view that there is also a growing challenge with respect to the provision of data scientist and bioinformatician expertise within the NHS (in Wales and the wider UK). This known workforce challenge is a major issue, exacerbated by a slow pace of change and pay scales and expectations that are significantly worse than what people can get in industry. Ultimately, a major part of the pandemic response was data driven, but in Wales the data elements were driven by a very small number of people, at both the advisory and operational levels. As it was, the risk to resilience from this did not materialize – however in a future pandemic we cannot rely upon this.

130. Finally, I think there were also instances where we generated data or information, and it flowed into one place (e.g., I know that JBC was undertaking work on genomic data, but know no more than that, as it wasn't, to my knowledge, shared with me in my role in PHW or with TAG). I know that the national core studies were undertaking a range of activities, but engagement was variable from

a genomics perspective (from very good with Genome to phenome (G2P) and the Data NCS to very limited with some of the others). Also, throughout, it was unclear on what basis data could/should be shared with the range of people who wanted access to data. Where formal arrangements were negotiated (e.g., for COG-UK), the data sharing elements took months of work to tie off – over which time we had to operate at risk, in the hope that everything would be sorted. The data sharing aspects are something that should have just worked; however, they were a serious issue to overcome, which was particularly difficult when there was a very valid need to do things quickly.

Reflections on the early stages of the pandemic, the first national lockdown, and views on actions prior to my joining of TAG

131. I first became aware of COVID-19 in late December 2019, from chatter on Twitter. By the start of January 2020 there were extensive conversations happening on Twitter involving a number of collaborators/colleagues.

132. I wasn't part of any formal advice structure in Wales prior to the announcement of the first national lockdown. I was a part of COG-UK (which had a formal launch of the 1st of April, but generated its first report, including using Welsh data on the 23rd of March).

133. I didn't liaise officially with WHO or international organisations in the early pandemic. My role was very much to continue to support the genomics services we already provided and to undertake my university research.

134. From January to March 2020, I was predominantly liaising with colleagues in the research space – primarily the ARTIC Network team who developed the amplicon scheme for sequencing SARS-CoV-2.

135. As such, I cannot comment on advice that was provided to Welsh Government in relation to the first national lockdown, or the balance of advice from TAG vs other groups such as SAGE.

136. With regards to my views on the first national lockdown – I feel it important to note that I was not involved in discussions relating to the first national lockdown, and the policy adopted by the UK and the Welsh Government. My views on decisions made will not be based on 'all the data' that was available to advisors at the time. I should also say that reflecting on my views at the time, I was not expert

in the area of Non-Pharmaceutical Interventions (NPIs) as a mechanism to control epidemics/pandemics, and although I have considerable expertise in genomics and genomic epidemiology, my prior work had not involved aspects such as modelling the impact of NPIs on outbreak/epidemic transmission.

137. I would partially agree with the UK Parliament Health and Social Care and Science Technology committee that the initial policy adopted by the UK government of a 'slow and gradualist' approach to introducing non-pharmaceutical interventions proved to be the wrong policy. I would caveat this by saying that I think it was a prudent approach early on in the pandemic (in January and probably into February 2020). My personal view is that I do not think it was the right policy as case numbers jumped and it became evident that there was local transmission (within the UK), in February and into March. My personal view is that at that point the policy should have been altered, and more restrictions put in place, more rapidly. However, as I don't know what data was available at the time, and what advice was provided, it is difficult to provide an authoritative view – as I am very much sharing an opinion that is from the outside looking in. My feelings at the time are evidenced by the fact that within the Pathogen Genomics Unit we informed the bioinformatics team (who were office-based) that, where possible, they should work from home from the 17th of March 2020.

138. Work that we were involved in subsequently, led by Prof Oliver Pybus (shared with SAGE in COG-UK report 8 **[EXHIBIT TRC/78 INQ000228334]** in June 2020 and published in Science **[EXHIBIT TRC/40 INQ000228280 as above]** in February 2021) demonstrated the number and scale of imports into the UK prior to the imposition of the lockdown. To me, in mid-2020, and now, the findings of this work demonstrated that travel restrictions should have been part of the mix and may have had a role to play in reducing the speed at which the pandemic initially established in the UK.

139. It should also be said, however, that this was the first time I am aware of globally when there was a sufficiently large-scale, high-resolution sequencing dataset to accurately examine the impact of imports into a country with respect to the establishment of local transmission. Routine flu genomic surveillance data is much smaller in scale, and simply doesn't allow for the sort of analysis that Professor Pybus and his group were able to undertake for SARS-CoV-2. I think this is a good example of the use of genomic data to unpick a key question about

a new virus, which could then be used to inform future actions and planning – it is also a salient lesson in the time it takes to pull together large datasets and undertake a robust, high-quality analysis.

140. With respect to the lockdown itself, it was my personal view at the time, and remains my personal view now, that the lockdown should have been enacted earlier. Based on the evident effectiveness of the lockdown in controlling SARS-CoV-2 in 2020, in my personal view, if lockdown had been implemented earlier, there would have been far fewer cases in the first wave, and the lockdown **may** have been shorter as a result. In this respect, I am broadly in agreement with Vaughan Gething's statement that if Wales had entered a national lockdown a week or two earlier *"we'd have saved more lives"* – certainly in the first wave.

141. However, amongst all of this crystal ball gazing, what is also important to remember, is that the pandemic is not a set of discrete independent events, but a complex, interconnected, set of local outbreaks and transmission, occurring globally, which are themselves linked to factors such as policy, control decisions and human behaviour. Had we reduced the size of the first wave, there may have also been consequences including subsequent waves during the summer of 2020, which would have required further hard decisions on additional lockdowns. As such my professional view is that it is extremely difficult to confidently war game what would have happened. For every case where we can identify a likely immediate result, there would have been longer term consequences that would likely have had impacts that we could not guess. The key point being that the outcome of any 'what if' that would have reduced the size of the first wave and duration of the first lockdown would also have been very likely to impact the shape and timing of the next waves of the pandemic.

142. Considering containment and early policy decisions, one of the key early questions I remember thinking about was around transmission. The term 'asymptomatic transmission' has been used in a few cases; however, it is important first to be clear on the meaning of this. Transmission could be from asymptomatic individuals who were either pre-symptomatic (i.e., they could transmit before they had symptoms, but did go on to develop symptoms) or who were truly asymptomatic (i.e., they were infected but never developed obvious/detectable symptoms). In addition, there are those people who were pauci-symptomatic (i.e.,

they developed few symptoms, and may not have altered their behaviour as they did not think they were infected with COVID-19).

143. Thinking back, my assumption from reasonably early in the pandemic (January/February) was that there was some sort of asymptomatic transmission (no view on if that was pre-symptomatic, asymptomatic or paucisymptomatic) – as this would be consistent with the spread that was being observed and other viruses. I think it important to note, however, that the scale of asymptomatic transmission was not known, and that is arguably the more important component, as it is the scale of asymptomatic/pre-symptomatic transmission which is critical for informing control measures. As some of the early preprints and other data came out (particularly from China, Washington State and the cruise ships) I think it was pretty clear that there was transmission before symptom onset as well as asymptomatic infection, and these papers started to provide some idea of the scale of that, which also explained the extensive spread and issue with controlling the virus in multiple places. I certainly remember questions about asymptomatic transmission and testing being discussed at TAG after I had joined.

144. I would have expected an understanding of transmission to underpin the decision making with respect to controls prior to the lockdown. In particular, I have been asked about the cancellation of events, an issue that elicited some debate in the media. I wasn't myself involved in discussions, and I don't know what data was available to decision makers. I do think that it is difficult to focus on particular events – as, in my personal opinion, without other NPIs in place, the exposure risks associated with people gathering in a concert have to be put in context with other opportunities for mixing and transmission – such as continued working from offices, keeping venues such as pubs, restaurants etc. open.

145. Big events can be important, and clearly can provide an opportunity for seeding/initiating large local outbreaks (as was subsequently shown with the Boston Conference), as they can create opportunities for the introduction of the virus into a new area. My expectation would also be that those events almost certainly caused additional cases. However, in the wider context at the time - with everything else being 'open' and the considerable force of infection coming via travel in February/March, I don't think you can judge single events. Moreover, sporadically cancelling some big events, but having no measures in place to reduce the risk of exposure/transmission for the rest of the population, or for

everyone who attended those events in their day to day lives isn't, to my mind, a coherent strategy. Ultimately, while I wasn't involved in discussions or decisions related to these events, my expectation would be that any decisions of this sort should have been accompanied by some sort of risk assessment, which would have brought together the intended strategy and predicted impact in terms of cases/transmission, offsetting this against other harms and other implications from cancelling the events.

The pandemic from April 2020 onwards - specific advice provided to and actions of TAG and other groups

146. I joined TAG following the lockdown – so can't comment on any discussions that took place with respect to the lockdown prior to it happening – as I wasn't involved in those discissions.

147. From my perspective, I think the basis of the decision to lockdown in March 2020 was clear to me as an individual watching from the outside, both at the time, and subsequently. After I had joined TAG I particularly recall discussions in relation to COVID harms in TAG (e.g., the discussion of the four harms from a modelling perspective - **EXHIBIT TRC/79 INQ000228335, EXHIBIT TRC/80 INQ000228337**), which had a direct relationship to the aims of lockdown, and which provided a framework to assess harms from lockdown against other COVID-19 harms.

148. I recall behavioural analyses being discussed on several occasions during 2020, and certainly recall information such as adherence to NPIs and mobility data being discussed during meetings. I also recall some of the preconceptions about adherence to NPIs which proved to be wrong, - and how the public responded brilliantly. Changes in lockdown compliance, were, to my recollection discussed on several occasions, and TAG included colleagues with expertise on behaviour. While these discussions were interesting, I was not involved in them. Therefore, from my personal perspective I would say that behavioural considerations formed part of the advice and information that came out of TAG and went to ministers and played some part in decision making. However, colleagues with expertise in the area would be required to identify if these discussions were adequate, as I am not

in a position to judge. Furthermore, I don't have sight of how information and advice was used – and so can't comment beyond recalling that discussions took place.

149. I don't recall being in any discussions with respect to discharging asymptomatic patients from hospitals into care homes without a COVID-19 test. As this was a policy in March, I am guessing this would have predated my time in TAG. I do recall some discussions around the use of testing capacity for care homes in early April and then the development of a consensus statement in early May **[EXHIBIT TRC/81 INQ000228338]** – although this was more focused on screening staff, rather than patients. My main involvement with respect to care home testing questions was in raising some questions relevant to genomics and planning, and highlighting genomics work – particularly COG-UK results that had shown that staff played a key role in introducing SARS-CoV-2 into care homes in London **[EXHIBIT TRC/82 INQ000228339, EXHIBIT TRC/83 INQ000228341,]**

150. I don't recall TAG being asked for advice with respect to the Eat Out to Help Out scheme in 2020. I think there is a challenge in examining specific measures; from a purely scientific perspective, any scheme that promotes mixing of different households in a confined space carries a risk of promoting viral transmission. However, based on the case and sequencing data for the summer of 2020, SARS-CoV-2 was largely eliminated across Wales, and so in that situation, the risk has to be offset against the benefit to the economy/hospitality sector. There was some regional variation in rates, which may not have been fully considered by the scheme. However, I am certainly not expert in economics or policy, and so wouldn't be able to comment on the balance of these risks. In Wales, case numbers were low over the summer of 2020, and many of the key lineages that went on to dominate in Wales in the Autumn, prior to the emergence of Alpha, were descended from the B.1.177 lineage, which emerged in Spain **[EXHIBIT TRC/84 INQ000228342]** and was bought into the UK and seeded in many regions by international travel.

151. My main role throughout TAG was the provision of information analysis and insight based on genomic data. I also tried, where possible, to ask questions/highlight issues that I was aware of or that seemed obvious to me, based on discussions in TAG or in other groups to which I was party. The majority of the information/analysis I provided was shared as it was generated, and wasn't necessarily directly targeted to relate to particular questions (e.g., to identify if a

lockdown was needed) but was intended to provide information to help understand and interpret the current situation, and from that provide information for decision making. The advice provided was therefore relevant to the management of NPIs, even if that was not the explicit motivation/purpose behind its creation. As I have indicated previously in this statement, however, I also have an extremely limited idea of how the advice I generated or contributed to was ultimately used – my expectation is that it formed part of a patchwork of information to provide a situational understanding for decision making. Advice provided that I believe may have been relevant to, or may have been used as part of decision making with respect to NPIs includes;

a. I was directly involved in preparing reports from COG-UK, and have records of at least 14 reports generated over the course of 2020 **[EXHIBIT TRC/50 INQ000228293 as above, EXHIBIT TRC/37 INQ000228277 as above, EXHIBIT TRC/85 INQ000228343] EXHIBIT TRC/86 INQ000228344, EXHIBIT TRC/87 INQ000228345, EXHIBIT TRC/84 INQ000228342 as above, EXHIBIT TRC/88 INQ000228346, EXHIBIT TRC/89 INQ000228347, EXHIBIT TRC/78 INQ000228334 as above, EXHIBIT TRC/90 INQ000228348, EXHIBIT TRC/91 INQ000228349, EXHIBIT TRC/92 INQ000228350, EXHIBIT TRC/93 INQ000228351, EXHIBIT TRC/94 INQ000228352, EXHIBIT TRC/95 INQ000228353 EXHIBIT TRC/138 INQ000320594]**. This included Welsh-specific analyses in COG-UK Reports 2 (Nosocomial transmission in Wales) **[EXHIBIT TRC/50 INQ000228293 as above]**, 6 and 9 (D614G mutation), and COG report 9 (hospital transmission and identification of outbreak clusters) **[EXHIBIT TRC/90 INQ000228348 as above]**. I also contributed to a COG-UK review of reinfection in response to a paper detailing reinfection published in August 2020 **[EXHIBIT TRC/96 INQ000228354]**. I also contributed to advice presented to the four CMOs around sequencing in September 2020 **[EXHIBIT TRC/97 INQ000228355].**
b. I was asked by Dr Rob Orford to put together a paper in October 2020 covering genomic insights to that point. This analysis drew upon the work we had been undertaking looking at the phylogeography of SARS-CoV-2 in Wales, as well as highlighting several key insights that had come from

work over the summer of 2020 **[EXHIBIT TRC/63 INQ000228313 as above].**

c. I contributed to advice that was provided to TAG to brief on the Alpha (summary in the notes from the TAG meeting on the 15th of December 2020) variant and provided text and edits to the consensus statement that was issued by TAG **[EXHIBIT TRC/98 INQ000228356, EXHIBIT TRC/99 INQ000228358]**, as well as contributing to a ministerial briefing via PHW **[EXHIBIT TRC/100 INQ000228196]**. I also provided input to, or wrote other summary/variant documents subsequently, the content of which may have been shared with TAG (I can recall **[EXHIBIT TRC/101 INQ000228197]** but there are likely to be others).

d. I also contributed to the virological post which outlined the genomic features of Alpha to the world, sharing this as information/advice to TAG **[EXHIBIT TRC/102 INQ000228198].**

e. I contributed to an ECDC briefing and rapid risk assessment that were also shared with TAG/Welsh Government on the subject of Alpha **[EXHIBIT TRC/103 INQ000228199, EXHIBIT TRC/104 INQ000228200].** I also contributed to an ECDC method advice paper **[EXHIBIT TRC/105 INQ000228201]**

f. Following the identification of recombination in cases in the UK (including Wales) in 2021, I provided a briefing on what it was and why it mattered to TAG **[EXHIBIT TRC/39 INQ000228279 as above]**.

g. When Delta arrived, I played a key role in analyses and provided materials and briefing to TAG with respect to the genomics and insight from the phylogenetic signal in relation to questions such as the number of imports that may have occurred to seed it in Wales **[EXHIBIT TRC/101 INQ000228197 as above].**

h. I provided specific input into numerous consensus papers and other documents. The larger work, where I played more of a leading role included including helping to draw together the consensus paper entitled 'COVID-19 evidence associated with transmission and potential risks associated with religious activities and places of worship' and leading the development of a paper describing the diagnostic lab process and considerations for new technologies **[EXHIBIT TRC/106 INQ000228202, EXHIBIT TRC107**

INQ000228204, EXHIBIT TRC/108 INQ000228205]. In addition, I commented on numerous consensus and other documents shared across TAG (e.g., **[EXHIBIT TRC/109 INQ000228206, EXHIBIT TRC/110 INQ000228213 EXHIBIT TRC/111 INQ000228218, EXHIBIT TRC/112 INQ000228220]**)

i. I and my team provided support to the modelling team as part of the policy modelling subgroup, providing information with respect to imports into Wales and other genomic information to help parameterize the models that were developed for predicting the reasonable worst case (e.g., in this email trail – most discussions happened in other places **[EXHIBIT TRC/113 INQ000228223, EXHIBIT TRC/114 INQ000228225]**).

j. Lastly, we also suggested and then provided a set of indicators which were fed into an internal dashboard developed for Welsh Government by Armakuni **[EXHIBIT TRC/115 INQ000228226]**.

152. In addition to reports and input into TAG, I was also involved in academic research, publishing a number of papers related to SARS-CoV-2 in peer reviewed journals **[EXHIBIT TRC/116 INQ000228227, EXHIBIT TRC/117 INQ000228228, EXHIBIT TRC/118 INQ000228229, EXHIBIT TRC/119 INQ000228230, EXHIBIT TRC/120 INQ000228232, EXHIBIT TRC/121 INQ000228233, EXHIBIT TRC/122 INQ000228234, EXHIBIT TRC/123 INQ000228235, EXHIBIT TRC/124 INQ000228236, EXHIBIT TRC/125 INQ000228237, EXHIBIT TRC/126 INQ000228238, EXHIBIT TRC/127 INQ000228239, EXHIBIT TRC/128 INQ000228240, EXHIBIT TRC/129 INQ000228241, EXHIBIT TRC/130 INQ000228243, EXHIBIT TRC/131 INQ000228244, EXHIBIT TRC/132 INQ000228245, EXHIBIT TRC/43 INQ000228283 as above, EXHIBIT TRC/41 INQ000228281 as above, EXHIBIT TRC/133 INQ000228246]**, and one preprint that has not been published in a peer reviewed journal **[EXHIBIT TRC/134 INQ000228247]**. I also helped write the COG-UK announcement paper **[EXHIBIT TRC/135 INQ000228248].**

Questions in relation to modelling and the firebreak and subsequent national lockdown

153. Moving into the autumn of 2020, I recall there being particular concern with respect to the re-seeding of SARS-CoV-2 in Wales. While I wasn't involved in the

modelling itself, I recall divergence between what SAGE predicted the R for Wales was, and what it was felt to be by TAG. I do not recall the specifics, but there were sometimes occasions where SAGE would be working from data that was not as up to date as that within PHW or available to the modelling team, or where SAGE would be using UK-wide models that did not fully take into account local nuance.

154. I recall that it certainly was the case that there were some large clusters that were growing quickly locally, but that the situation in the late summer/early autumn was variable across Wales. It is, I think, also important to understand that while a country-wide 'R' value might be useful for a general sitrep, an epi/pandemic is a series of local outbreaks, which overlap in time. In Wales we see different dynamics and timing regionally (e.g., epidemic spread is generally east->west, rather than north<->south), and so understanding what is happening locally is really important, and I don't think that a summary statistic for the whole of Wales was necessarily going to communicate the full nuance of what was happening on the ground. One of the advantages of the TAG approach was that it did enable what was happening locally to be considered by people with local knowledge. I think that there was something of a data addiction during the pandemic, with a large number of indicators being generated from the significant volume of data that was being produced. The key here is that while numbers such as a 'Wales-wide R' may sound simple, they are anything but. Ultimately, absolute values at one point may not be that useful, and numbers may not be comparable between models. Trends may be more useful (up/down etc.), but in somewhere like Wales, I believe that local views/views on the ground are going to offer a very important way to understand what is happening on the ground/in our communities, and this was something that TAG was in a position to consider, but SAGE was not.

155. Alongside the consideration of the impact of travel on re-seeding SARS-CoV-2 in Wales, the impact of students on case numbers was also remarked upon (particularly, if I recall correctly, because of the age skew in cases in the autumn). Although work looking at the return of students was mentioned, I wasn't specifically asked to look at this as part of my work.

a. Based on the genomic data that we generated in 2020, there was evidence that SARS-CoV-2 was largely eliminated in many parts of Wales following the NPIs put in place in the first half of 2020. In the late summer and early autumn, we saw multiple reintroductions of new lineages of SARS-CoV-2

into Wales, some of which then re-established local transmission in communities across Wales. It is this reintroduction, and re-establishment of local transmission that the phrase 're-seeding' is meant to capture.

156. In September 2020 TAG provided a series of pieces of advice in relation to the worsening situation. I think the advice was taken seriously, although as previously indicated, I wasn't always aware of what happened to advice provided to Welsh Government. I do think that there is a broader issue with political decision making with respect to lockdowns. As an example, when you consider, for example, that the doubling time of SARS-CoV-2 may have been in the order of 2-5 days in early 2020, pre-lockdown, it is easy to understand that the speed of decision making is critical. The idea of a politician 'taking a weekend' to make a decision sounds reasonable enough – until one realises that the 2+ days that represents could mean an almost doubling of the number of cases. I remember worrying about this at the time, and I personally think that the impact of not making a decision when it is obvious that the situation is already bad and getting worse could be significant. I don't envy the decision makers having to weigh up the options, but the bottom line is that if a lockdown is required, the sooner it happens, the shorter it may be.

157. In terms of the decision to put in place the firebreak lockdown, I didn't do the modelling, but I do recall scenarios being discussed as part of the RWC modelling that took place in 2020.

158. Overall, my personal view is that the firebreak lockdown should have been sooner and national (UK-Wide). In Wales we have a particular issue with cross-border transmission with England, and so I think that synchronizing measures on either side of the border is potentially important.

159. My view on the firebreak itself was that it did have an impact, I think that earlier implementation and longer duration would have had an impact on immediate case numbers, however, I think if this wasn't UK-Wide it would be almost impossible to accurately predict what might have happened. I do think there is a more interesting scenario to consider on a UK-wide basis, which is that had a national firebreak/lockdown of been implemented in September/October time, would this have snuffed out or enabled earlier detection of Alpha? I suspect that if it were longer and similar to the first lockdown, then it might have done, and could have had a material impact on the wave that was seen over Christmas 2020.

However, as with the questions around timing of lockdowns, it is important to note that this is pure conjecture and really only serves to demonstrate that when decisions to impose (or not) NPIs were made, there were a host of unexpected consequences.

160. As with the other lockdowns, it is likely that had the third national lockdown been implemented sooner, then this would have had a material impact on the number of cases in the short-term, but this would ignore downstream effects, and the potential for other harms that would have been caused.

Communication of Scientific Advice

161. I personally think a public narrative (across the UK) was developed that politicians were 'following the science' and I think this may have created an impression to the public that politicians were doing what scientists told them they should do. My perception was that much of the 'advice' that I provided was informational – rather than advocating a particular course of action, it was information or analysis that informed the choice that was to be made, from several options. I think a better term would have been that decisions were 'informed by the science' rather than 'following the science'.

162. Considering the wider challenge of scientific advice – that scientists can only confidently advise within their area of experience and competence, and are constrained, to some extent, to provide advice based on the questions that are asked.

163. If you ask a clinician a question, you can expect that the advice that will come back will be advice that is consistent with the clinician being the strongest advocate for their patients. If you ask a public health professional a question about controlling an outbreak, you can expect that the answer that will come back will be the answer how to do that – regardless of other harms that may be caused.

164. One of the challenges of the concept of 'following the science' is that most scientists are specialists, and are not the experts when it comes to government, policy, the economy etc. Conversely, many civil servants and people in government are generalists. I sometimes wonder if part of the issue with 'following the science' is one of perspective and position. Do scientists understand the perspective of civil servants when questions are asked? Do civil servants

understand when asking a question of a room of specialists, that they are the ones who have to put the answers back together? Do civil servants understand that the onus is on them, as question asker and the 'specialist generalists' with an understanding of government, policy etc. to turn information, insight and advice into action? I don't know the answers to these questions – but I think they probably go some way to the heart of the questions around what 'following the science' should mean as a process, in a government and policy context.

165. I think this also relates to a larger point, that that there were a range of different roles, and it wasn't always clear that everyone understood what the roles were, what their role was, and what the expectations were. TAG was a small-ish group, with many people wearing multiple hats. One of the challenges of civil servant policy people being involved in the discussions is, at what point does advice become altered by their involvement?

166. Moreover, when formulating questions and advice, there is an important difference between;

a. Understanding what has happened in the past (i.e., what is known/expected)
b. Understanding what is happening now (interpreting data as it comes in through a scientific lens – to put together a picture of what we are seeing)
c. Understanding, based on the known science, what is expected to happen next (to inform options and support decision making)
d. Guessing/predicting based on the information and analysis available, along with other information, what might happen next.
e. Understanding what one might want to do, from a policy perspective in a complex system, to alter what is going to happen next (who is it that has that systems view of a complex problem? whose responsibility should it be to have that view?)
f. Being able to integrate all of the different pieces of information and conflicting priorities into a set of policy actions that are intended to result in a set of identified outcomes (i.e., how do we change what we expect to happen next).

167. While in a-c and d, the role of clinical/public health/biomedical advice should be obvious, these also need to cover things like other harms etc. The extent to which this is covered is, in my view, the responsibility of the people organizing

the group. The bottom line being, you can get the world's greatest subject matter experts in the room – but the onus has to be on the people getting them in the room to know what to do with them once they are there. Those experts cannot be expected to have a view of the bigger government or policy picture – you have the experts there for the specialist knowledge. This is one of the real challenges with advice ultimately, scientific advice will be provided in good faith, but it is up to government to use that, and up to the civil service to ensure that the information covers the ground that is required.

168. More generally, I think that the pandemic reveals the extent of challenge that has to be faced when managing the emergence of a pathogen that is largely new to science and medicine when you have a large, very complex system with a huge number of unknowns. My personal view is that the pandemic shone a harsh light on issues such as lack of data interoperability and availability across the public sector, the challenges of operationalizing decisions such as 'increasing testing', disconnects between directives from the centre and what works best/is needed on the ground and the difficulties of securing advice and turning this into policy at pace. I think there is, looking forward, a real question of what is required in terms of systems leadership and system design to do things better in the future. I should also note that this is very much not my area. I am not a leadership or complexity expert, and this is very much my perception – I also appreciate that issues such as data interoperability and data sharing are perennial issues for the public sector, albeit ones which had knock-on effects when the pandemic hit.

Other thoughts and reflections

169. In addition to the above, I have a number of reflections, thoughts and suggestions in relation to TAG. I acknowledge that in some cases these are outside of my immediate area of expertise, however, hopefully these will still be of some use and will help inform some of the work and recommendations of the inquiry.

170. Data sharing, and the legal situation of sharing information into TAG is something that I don't feel was adequately considered. This relates partly to the question of the basis on which people are part of TAG (as representatives of their organisations or as individuals), but also to the system in which TAG sits, and

agreements that exist between participants. I think there is real thought required with respect to providing future guidance to participants on what data/analysis can be shared with TAG, what the expectations are with respect to members, and who has the responsibility for data protection/aspects such as GDPR with respect to the sharing of data/information to TAG, and then who has responsibility for these aspects in terms of the use of the data/information by TAG. More broadly, I think data issues were a significant impediment to the generation of timely results/analysis, and I think more thought needs to be given, by government, to how it can support rapid data sharing in an emergency.

171. Provision of advice - TAC/TAG was bought together quite rapidly and grew in an organic way. I think it would be great to both have a clear structure in place in future, and, in the area of public health advice/health security, it may even be worth having a standing group in Wales that provides advice during 'normal' times and then can be expanded during times such as pandemics.

172. For Wales in the future, I think having a publicly shared and agreed playbook for advice (similar to the SAGE guidance) would be really useful for participants and government itself. The real challenge in balancing where advice stops and policy begins, especially when we are in uncharted waters and an unprecedented situation would be simpler if this planning were in place ahead of any future incident. Advice being closer to policy may not be a bad thing, but with that comes responsibility, and I think we, as a society, need to think about that carefully. It is especially important to understand the perspective of people providing advice, and to think about balance in how that advice is generated. I don't have a solution to this but suspect that the Inquiry is an opportunity to identify best practice and recommendations covering this in the future.

173. Managing the evolution of structures through a pandemic – my impression of the way that TAG/TAC was setup was that it was not set up to run for years, but with an expectation that the 'emergency' would be relatively short. As part of this, my observation was that TAC/TAG started off small and then grew significantly over time. I think one of the key future challenges is around the structure; and I would think that future advisory groups for pandemics need to be planned with the idea that they could operate for years. Further, I think plans for the evolution of those groups should be baked in from the start, with a clear set of processes for implementing subgroups that feed into a more central strategic/air traffic control

group for advice. I think this began to happen in 2020 and developed as the pandemic developed, but I think next time it would be better to be operating to a pre-defined template, so that everyone (experts, civil servants, politicians) understands how 'advice' is generated and passed on/escalated.

174. Transparency of advice and analysis - I think that TAG was very good at sharing its advice and being transparent with what the group was passing on to government. I think the guidelines/basis for the data and information sharing aspects of groups with advisory functions should be codified and built upon. I took part in a number of media briefings, but one of the things I think we could have done better is to have worked to better communicate the 'advice' process to the public. I think it is definitely worth thinking about the ways in which a group like TAG can engage more widely so that the public and patients are aware of what is going on – and if there are ways such as utilizing professionals with science communication expertise to support advisory groups in communicating with the wider public and presenting both information/advice as well as the advisory process to a concerned/interested public.

175. Alongside the transparency question, while not such an issue in TAG, I have seen cases of experts being attacked online for political or other similar reasons. I think that we do need to consider how experts are treated, and potentially protected, when they are asked to provide advice in good faith, and to lend their expertise to serve the country. I don't know what the best solution is, and the challenge of the security of experts (both from abuse and as targets from foreign state actors, for example) had clearly been considered in SAGE guidance previously, which was changed following demands for greater transparency in terms of the SAGE membership. Finding a balance is critical – and I think that a solution is needed covering both abuse from members of the public, and from politicians targeting (paid or unpaid) experts who have said something they disagree with.

176. TAG had limited ability to commission its own research, and this meant that for questions with limited/no research evidence, either TAG members would have to undertake unfunded research, or the group would have to wait until research was completed elsewhere to be able to articulate an evidence-based opinion. In England, activities such as the national core studies were initiated which covered the UK, but the involvement of TAG in these was not integrated. While it makes a

lot of sense to identify questions that are of import to the development of advice and fund research in those areas by UK-wide networks it would be good, in the future, for similar initiatives to integrate the views of advisory groups across the UK to ensure that local needs/questions are covered, and to provide a route for urgent questions to be raised for rapid research answers.

177. Related to the question of commissioning research, there is the more day-to-day question of how analysis capacity is resourced, and the process by which TAG should be able to request analysis from experts. We undertook a number of analyses on request from TAG, and this was manageable because we had staff (research and PHW) who were funded for research that we could retask. I still don't think there was a proper process for supporting researchers who made use of (fixed term contract) researcher time to support the pandemic response, especially where the funding for these staff came from charitable sources. My research group certainly took a hit in terms of undertaking research/analysis in response to needs in Wales, as we didn't receive funding to replace that we had used when we retasked staff. This has had a longer-term impact in terms of our ability to go out and win new research funds, while my focus, working solidly on COVID, meant I simply didn't have the time/space to put together research grants – which has impacted my research post-pandemic.

178. Intensity of effort and support for members - I served on TAG throughout the pandemic, and at times it contributed a significant additional workload for me. This had real effects on my own mental health, and I often felt that attendance was expected/required because of my area of activity and the fact there were a limited number of other experts in my area on the group. I would expect that other colleagues – such as those in PHW – may also have felt similar pressures, which are manageable over a few months, but are problematic when exerted over 2-3 years. I think the management and support for members of the group should be thought about in future, and specific measures put in place to help protect the health of experts who are contributing to TAG while also running parts of the pandemic response. It is also worth noting that in preparing this response I asked Welsh Government for information they held on my attendance at TAG. The fact that in most cases (82/149 meetings, according to the information supplied to me), attendance wasn't recorded, and in some cases where attendance was recorded, it wasn't recorded correctly is also not ideal, and points towards an impression that

TAG itself did not 'look after' its people as well as it could have done. In some ways I wish I hadn't asked – as it actually makes me feel as though my time/contribution was under-appreciated/not recognised, despite TAG being a major draw on my time over the past three years.

179. As I indicate earlier in this witness statement, there was an amount of uncertainty with respect to my role in TAG – as an individual or as a representative of my employing organization. I think there was a potential for tension from there being questions asked within TAG which could also be asked of the NHS or PHW. This created a potential for conflict, and also potentially created a situation where an individual within TAG could have provided advice that differed from 'organisational' advice that had come through an internal PHW route. I am unaware of this occurring, but I do think that there is a risk that without roles and responsibilities being clear, TAG could end up putting people in a difficult position in future.

180. Having provided advice to Welsh Government, and interacted with civil servants, on a personal level I would have appreciated being able to understand the role our advice has played in the pandemic response, and also, in some circumstances, to understand how our advice has been taken. At points, it did feel like we were feeding data and advice into a massive governmental machine, without necessarily seeing where that was going, or how it was helping to move things forward. For my own personal and professional reflection, it would be useful to know what worked well, and what wasn't so useful, so as to enable me to be better prepared for any future pandemic.

181. More generally, I think there is a challenge in the area of advice and evidence generation, in the sense that as the data changes, results change, and interpretation changes. A key reflection going forward is how science feeds into advice, and what is the process for digesting, critically evaluating 'science' that exists (in un-peer reviewed and peer reviewed formats) to synthesise that information into advice. To my mind, advice requires critical thinking and evaluation, and that applies whatever the input material. As part of this, I think that there is probably a better level of understanding of the scientific process required more generally, and I think we probably also need to think carefully about what we want from advice and advisors, and if that is the same as what we want from researchers who are asked to generate evidence. Specifically, I think we need to

think about what types of people we need on our advisory panels. For example, I think you can have people who;

a. Generate evidence and provide advice.
b. Provide advice, but don't generate evidence.
c. Generate evidence but are not suited to provide advice.

182. I don't think we explicitly distinguish the type of 'expert' we are looking for, or think about the skills/training/experience required for the different roles. I think considering this and baking it into advice generating structures would be helpful for the future. On the same point, I feel as though while we have a conveyor belt for producing researchers, I am not sure that we have as reliable a system for producing advisors who are able to critically evaluate the evidence and then provide clear advice that is understandable to policy makers. I think that is probably a need that should be thought about, given the scale and variety of advice that was required as part of the pandemic response.

183. Overall, I was involved in quite a number of different groups, as well as performing my day-job (running the PHW PenGU Bioinformatics team, running the SARS-CoV-2 genomics in Wales etc). So, to me, at times support felt quite limited, and the structure was quite clearly set up to provide information to Welsh Government. I don't think the structure was especially brilliant for supporting members of the group. Throughout the pandemic my day job was intense, and while I managed to do it, I don't feel there were particular mechanisms to support me directly in providing advice. Providing advice as part of TAG and the other groups I was involved in meant lots of very short deadlines, and late nights, short turnarounds for comments on documents - all in addition to long hours elsewhere. It also required lots of analysis to be done – including finding resource at short notice to do this – or having just to do it myself. At time it felt as if government was almost 'addicted to data', and the machinery of government forgot that at the end of the reports, analysis and visualisations were a small group of people who had worked at a very high intensity for some time. The pandemic response was both the hardest and most rewarding thing that I have done in my professional career, and while I wouldn't change my involvement or effort, I think it is important to think about how experts are supported, and the potential for a small number of experts, spread across multiple groups, to be overwhelmed by uncoordinated asks from different sources.

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: ____20th October 2023_____