Witness Name: Professor John Watkins
Statement No.: 1
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UK COVID-19 INQUIRY

MODULE 2B

WITNESS STATEMENT OF PROFESSOR JOHN WATKINS

I, Professor John Watkins, Consultant Epidemiologist, Public Health Wales, will say as follows:

I am a Consultant Epidemiologist on the Specialist Register of the GMC (Number 2730372) and the GMC register as a GP and make this Witness Statement further to receipt of the Rule 9 letter from the Public Inquiry dated 2 June 2023 and to provide assistance to the Public Inquiry in relation to Module 2B.

1. The facts and matters set out in this statement are within my own knowledge unless otherwise stated, and I believe them to be true. Where I refer to information supplied by others, the source of the information is identified; facts and matters derived from other sources are true to the best of my knowledge and belief.

2. I attach to my Witness Statement various exhibits to which I refer in the following paragraphs of my statement. References in square brackets below are to those exhibits.

Professional background and relevant experience concerning pandemic preparedness.

3. For over 30 years, I have worked in the field of Epidemiology with a special interest in the epidemiology and prevention of illness due to respiratory pathogens, particularly Influenza in its seasonal and pandemic forms. I have conducted research and published on all aspects of Influenza, influenza vaccination, surveillance systems and pandemic disease. I have published on these topics in international peer reviewed journals and presented at major international conferences relating to Influenza and other respiratory diseases, particularly the Options for the Control of Influenza conferences, (since the second conference in 1992) and a number of ESWI conferences. **(JW/01 INQ000409590)** Of relevance to this statement are the findings presented to the Options meeting that took place in 2003, when the initial findings from the original SARS epidemic were presented by the clinicians and scientists with first-hand experience of the cases.

4. From the mid 1980's, while still a GP, I was one of the foundation GPs that helped Professor Stephen Palmer set up the embryonic Influenza surveillance system in Wales. Over the years and since becoming an Epidemiologist, I have worked closely with colleagues in PHW and helped develop real-time monitoring of Influenza and Influenza like illness directly from GP computer systems. Over the years we have added in other streams of data and about 10 years ago I facilitated the addition of virological surveillance in sentinel ITUs in Wales. In addition, I have worked with GPOOH agencies and the ambulance service to add data from these sectors to the system.

5. More recently, I have collaborated with a number of colleagues across Europe looking at international comparisons of surveillance systems for Influenza and during the pandemic SARS-CoV-2. This work has been published in peer reviewed journals.**(JW/01 INQ000409590)**

6. In the period from 1995 to 2000 I worked with colleagues across the UK including Dr Douglas Fleming of the RCGP Surveillance Unit and Professor Jonathan Van-Tam Former DH deputy CMO, advising the UK Government and the CMO on all aspects of seasonal Influenza and Vaccine Policy.

7. In relation to pandemic Influenza and pandemics in general, I presented one of the first papers on the impact of the 1889 'Russian Influenza' pandemic in London in 2006, which was subsequently elaborated on in Toronto in 2007. Also in Toronto, I presented a paper on Age as an independent risk factor from pandemic influenza. **[JW/02 INQ000211746] (JW/03 INQ000408059)**

8. In 2006, I wrote a discussion document for the lead for Pandemic Planning, David Goulding, at the Welsh Government "WG", the subject of which was an option appraisal for Call Handling and the healthcare response during a pandemic **(JW/03 INQ000408059)**, see also **[JW/04 INQ000211737].** In the document my advice was that, in the event of a pandemic, we largely continued business as usual, using routine systems for both the triage of cases and the administration of antiviral therapy, while building in contingencies for escalation. A path we followed with the relatively mild pandemic of 2009.

9. In 2007, I reviewed the findings of the 'Winter Willow' exercise and the repercussions of its findings for Wales.

10. During the 2009 H1N1 pdv pandemic, I was a key adviser to the WG on its response to the pandemic and took part in most of its policy discussions. Between 17th and the 20th November 2009, I was invited to take part in a meeting, held in Geneva, organised by the WHO Global Influenza Program, which involved some 200 scientists and policy makers from around the world. The aim of this meeting was to formulate policy on the Global Research Agenda for Influenza, which was subsequently published, to date it has received over 4000 citations **(JW/05 INQ000408070)**

11. In more recent times, I have worked with colleagues across Europe and published a number of papers comparing Influenza surveillance systems across Europe **(JW/06 INQ000408081, JW/07 INQ000408092).**

12. Prior to the 2009 H1N1pdv pandemic, I had worked closely with both the UK and Welsh governments on pandemic preparedness and vaccination policy, at one stage chairing the winter vaccination group in Wales.

13. In 2013, I presented a paper at the Options for the Control of Influenza conference in Cape Town which addressed the use of R (the basic reproductive number) JW/02 **INQ000211746**] in Influenza research and, in 2014, at the ESWI Influenza

Conference in Riga, I presented a paper on the role of network structure on the propagation of disease in the real world and the implications this has for pandemic planning. Both these topics have relevance to the way in which the UK modelled the evolution of, and responded to, the COVID-19 pandemic. **(JW/03 INQ000408059)**

14. Prior to studying Medicine, I gained a First Class honours degree in Physics and I have throughout my career maintained an interest in mathematics. After graduation as a medical doctor I continued with my mathematical interests and how they might apply in medicine. This naturally led me to the field of Epidemiology and Infectious diseases, particularly Influenza. Over the years I have collaborated internationally with colleagues and published work looking at methods for establishing the excess mortality due to influenza. **(JW/08 INQ000408101)**

15. From about 2010 I have become interested in the academic area of study of Complexity and particularly its application to healthcare. In order to increase my knowledge and skills in the background mathematics underlying the study of what are known as complex adaptive systems, such as society, the stock market and modelling, I pursued numerous on-line courses with the Sante Fe Institute, SFI, in New Mexico, the world renown centre for the study of complexity. I also attended a week-long workshop in 2015 on how complexity could be applied to health and healthcare. With the SFI I have successfully completed courses in Dynamical Systems theory and Agent Based Modelling, among others. In 2017, I attended the *3rd International Conference for Systems and Complexity Sciences for Health* and presented a paper at this meeting on complex adaptive systems .The proceedings of the meeting have been published as a textbook *Embracing Complexity in Health*. **(JW/09 INQ000408102)** From 2012, I took part in almost all of the meetings of the Welsh Pandemic Influenza group, which met from 28th June 2011 to 9th July 2018. **(JW/10 INQ000211731), (JW/11 INQ000211711), (JW/12 INQ000211720), (JW/13 INQ000211721), (JW/14 INQ0002117222), (JW/15 INQ000211725), (JW/16 INQ000211726), (JW/17 INQ000211727), (JW/18 INQ000211728), (JW/19 INQ000211729), (JW/20 INQ000211730), (JW/21 INQ000211732), (JW/22 INQ000211733), (JW/23 INQ000211734), (JW/24 INQ000211735), (JW/25 INQ000211736), (JW/26 INQ000211743), (JW/27 INQ000211744), JW/28 INQ000211745).**

16. In early 2020, my Consultant Job Plan was for 6 sessions with PHW and 4 sessions with Cardiff University. My 6 sessions in PHW were split between HealthCare Public

Health, Technology Appraisal and Health Protection. The latter was mostly related to Infectious Respiratory Disease. The Sessions for Cardiff University involved teaching and research. My research focus in a large part has been Influenza and other Respiratory viruses and involved collaborations with international colleagues, this work has been published in peer review journals. **(JW/29 INQ000408103, JW/30 INQ000408104)** I also have a research interest in un-scheduled demand on the healthcare system and its ability to cope. This involves work on the quality of care and resilience of the system. This dovetails well with my interest in infectious respiratory disease.

Membership of TAG advisory structures

17. With over 30 years of experience in infectious respiratory disease and its prevention, and a track record of research and publications in peer reviewed journals and international conferences, I was surprised that I, and others, were essentially not called in to provide continuity and expertise at the start of the COVID-19 Pandemic. In fact, I had communicated widely with the CMO, the CEO and many other colleagues in Wales as soon as I became aware of the pandemic threat posed by the SARS-CoV2 virus, from very early January 2020. I will elaborate on this later.

18. In addition, before TAG was formed, or any formal arrangements had been put in place, I provided a summary of an early paper that came out of China. **(JW/31 INQ000408105, JW/32 INQ000408060).** This summary was largely ignored by the CMO, CEO of PHW and others. In February 2020 I shared a draft editorial to the same group of individuals highlighting my concerns that the SARS-CoV2 virus, as it would later be called, had spread beyond the boundaries of China, was spreading rapidly across the globe and any efforts to prevent it becoming a Pandemic were likely to be unsuccessful and so we needed to start planning to deal with this pandemic. In this editorial I highlighted the fact that a significant number of cases were asymptomatic and so, in my opinion, containment would largely fail. **(JW/33 INQ000408063, JW/34 INQ000408064).** In fact I was reprimanded, post-publication of the editorial in the BMJ for not using the correct process, despite sharing a draft several weeks before with numerous colleagues, including the CMO and CEO of PHW, the latter stating they did not have time to read it. **(JW/35 INQ000408065, JW/33 INQ000408063)**

19. Having been part of the UK and Welsh Pandemic framework for well over a decade and with first hand experience of the issues, I would have expected to be asked by PHW and the WG to be part of the advisory framework. This was not the case. The draft Editorial, with its key messages, was, essentially, ignored by the CMO's office at the WG and the CEO at PHW, as I did not have any comment or response. I submitted this editorial to the BMJ in the third week of February 2020 and it appeared, online and in the Print copy of the BMJ on the 28th February 2020 **(JW/34 INQ000408064)**. This Editorial attracted world-wide attention and, according to Research Gate, received more attention than 99% of all articles over the past 3 years. Even this did not prompt PHW or the WG to invite me to help. I wrote several times, over the course of the Pandemic, to the Chief Scientific Officer for Health, who chaired the TAG group, to ask if I could join the group but never even got a reply. **(JW/36 INQ000408066)**

20. From my point of view, which I admit is just my own experience, the recruitment process to TAG was not transparent and I have no idea how people were selected. I was never asked to take part directly.

21. I was asked to advise the WG by one of the Senior Medical Officers, which I agreed to do. In order to proceed with this I was asked to clear it first with the Medical Director of Public Health Wales and was told, following a discussion with his Deputy in Health Protection, that it had been decided that all advice would be routed via himself and the MD, despite neither having a track record in the real challenges that we were facing, and no prior input into the Pandemic planning process in Wales. **(JW/37 INQ000408071, JW/38 INQ000408067)**

22. The request that I assist the WG was not referring to membership of TAG or TAC, as prior to March 2020 I was not aware of either and I am not sure they were up and running. I was open to any input I felt would be valuable to the pandemic effort. I was not being precious about being involved for the sake of it, I genuinely believed and still believe that I have considerable skills, knowledge and expertise across the board in epidemiology, disease transmission dynamics, clinical care and prevention and vaccination that would have made a significant contribution. I was happy to help in any way I could.

23. Following this rebuttal of my involvement, I was left with the impression that the PHW executive/management were going to work on the basis of rank and did not open the doors, seek soundings, or have 'big room' discussions as to what was the best way to proceed. They had decided that the process of advice and interaction was to come from senior management, irrespective of experience. I was never at any point recognised as someone who could help and I was left with the impression my interventions, up to that point, the clinical summary paper and the editorial, were not welcome. **(JW/32 INQ000408060, JW/39 INQ000408062, JW/33 INQ000408063, JW/34 INQ000408064, JW/38 INQ000408067).**

24. Many of those involved in TAG/TAC and the Welsh input to SAGE had very little, if any, history, or experience in Pandemic Planning, Clinical Disease Management, Vaccine Use and distribution, or any 'hands on' experience of working through a pandemic.

25. In my opinion, because of the lack of experience in communicable disease, in general and pandemic planning in particular, highlighted above, this led to a lack of balanced debate and little prior knowledge and continuity as to what had gone before in terms of pandemic planning. This latter point was obvious when the plans that were in place since 2011 were not really used, or considered. For example, should schools remain open, or closed? This question was addressed in many hours of debate when the 2011 Pandemic Plan was drawn up, **(JW/40 INQ000408068).** However, it was difficult to see any counter views to school closures emerging from TAG. Another example is the issue of border closures and implementation of NPIs. At no point, during the first stages of the pandemic, were the non-COVID-19 impacts of NPIs debated and evaluated. I believe if there had been continuity and wider input from those with experience that different actions may well have been proposed. **(JW/41 INQ000408069)**

26. I was eventually asked to take part in the Policy Modelling Group that fed into TAG from May 2020 and also the PHE Mathematical Modelling Group. I was also asked to sit on a Cabinet Office Group on International Comparisons and two groups for the DH, the Children's Working Group and the Social Care Working Group. I am not aware that these latter three invitations arose via PHW, or the WG.

27. My experience on the Policy Modelling Group, which was chaired by a Health Economist, and dominated by mathematicians, was that there was a lack of

experience and understanding in the basics of a number of things relating to communicable respiratory disease. While the mathematicians were incredibly competent in the development and population of SEIR models, the group itself would have benefited from some debate around alternatives, such as agent based models, the impact of network structure of the population etc. There was an over reliance, later on, with regards to R(t) as a parameter in monitoring disease transmission rates and a lack of understanding that this parameter was greatly flawed, especially at times of low testing/cases. **(JW/37 INQ000408071)** Later on the group would have benefited from greater insight and understanding of clinical disease. I am not convinced that there was a widespread understanding that 'Long COVID' was a multi-system disease and hence not amenable to a single intervention. I made a programme with a reporter for the BBC on Long COVID in 2020 which addressed this issue. **(JW/42 INQ000408072)** In addition, later in the pandemic, when the vaccine had been rolled out, with high population coverage, I was not convinced that the group really understood the process by which vaccination and natural infection produce long-term protection. The mathematical models did not take into account the protection offered by the memory aspects of immunity, the memory B and T cells, that give long-term protection from the most serious aspects of SARS-CoV-2 infection, multi organ COVID-19.

28. The modellers took immunity from severe disease to be linked solely to antibodies and hence were predicting a resurgence of severe cases and suggesting the reintroduction of more severe NPIs. It was on this basis that in the summer of 2021 I broke silence in the press and challenged the view that, because antibody levels were dropping, there would be a resurgence of severe disease. **(JW/43 INQ000408073)** The group did not fully understand that it is inefficient for the body to keep pumping out high levels of antibody when exposure drops, over time. This drop in antibody does lead to an increased risk of infection but not hospitalisations and deaths.

29. There was also a lack of understanding, in my opinion, that immunity is made up of multiple different antibodies, targeting many antigenic sites on the Spike protein of the coronavirus and other areas on the virus. This heterogeneous antibody response protects us against variants, a point I tried to make many times, when, late on in the pandemic, more extreme forecasts were being suggested because of new variants, or waning immunity. I believe that this lack of diversity and understanding led to an overly cautious view on managing the pandemic later on. The small risk to young people posed by COVID-19 was never really discussed when talking about NPIs and

hence these small risks were never balanced against the profound effects of imposed social isolation on mental health, education, relationships etc. **(JW/41 INQ000408069)**

30. Despite asking many times within the PMTAG, as to what was the intended end-game with lockdowns; reduced deaths? reduced cases? protecting the NHS? eliminating the virus? this question was never really debated. The same was true at the PHE Maths modelling group.

31. With regard to the WG's response to the pandemic in Wales, I think that in many ways the lack of open debate and the lack of discussion about the evidence base for many of the NPIs, led to some flawed decision making, for example, the arbitrary and often conflicting rules on group sizes for meeting in public, which often differed from England, the asynchronous imposition of opening pubs, restaurants, mask wearing etc., between England and Wales led to people travelling to England to shop and go out to hospitality venues. The rather arbitrary and intrusive lockdowns imposed in some areas and not others and the restriction of movement of citizens, based on the false premise that such restrictions would make a difference. **(JW/37 INQ000408071 , JW/44 INQ000408074)**

32. The one decision I found particularly divisive was in the spring of 2022 when the WG decided to leave the decision on mask wearing in schools to the discretion of school head teachers. One can argue about the merits and effectiveness of mask wearing in these situations but, whatever side of the argument you fall, the decision should not be left to lay people. I felt this was an abdication of the Government's responsibility as the head teachers were not in any position to base the decisions they made on facts, only personal views. I was so concerned with this decision I wrote to the CMO and CSO, expressing my concerns **(JW/45 INQ000408076)** I also again raised this with the press. **(JW/46 INQ000408075).**

33. One particular issue stands out with regard to the advice in Wales. I wrote and widely circulated two documents, one relating to the clinical features of SARS-CoV-2 coming out of the first cases in China, which broadly mirrored, in terms of demographic impact and symptomology of the original SARS coronavirus **(JW/31 INQ000408105, JW/32 INQ000408060).** Second, also in February 2020, I wrote the editorial for the BMJ. **(JW/34 INQ000408064).** These documents outlined most of the key features of SARS-CoV2 infections, particularly the potential for a significant proportion of

individuals being infected asymptomatic but still capable of transmitting the disease, while others were already excreting virus before they become symptomatic. The DH along with PHE and the CQC in early April 2020 published guidelines on the discharge of patients into care homes. **(JW/47 INQ000408077)**. On April 9th, without wider discussion, PHW published its own document, **(JW/48 INQ000408078, JW/49 INQ000408079)** authorship not known to me, that translated the English document into Welsh, along with English text. The PHW document that was produced mirrored the text of the English version, except it contained a paragraph that directed hospitals and care homes to contact PHW for advice on safe discharge. **(JW/50 INQ000408082).** The BMA in Wales wrote to PHW expressing its concern that PHW was inserting itself into the clinical decisions to discharge patients to care homes, a clinical decision which should be taken by the clinicians managing individual patients and that consultants, not versed in day to day Health Protection would be redeployed and asked to supervise lay call handlers. **(JW/51 INQ000408080, JW/52 INQ000408083).**

34. Within PHW a whole floor of its main HQ in Cardiff had been turned over into a call centre to support 'Track and Trace' and this was now changed into a 'Closed Settings Cell' manned by lay (as in, not Health Protection trained) staff, supported by the general Public Health Consultant body. The discharge of patients, untested, into care homes from hospitals has been found to be unlawful in England. Considerable pressure was placed on the Consultant body to partake in this service, which I not only resisted, mostly on the grounds that my expertise was better served advising on the science, but also that I did not agree that this was a role for PHW. When I was told to take up shifts I expressed my disagreement with PHW's involvement on the basis that as an organisation it did not have the mandate, or the competence, to give advice on this issue; these were clinical decisions and infection control in care homes was outside of its legal remit. **(JW/51 INQ000408080, JW/53 INQ000408087)** In short, my advice was against PHW putting itself in this position. I am not aware that the Health Protection Consultant body, TAG, or the CMO's office were involved in the creation of the PHW document.

35. In the early stages of the pandemic, particularly, I do not believe that the work of TAG was sufficiently open to challenge and when alternate views were raised by myself and others, at PMTAG, these were often dismissed. **(JW/43 INQ000408073)** In addition, it did not necessarily have a broad enough representation from those with previous experience of past pandemics/pandemic planning. Mathematical models

drove much of the agenda around the benefits, or otherwise of NPIs, **(JW/41 INQ000408069, JW/54 INQ000408093),** without challenge as to alternate courses of action. A number of scientists wrote to the WG expressing alternate views, which were not necessarily welcomed. **(JW/55 INQ000408084, JW/56 INQ000408085).**

Policy Modelling Sub-Group of TAG

36. The first meeting of the Policy Modelling Sub-Group of TAG "PMTAG" that I attended was in May 2020.

37. As far as I am aware, the scientific advice that was sought from PMTAG was communicated via the Chair of PMTAG, directly from TAG. The notes of these meetings were produced, but I am not sure how these were communicated back to TAG and the WG. I am also aware that papers were produced using some of the work of PMTAG without necessarily being shared back for comment. It was clear from my discussions with the Deputy Director of Health Protection and Health Services at PHW that the main conduit for advice to and from PHW to the WG was via himself, the MD and those who sat on TAG **(JW/38 INQ000408067)**. I did not have a formal mechanism to feedback from my meetings on SAGE sub groups and the Cabinet office group, to the WG/TAG. I thought that being able to sit on TAG would have facilitated this but, despite requesting this of the Chair, Chief Scientific Adviser for Health, I never got an invite/response. **(JW/36 INQ000408066)**

38. I have no knowledge as to how scientific advice was commissioned by the WG. I do not believe the WG reached out to any of its former members of the Pandemic Planning Task and Finish Group, and the Chair of that group, a civil servant at the WG, was not centrally involved in the overall planning, despite carrying out this role during the 2009 Pandemic.

39. I cannot comment directly on Robin Howe's statement regarding the process by which policy owners sort commissions, except that PMTAG's work plan was driven by commissions from TAG, communicated verbally via the Chair of PMTAG. Many of the members of PMTAG attended TAG meetings. To me, especially early on, there did not seem to be a mechanism by which questions could be raised, for example, questions on the wider, negative, implications of NPIs, **(JW/41 INQ000408069),** what

goal were we trying to achieved by lockdowns, the merits, or otherwise, of using R(t) as a control parameter, etc. **(JW/36 INQ000408066, JW/37 INQ000408071, JW/43 INQ000408073)**

40. I think this lack of a formal process, early on, in garnering scientific advice led to several misunderstandings. For example, mathematical modelling was seen as being predictions and forecasts, upon which policy was produced, rather than scenarios. This combined with overconfidence in monitoring pandemic activity, down to small populations, without fully appreciating its extreme limitations, led to restriction of travel and more draconian NPIs in some areas, e.g. Caerphilly and Merthyr Tydfil. **(JW/37 INQ000408071)**

41. Scientific input could be improved in any future pandemic by recruiting and actively inviting expertise based on knowledge and experience, not just rank, or employer. In the initial stages, it would have been good to have had a very open dialogue with the broad scientific community so that the key facts were shared and understood and any gaps in understanding explored.

42. Ultimately, policy is the domain of politicians but scientists have a duty to make sure policy makers are well informed and that 'following the science' is sometimes not as straightforward as a lay person might think, and this uncertainty and debate needs to be communicated. **(JW/37 INQ000408071)**

43. I do not think that the broad range of scientific debate and conjecture was conveyed to policy makers due to a lack of input that would challenge and promote this. I have been struck by the evidence given by politicians, in the early parts of the inquiry, that the reasons the UK was not as prepared as it could and should have been was because we planned for the wrong virus, i.e. Influenza, not a coronavirus. However, it is also apparent that ministers and AMs were either not aware that Pandemic plans existed, or they chose not to read and follow them. If policy makers had read the UK Pandemic Plan 2011 and all the other planning documents since then, things may have been very different. **(JW/40 INQ000408068)** The view propagated is that 'lockdowns' are the new and innovative necessity for a coronavirus pandemic and that this and other NPIs were not planned for in the case of Influenza. This, in fact, is not the case. The Influenza Pandemic Plan called for the need to stockpile PPE, which we did not do, to plan for resilience, and that 'Track and Trace' had a role for the first introductions of a novel virus into the community but once transmission was

established any track and trace system would be overwhelmed. The UK Pandemic Plan discussed and dismissed closing schools, universities and borders, once widespread transmission had occurred, on the sound scientific basis that this would, at best, make no difference. Since there was widespread asymptomatic transmission of SARS-CoV-2 and that children and those below middle age were at very low risk of serious complications, in this pandemic, much of the UK Pandemic Plan, pertaining to a respiratory transmitted pathogen, was highly relevant. For those policy makers who did not seem to understand, or know of, this large body of preparatory work, then they were directed by overly pessimistic mathematical models for which they had little understanding how they were constructed and the aggressive use of NPIs etc., advocated by those who believed in their effectiveness.

44. I had no direct input into any PMTAG and TAG commissions. Issues that I raised were recorded in the notes of PMTAG meetings but feedback on the debate was recorded in the notes given by the Chair of PMTAG, who was also on TAG, as were mathematicians from Swansea University who also sat on PMTAG.

45. No one really contacted me directly from TAG around issues I raised. However, during and throughout the pandemic, I was contacted regularly by the print and broadcast media for comment. Only on a few occasions, when I had a strong point of view that I could not get across to policy makers, would I agree to be interviewed. It is interesting that on some of these occasions, when perhaps my views were at odds with the policy decisions, I was contacted, in a roundabout way, or directly **(JW/37 INQ000408071, JW/56 INQ000408085)** and asked how something had occurred. For example, following my interview with the BBC that suggested vaccines protected against hospitalisations and deaths, despite rising community cases. This led to the First Minister being asked by the leader of the Welsh Conservatives whether or not he agreed with me. **(JW/43 INQ000408073)** I had agreed to that interview on the basis that more restrictive measures by the WA were being considered.

46. Requests to PMTAG were filtered down through the Chair of the group so I am unable to comment on any multiplicity of requests for information. The processes for requesting advice from TAG could be improved in the future by ensuring that the government received the broadest possible input and advice at the highest level, including all those with relevant experience yet divergent views. This, perhaps, might limit the duplication and multiplicity of questions, as those who could answer certain queries would be in the room when they are raised. In addition, while a great supporter

of mathematical modelling to explore the parameters of dynamical systems such as epidemic disease transmission, I think there needs to be less reliance and influence by mathematicians and more by experts in epidemiology, disease control and infectious disease. Also, a greater input from clinicians on the ground would ensure, in future, that large amounts of money are not wasted on symbolism, such as Nightingale hospitals, which could never be staffed to look after the acutely ill, but may have had a role, if configured differently in a step down process of care, instead of discharging potentially infected individuals back to care homes. Anyone with any experience of the care home sector would realise that isolation in these environments would not be possible.

47. In my opinion, as I outlined above, there was not sufficient dialogue with regards to the strategic aims of policy. It has been said by politicians many times that "*we were planning for Flu and got a coronavirus*". The issue is, as I said above, if we had followed the UK Pandemic plan 2011 **(JW/40 INQ000408068)** and activated the LRF plans, combined with Dame Deidre Hine's report **(JW/57 INQ000408086)** on the 2009 pandemic, then we would have been better prepared. It is simply not true that the plans post 2009 were inadequate, the truth is attention and resources were diverted away from building resilience into the health and social care systems, both starved by years of austerity cuts and from 2018 attention was diverted to BREXIT. That said, the main difference with an influenza pandemic on the impact side, would be that the sector of the population most affected would be those not exposed to the circulating strain, in a previous epoch, generally post-pubertal teenagers and young adults. On the mitigation side we do have effective antiviral drugs stockpiled. **(JW/03 INQ000408059)**

48. The wholesale abandonment of the Influenza Plans and those who were involved in formulating them led to much confusion in the early stages, including muddled decision making, an almost hourly change in recommendations and guidance for professionals and rules for the general public.

49. I agree wholeheartedly with the TAG sub-group members who have expressed the view that they did not receive feedback on the advice provided and that there was a lack of clarity on how the sub-group's reports and recommendations were shared, discussed, or accepted by TAG and TAC. For example, my concerns on the inadequacy of R(t) to measure and monitor disease impact and progression, the role of cellular immunity in preventing severe illness, the need to shield the elderly and

vulnerable while relieving restrictions etc., were things I raised within PMTAG, but I am reasonably sure were never raised upwards to TAG. I was never invited to go and explain my reasoning.

50. I wanted to input directly into the TAG meetings rather than through the work of PMTAG, not for the kudos, if there was any! but because I genuinely felt that I could make a significant contribution. I have a broad range of experience and expertise in infectious respiratory disease and its prevention gained over my long career. I have a background and still practice, as both a GP and an Epidemiologist and Academic. I have spent 40 years writing about and researching Influenza and past pandemics, had key roles within the UK and the WHO during the 2009 pandemic and I understand the mathematics behind disease modelling. My collaboration internationally and my attendance at international conferences have given me a broad understanding of immunology and viral genetic variation. I felt that I could contribute much more to the debate in Wales than the narrow perspective of mathematical modelling. Despite writing to Dr Rob Orford, Chair of TAG, several times and raising this within PHW, I never got a response, positive, or otherwise. **(JW/36 INQ000408066, JW/38 INQ000408067, JW/53 INQ000408087)**

51. I think Welsh representation on SAGE was wholly inadequate, the same could be said for the other devolved administrations. For example, several institutions, such as Imperial College London, had more input into SAGE than Wales, in terms of seats at the table. In addition, I do not believe that, while the chair and co-chair of TAC were part of SAGE, there was enough representation from the devolved administrations with relevant and practical experience of pandemic infectious disease epidemiology and other relevant sciences, that would have led to a more informed and diverse input. For example, input from individuals with training and experience in infectious disease epidemiology, control and prevention, immunology etc. A lack of deep understanding of these factors would mean that the Welsh input was unlikely to be able to challenge the mathematicians, who seemed to hold sway, or add much to the debate. I am not aware that deliberations at SAGE were shared widely within Wales and the PMTAG did not get any direct feedback about the level of debate around any issues discussed. There was also no mechanism for this feedback that I could see, other than via the members of TAG that sat on SAGE. I am not convinced that feedback was a road well-travelled. My impression, which is probably ill informed, is

that TAG and the WG allowed SAGE and UK Government advice to be taken, as read and interpreted, rather than challenged and debated.

52. I was on a number of sub-groups that fed into SAGE, none of which were based on being the Welsh representative. I am not aware of any formal mechanism by which I could feedback from these sub-groups to TAG and I was never asked to do so. If there were some pressing issues I would contact individuals directly and feedback.

53. This lack of involvement between those with the experience and background in infectious disease epidemiology and infection control, is in direct contrast to the way the 2009 H1N1 Pandemic was managed.

54. For most of the period of its existence, I was the only person from Wales involved in the Social Care Working Group that fed into SAGE.

55. I agree with Dr Christopher Johnson that information on both the content of discussions in the groups and the evidence on which decisions were based was not freely shared. For example, the evidence base for the 'rule of 6' and the rules on social mixing/social distancing were never freely shared and, while they appeared arbitrary, with the absence of evidence that could be challenged they never were. In fact, in both the case of the rules of mixing and group size, there were significant differences between the home nations, most of which did not make sense to scientists, let alone the lay public. We now know that the evidence supporting these directives, for which people were prosecuted, was of low grade, or even worse, non-existent. **(JW/37 INQ000408071)**

56. Another example of the above was when the WG decided to devolve the decision on mask wearing by pupils in school to head teachers. This policy made no sense at all. I felt at the time that, irrespective of the merits of wearing facemasks, this decision should not be left to lay people and their personal opinion and said so publically. **(JW/46 INQ000408075, JW/45 INQ000408076)**

57. The members of PMTAG did not have, in my opinion, a sufficiently diverse range of expertise. I was the only epidemiologist and the only clinician in the group most of the time and hence the only one with frontline expertise in the NHS. This lack of a wider school of thought can be highlighted by the lack of concern for the wider societal and individual damage caused by the imposition of lockdowns, without consideration for

individual's mental health, or the educational damage that might occur. **(JW/41 INQ000408069, JW/54 INQ000408093)** The lack of clinical understanding of what was meant by the term 'Long COVID' by the group as a whole, due to the absence of clinical input, I think lead to an underestimation of the fact that this was a multi-organ, multi-faceted, diverse set of conditions without a single measure, or intervention.

58. PMTAG lacked sufficient input from behavioural scientists and I am not aware of the extent of cross representation on the other subgroup giving behavioural science advice. This lack of input into the policy modelling group, I believe, led to a lack of consideration for the non-COVID related harms created by lockdowns and other NPIs.

59. The main output of PMTAG were forecasts of the potential course of the pandemic based on mathematical models which, in my view, did not fully take into account the complexities of society and the impact social network structure has on disease transmission. For example, the inherent flaws in the calculation of R(t), especially on limited data. **(JW/37 INQ000408071)** For this reason, I often felt like a lone voice in raising issues with an alternate view, or interpretation. Input to debate by people from a broader background, with experience in the social sciences and infectious disease epidemiology, taking into account population need rather than technical mathematical skills, would potentially have led to better policy advice, forged by greater debate and challenge e.g. balancing COVID-19 direct harm against the societal damage of lockdowns. The models that were produced and discussed by the group were often populated by incomplete/inadequate data, especially late on in the pandemic and having more individuals with expertise to challenge assumptions would have been desirable. **(JW/41 INQ000408069, JW/54 INQ000408093)**

60. I totally agree with the views expressed by Dr Williams, that there was a greater need for diversity in professional backgrounds involved in PMTAG, e.g. Immunology, vaccine effectiveness and distribution, clinical disease, impact of isolation on the mental health of individuals and related harms of NPIs. Dr Williams raised his concern that some individuals were expressing their opinion outside of their area of expertise many times in the print and broadcast media. For example, in interviews mathematicians and others expressed their view on clinical issues and vaccine effectiveness with no formal training or track record to back this up. In fact, I raised this issue with the BBC and the members of staff I spoke to there agreed with me. **(JW/58 INQ000408088)** In future, there needs to be a more open, inclusive process

of recruitment and participation in these types of groups with participants drawn from the widest possible areas of expertise.

61. I do not consider that there was a clear definition of roles within TAG and PMTAG.

62. I am not aware of the resources that were available for TAG and its members and the support offered. As far as my participation in any of the groups that I served on during the pandemic, I was never asked what support I needed.

63. I have eluded above as to how I feel the whole advisory structure could have been improved:

    a) Broader membership based on skills and expertise.

    b) A clearer understanding, transmitted to recipients, that mathematical modelling outputs are not forecasts and, as such, should not be taken with any level of precision and certainty.

    c) The whole SAGE/TAG, Cabinet Office/WG machinery should be much more open and transparent and invite dissent and challenge. 'Following the Science', while a catchy slogan, is the complete antithesis to the scientific method and demonstrates little understanding beyond school science, where everything is taken as fact.

    d) A more open debate should be encouraged with active scrutiny of the evidence base on which decisions are made. As far as I am concerned this process was opaque.

64. I was not a participant in any WhatsApp or other messaging groups with Welsh Ministers, senior advisors and senior civil servants.

Infectious Disease Modelling: An Overview

65. In the words of George Box " *All models are wrong but some are useful".* Generally, the purpose of mathematical models is to explore the dynamics of a system and, for some simple systems, the models can be reasonable facsimile of a system itself. This

is not true of complex dynamical systems, such as the weather, financial markets and pandemics. Mathematical models, even if they are fully deterministic, are subject to chaotic randomness and this generally, except across very short time scales, makes future behaviour unpredictable. During the pandemic and previously, departments such as those at Imperial College and the LSHTM have used SEIR models to generate reasonable worst case scenarios, the aim of which is to raise awareness and drive policy making. Unfortunately, during the COVID-19 pandemic there became an over reliance on the mathematical models which were adopted with almost evangelistic zeal and little understanding as to their shortcomings. This, I believe, is in no small part due to the general lack of understanding of mathematics by policy makers.

66. Models fall into two broad categories; mechanistic and non-mechanistic.

a. **Mechanistic models**, in the most part, are based on fundamental laws with known interactions/forces acting upon them, e.g. planetary motion. These types of systems have dependence on initial conditions and display chaotic behaviour. This has an impact on long-term predictions.
b. **Non-Mechanistic models,** in contrast, are often 'Black Box' models based on inputs and outputs and often use artificial iIntelligence and machine learning to deduce the relationships between the inputs and outputs of a system. The influence any one input parameter has on the system, in terms of output, is often determined by refining the model on learning data sets. Validity of the model is then tested on a sample data set, where later outcomes are known, i.e. does the model make reasonable predictions, from a system's inputs, when the outputs are known. This is often the method used with 'real world' data sets.

67. In addition, models can be deterministic, where input parameters into the model can be exact variables e.g. temperature, density, concentrations, speed etc., or statistical where the various inputs and interactions are based on probabilistic assumptions, e.g. around susceptibility, transmissions dynamics etc. If person A comes into contact with person B the probability they will be infected is ….%

68. Models can be compartmentalised so that the inputs of one compartment feed into another. For example, one can segregate the population, with respect to an infectious disease, S - susceptible, E- exposed, I- infected, R- removed (recovered, or dead). SEIR, as these types of models in relation to infectious disease are called, then make

assumptions based on probabilities of infection rates etc., for transition from one state to another, exposed to infected say. Stochastic models such as this embrace uncertainty within the parameters it uses. The key point is that since these models do not deal with individual transmissions from one person to another but envisage the population as being divided into compartments with the transmission proportions within and between compartments much like liquid flow. In this sense, therefore, such models are a huge abstraction from the real world with all its cacophony of individual interactions and social networks. Outputs from such models are not in themselves predictions and are unlikely to bear more than a passing resemblance to actual outcomes.

69. To overcome some of the problems in the oversimplification of society made by SEIR compartmental flow models, then another way of treating this is to build the model up, starting with individuals. These individuals, or agents, are the basis of Agent-Based Models. In such models, an individual will be assigned to one of the SEIR compartments at the start of the model and then one can build in such things as network structure, how many people does an agent have close contact with, how often, what other individuals and groups are they connected to, etc. Transition probabilities are then assigned, e.g. if exposed as a susceptible, how likely is a particular agent to become infected? If infected, how likely are they to die? How long will they be infectious for? What is their probability of death? etc. Each individual agent can have a different probability of, for example, becoming ill, or dying, based on age, prior exposure etc. Agent-Based models are a huge step forward in modelling complex adaptive systems, but due to their complexity take up an enormous amount of computing power. However, such models can be very useful in exploring what-if scenarios, such as social distancing, closure of schools etc. In theory, one could also build in the probabilities related to an individual who is socially isolating developing mental health issues. These types of models were not used very much during the pandemic, mainly because there is a distinct lack of understanding, competence and expertise, this could and should be addressed going forward.

70. As defined above, the basic structure of the models used by Imperial, LSHTM and Swansea University were all SEIR differential flow models. As such, individual and heterogeneous susceptibility in one part of the population over another, such as that associated with age, were not catered for. In contrast to the assumptions made in SEIR compartmental models, infectious disease passes from person to person along contact networks and so real world disease transmission is highly dependent on

individual contact rates and network structure. Population network structure is non-linear, in that most people have low rates of contact, however there are a small number of individuals, often in key roles, who have a large number of contacts. Infecting a highly connected individual can lead to a super-spreader event, compared to the average. This individual network effect has a profound impact on disease propagation and how disease spread can be contained. This 'real-world' rapid initial trajectory is driven by highly connected individuals being infected early in the pandemic, the rate of transmission slowing, thereafter as progressively the more isolated are reached. This has been explored mathematically, the Nobel Laureate Michael Levitt and others **(JW/59 INQ000408098)**, giving credence to the role network structures plays. These findings also mean that shielding those most at risk, while the pandemic spreads through less vulnerable sectors of the population, is a viable strategy, as pursued in some countries. None of this was ever discussed, fully, in any of the groups of which I was a part. Even when I raised the issues discussed above they were only given cursory attention and I am not aware that they were raised at TAG or SAGE, in this way. In fact those 28 scientists who wrote an open letter to the Prime Minister calling him to adopt a selective shielding strategy were subjected to negative press and treated as heretics. **(JW/55 INQ000408084)**

71. The limitations of the compartmental models used to inform the TAG were demonstrated when asked how the issue of vaccine effectiveness was being built into the model. It would appear that the vaccine effectiveness was modelled by reducing the susceptible population manually and not in a more natural, dynamic sense.

72. Other SEIR models, such as the one at Imperial College, had been constructed for Influenza and were essentially a 'black box', which was not subjected to peer review and scrutiny until well after the initial lockdown had been implemented. The Swansea model was the main driver for the advice coming out of PMTAG and, I believe, used the scenarios that were generated by other models at SPI-M for comparison.

73. The views of PMTAG were fed-back via the Chair of the group to TAG, notes of the meeting were circulated but often close to the time of the next meeting, as were the agendas. No consensus was sought, or agreed, and most of the time TAG policy papers containing Swansea University modelling scenarios were shared with the group after they had been completed.

74. Generally, models are used to understand the dynamics of a system. The models used and presented to SPI-M, SAGE, TAG and PMTAG, were highly simplified abstractions from the real world, as outlined above, embracing none of the complexity of the complex adaptive system that is society. No model can capture all the subtleties and nuances that arise in such a system which means the outputs from the model were never really predictions, or forecasts and most scenarios, apart from over very short time scales, were likely to turn out wrong. I am not sure this was truly embraced by politicians, or many of those professionals involved in the pandemic response. We accept that predicting the weather over timescales longer than a week, or down to small geographical areas at shorter time scales, is highly inaccurate, yet many of the outputs from these much less sophisticated models, of a more complex system, were taken as read - as predictions.

75. Agent-based models can, as described above, be used to simulate individuals, their risks and behaviours and are more appropriate to explore the impact of NPIs and changes in population behaviour but not of making predictions. If modelling was so effective then predicting the financial markets and hence making a fortune from them, would be incredibly easy and someone would have cracked it by now.

76. I have already described above that long-range, or even short-range, forecasts, with all the abstractions used in the models during the COVID-19 pandemic, were never going to either improve their accuracy, or usefulness, in modelling the real world. In addition, because of the inadequacy of such models, with wide confidence intervals on their predictions, it would be impossible to define cause and effect of changes in something like case numbers due to the impact of a firebreak lockdown.

77. For SARS-CoV-2, the data sources used to populate the models were the number of positive tests, test positivity rates amongst all tests, hospital admissions, rate of test positivity amongst hospital in-patients and the test positivity in those admitted for other things and deaths. For many years in Wales we have run the Influenza Surveillance System, which has been expanded to embrace SARS-CoV-2. This surveillance network also includes GP attendances for flu like illness, ITU virology data, calls to GPOOH services and in depth multiplex PCR for multiple respiratory pathogens.

78. Some, or all, of the above can be used to populate models. However, at times of high disease incidence, not all cases present for testing, with mild and asymptomatic cases

escaping surveillance. At times when the disease is more quiescent, then testing is more sporadic and so true population prevalence is unknown.

79. In the case of SARS-CoV-2, the disease process is such that once an individual has contracted the virus there is a pre-symptomatic period in which the afflicted person has no symptoms but starts to excrete virus. This viral load increases rapidly over the next few days when by Day 5 after exposure, symptoms, if they are going to develop, manifest themselves, noting that over half of infected individuals never develop symptoms. Individuals will be excreting contagious amounts of virus from 24 to 48 hours before symptoms develop reaching a maximum on day 3. After a further 3 days the viral load drops to non-contagious levels, in most cases. It is at this stage, roughly a week after symptoms have started, with low viral loads, the more severe COVID-19 symptoms kick in, in around 5% of individuals, who may require hospitalizations. If severe, life threatening symptoms develop, these usually manifest themselves 7 to 14 days after symptom onset. **(JW/60 INQ000408089)**

80. The time-course and sequence, described above, in which symptoms develop, poses a real problem for both surveillance and capturing data for modelling purposes. Hospitalisations lagging up to 2 weeks behind infections, and deaths even longer in most cases. To complicate this, there is a large pool of individuals who are infected but asymptomatic. In addition, some individuals may be hospitalised and test positive on admission or while an in-patient, but the real reason for admission may not be because of COVID-19, which may be an incidental finding. The same goes for deaths where people can die of, or with, SARS-CoV-2 infection. This latter distinction is really important if we use deaths as an input variable for modelling. Clearly for modelling and monitoring of a pandemic it is essential to have real-time data but the most accurate information, deaths, has a lag of several weeks, by which time the community picture is very different.

81. Different models use the various input variables, severe outcomes, deaths and hospitalisations etc. in different ways. These input variables need to be caveated with the knowledge that some cases of COVID-19 may not be the reason people are in hospital or their cause of death. However, these severe outcomes are more reliable than cases and allows one to then extrapolate backwards, e.g. 2% of cases are hospitalised, so 10 admissions equates to 200 community cases etc., though this would be 200 cases a couple of weeks ago. At times of low incidence of infections, with very low numbers of admissions, large random errors occur, making calculation

of parameters, such as R(t) meaningless, especially as something to base policy, such as locking down small geographical areas.

82. Uncertainty in epidemiological models can arise from the problems raised above with input parameters:

a) Uncertainty/variation in number of cases
b) Failure to capture all cases (highly likely)
c) Natural variation
d) Demographic and population variation
e) Differences in reality from assumptions about transmission dynamics
f) Not including/understanding the complexity of social interactions/network structure and contacts
g) Demographic structure of small communities and differences in intergenerational mixing
h) Variable contribution of different social settings to disease transmission e.g. social clubs etc.

83. The reality is that all models are oversimplified extrapolations of reality. Disease transmits between closely knit communities via a small number of external links - Watts and Strogatz demonstrated this power of small world networks to cut the path length across networks. **(JW/61 INQ000408091)** The models and policy flowing from the SEIR models used in COVID-19 such as border closures, limitation of movement at a community and individual level, etc., fails to understand the almost impossible task of containing highly infectious diseases due to this small world network effect.**(JW/62 INQ000408090)**

84. Sensitivity analysis is a process that seeks to explore the impact of uncertainty in models generated by uncertainty/range in the value of input variables. In this way, for any particular parameter, one can explore the impact it might have on outputs. By this methodology one can have some indication of the importance of the contribution each variable has to the model outputs. One major problem with some input parameters is that they may not follow, in their range of values, a distribution, normal, poisson, etc., with many being distribution free, or nonlinear. This nonlinearity can be really difficult to deal with. There are many examples in society of non-linear (power law) distributions, distribution of wealth being a good example. Of relevance to COVID-19 pandemic modelling is the fact that the network structure of society, in

terms of the number of contacts an individual may have in a given period of time is non-linear, most people having few contacts on a daily basis, with some having many. The contacts that individuals have can also vary by time. This makes sensitivity analysis more difficult.

85. For systems that are generally exposed to similar conditions over time, e.g. deaths from cardiovascular disease (in the absence of external factors, heat, cold, infectious disease), then one can develop models on a training set of historical data, possibly using AI, to develop relevant input parameters for a model. The derived model can then be tested on another sub-set of the same historical data, from which the data was taken to construct the model. The performance of the model in producing outputs, compared to what happened in the real world for the next historical time period after which the model data was based, gives assurance, or otherwise, about the model. In this way many 'black box' models are verified and validated.

86. In the early stages of a novel infectious disease outbreak some of the important epidemiological features may be known. For example, in the case of SARS-CoV-2, it was clear in January 2020 that the demographic makeup of cases; elderly, those with chronic conditions, was similar to the original SARS virus from 2003. It was also clear that many cases of infection were asymptomatic. Transmission dynamics and its level of infectivity was demonstrated by the Diamond Princess outbreak, all of which would help build up a strong epidemiological picture of what we needed to contend with. I communicated many of these early features of SARS-CoV-2 in my summary paper to the CMO in Wales and the CEO and others in PHW, in early 2020. I also, in my editorial in the BMJ in February 2020, highlighted the fact that there was asymptomatic spread of disease and that containment and hence prevention of a pandemic, was unlikely and so we needed to mobilise all efforts to deal with it, as set out in Pandemic plans. **(JW/31 INQ000408105, JW/32 INQ000408060, JW/63 INQ000408061, JW/39 INQ000408062, JW/33 INQ000408063, JW/34 INQ000408064)**

87. From an understanding of the above, one can get some idea of how dispersed a pathogen is likely to be in the community. For example, if we have identified one case, for example an admission to ICU, and we know that each ICU admission has resulted from roughly 200 community cases, then we have some idea of the rate of contagion per 100,000 of the population. This can help both in deciding whether it is possible to contain community spread by contact tracing and isolation. In the case of SARS-CoV-

2 we know that there is a delay, as outlined above, of a few days between infection and the development of symptoms during which time infected individuals are excreting live virus which reaches towards a peak some 24-48 hours, before showing signs, to 48 hours after symptoms develop. This combined with the knowledge that 50 to 60% of infected individuals are asymptomatic. Containing such a pathogen, by track and trace, when community cases are anything more than a few in number, is extremely difficult and needs to be done in a time critical manner. You cannot create effective mechanisms afresh when we think a new pathogen is spreading in the community, this process needs to be ready to go at a moments notice, a bit like our strategic air defences that are ready to go in minutes. Anything short of this rapid response, to contain the first few cases, will result in a totally futile exercise, the system being overwhelmed and consuming a high level of vital services that could be better served in managing disease. This Track and Trace process, not just in Wales but also in other parts of the UK, was totally ill prepared, caused panic in policy makers and NHS managers and was quickly overwhelmed, it also carried on sucking in resources when the whole exercise was futile.

88. In the early stages of the pandemic the models that were coming out of the LSHTM and Imperial College London, which fed into SPI-M and were adapted for Wales, were based on SEIR flow models with inherent flaws, as described earlier. Wales is a diverse region of the UK both geographically and socially, it has sparsely populated, often affluent, rural areas and large cities and its valleys, with huge variations in social deprivation. Some of Wales valley communities and inner cities, are amongst the most deprived in the UK, while other areas are amongst the most affluent. With the result homogeneous models treating the population as all the same, irrespective of postcode, is almost certainly going to be grossly inadequate and hence unreliable with low validity, especially in the early stages of a pandemic.

89. R(0), the basic reproductive number, has its origins in the study of malaria transmission in mosquitoes. It was repurposed for its current use in noting the initial growth rates in epidemic disease at its outset. It is formally defined as the number of new cases of a disease that arises from contact with an infected individual, on average. R(t) is the point estimate of the transmission rate at time (t) in the evolution of the epidemic. If R(t) is greater than one then it is assumed that an infected individual will infect more than one additional person, if less than one then the converse is true. R(t) being greater than one leads to a growth in an epidemic, less than one the epidemic is receding. This is the commonly accepted interpretation.

90. What is less understood, by the lay public, is that R(0) and R(t) are not biological parameters related to a pathogen, what they represent is the outcome of several factors, not just those inherent to the pathogen-host dynamic, such as transmissibility. The R number, as it is often referred to, depends on other things such as social mixing, the network structure of interactions, case ascertainment etc. As such, it has a number of problems that I communicated to David Shuckman and Fergus Walsh, both BBC presenters, who started using a thermostat graphic, in their news bulletins, implying greater precision to calculating and controlling R than was deserved. The content of my email to the BBC I also shared with Senior Consultants in PHW. **(JW/58 INQ000408088)** I also circulated this in early May 2020 to the CMO and Chief Scientific Adviser, who chaired TAG and was essentially reprimanded by one of my colleagues for speaking out of turn. **(JW/37 INQ000408071)**

91. It is clear from the email I received from a colleague at PHW in response to my email to the BBC, that it was not just the BBC that was putting great store in communicating R values to the general public, almost as a means of justifying policy decisions by politicians to impose travel restrictions and lockdowns and various stages of imposed NPIs. **(JW/37 INQ000408071)** It is also clear that the Chief Scientific Adviser for Health and Social Care did not seem to understand, or wish to accept the problems with using R in this way and that the calculation and use of R in this way was incredibly flawed and difficult. **(JW/37 INQ000408071)**

92. In reality, R(t) will not be homogeneous within any area/country and will depend on social structure, demographics and contact networks, this leads to great variation in R(t). This variation, dispersion, in R(t) within populations means that R values of less than 1 will not necessarily cause an epidemic to die out while values greater than 1 will not necessarily result in growth. Calculating R(t) for whole countries, let alone smaller nations, such as Scotland and Wales is fraught with difficulty.

93. This uncertainty was not conveyed to the general public and **(JW/37 INQ000408071)** there was a positive view being expressed that while accepting the flaws, it was considered "unhelpful" to let the public know. The use of R(t) in Wales was used to justify long time periods restricting population movement, social mixing and imposing lockdowns in some Council areas such as Merthyr Tydfil and Caerphilly while being lifted in others, all on a flawed premise.

94. Models should not be relied upon to make forecasts and predictions, for the reasons stated earlier. In addition, no modelling was carried out on the adverse impact of NPI, some of which could be predicted by extrapolating the known harms of social isolation and confinement. **(JW/41 INQ000408069, JW/37 INQ000408071, JW/54 INQ000408093)**

95. TAG modelling decisions were based on mathematical models and did not consider broader issues such as the natural epidemiology of infectious disease, vaccine effectiveness, adaptive immunity, impact of natural viral variation. The latter of these provides a good illustration about what I mean. There are always transcription errors that occur in viral replication, most make no difference to the capacity of the virus to be more transmissible, more virulent and escape the body's adaptive immune system. Most are neutral, many are a disadvantage to the virus, but some can change the affinity of a virus to bind to human cells. This change may lead to increased transmissibility but is unlikely to make it more deadly. Adaptive immunity against the coronavirus virus is directed against multiple binding sites on the viral surface, several on the SARS-CoV-2 spike protein and several on other parts of its coat. Viral variation will not result in a total loss of protection of acquired immunity and even as antibody levels decline, memory T cells etc. still police and protect against more severe outcomes.

96. If there had been broader representation from immunologists, virologists etc. on PMTAG, then there would have been a much better understanding of these concepts and how important they were. An example of this, being, during 2021, when vaccine coverage was high, case numbers were rising, but hospitalisations remained low, a discussion took place within PMTAG and the WG, of imposing more restrictions. This was when I appeared on the BBC to make the point that vaccines were protecting against the most serious outcomes and that rising cases would not necessarily result in increased hospitalisations and deaths. **(JW/43 INQ000408073)** The CMO for Wales conceded this very point in his next press conference.

97. Modelling results from SPI-M-O and other SAGE groups were being shared and used in Wales; however, for reasons given above, I agree with Professor Michael Gravenor that the results obtained from "scaling" of UK modelling output for Wales were not ideal.

98. I consider that there was an over-reliance on modelling during the pandemic, and its limitations meant that it played too influential a role in Welsh scientific advice.

99. In Wales, the Policy Modeling Group was basically driving the agenda in Wales with regards to imposing restrictions etc. The deliberations at PMTAG around modelling of reasonable worst case scenarios were fed back to TAG. Often the Chair would imply that since the trend from the models seemed to be suggesting, for example, rising cases before Christmas, then the response taken to TAG would suggest increasing NPIs/Circuit Breaker Lockdowns. I am sure that the Chair would have conveyed the debate in a balanced and informed way but the models may well have been seen, by others, as predictions, which of course they were not, and the First Minister appeared to endorse this view in his numerous press conferences. I was and never have been party to TAG and, as stated above, my numerous requests to Dr Rob Orford to attend were never answered. **(JW/36 INQ000408066)**

Early Stages of the Pandemic

100. I first became aware of the pandemic threat posed by the Coronavirus epidemic in China in late 2019, early 2020. To me it had all the hallmarks of the SARS outbreak of the early 2000's but with what seemed a greater escape into wider society. The outbreak on the Diamond Princess confirmed my worst fears.

101. I provided advice to core decision makers within the WG, see my emails and also I wrote a paper summarising the clinical features in early February 2020. I also shared my thoughts that the virus was likely to become a pandemic, that containment was unlikely to work and that we needed to prepare for this. I shared these thoughts widely and this resulted in an editorial that appeared in the British Medical Journal ("BMJ") on 28 February 2020. **(JW/63 INQ000408061, JW/39 INQ000408062, JW/33 INQ000408063, JW/34 INQ000408064)**

102. During the very early stages of the emergence of SARS-CoV-2 as a pandemic threat, I did not really liaise with colleagues across the UK. It was after I wrote the editorial, that appeared in the BMJ, I was contacted by William Sutherland and others and collaborated on a paper "A solution scan of societal options to reduce transmission and spread of respiratory viruses: SARS-CoV-2 as a case study" **(JW/64 INQ000408100)**. In addition, I collaborated with colleagues across Europe on surveillance systems which resulted in numerous publications. We continued to

collaborate during the pandemic and incorporated COVID-19 into our work **(JW/06 INQ000408081, JW/07 INQ000408092, JW/01 INQ000409590).**

103. I did not liaise directly with WHO, other international organisations, or my counterparts in other governments in respect of Covid-19. I only liaised directly with collaborators across Europe as explained above.

104. In January 2020, it was clear to me that SARS-CoV-2, in terms of its clinical impact, had features similar to SARS. I was aware of asymptomatic spread with SARS and the indications coming out of China were that this was so, in this case. My editorial in the BMJ and my clinical paper to colleagues highlighted this feature to decision makers. I initially sent an email relating to asymptomatic spread in the first week of February 2020. These papers indicated that the elderly and those with chronic conditions were most at risk and both documents, the editorial in draft form, were sent to the CMO, CEO and many colleagues in Wales. I had no direct feedback from the CMO, or CEO of PHW, to indicate that they had taken any of this on-board and the CEO suggested she did not have time to read it. **(JW/33 INQ000408063)** When I wrote the editorial I felt the virus was already circulating, mid-February 2020, in the UK and the window for containment was quickly closing. I did not feel that at this point closing borders and aggressive 'track and trace', would make any difference. **(JW/39 INQ000408062, JW/34 INQ000408064)**

105. I do not think that sufficient regard was taken of the risk of pre-symptomatic and asymptomatic transmission in the early stages of the pandemic. I raised the issue with colleagues and those in the WG and also that, with regard to track and trace, there was only a small window of opportunity in which track and trace could work before the system became overwhelmed. For example, PHW set up a call centre for which I expressed my view that the time for this had passed. I also felt that this activity would divert my colleagues and vital resources away from more important tasks.

106. Some time in March 2020, the operation of the Call Centre was changed to a 'closed settings' cell and placed PHW directly in the decision making tree of discharge of patients to care homes, without testing. I did not think this was a safe option for patients, or that PHW, with a call centre staffed with lay people, was a good idea. Many of my colleagues were 'press ganged' into this supervisory role. I expressed the view that I thought that PHW as an organisation and the staff it deployed to advise hospitals and staff about safe discharge, was not best placed to enter into these

decisions. Few of the staff handling the calls, or advising, had a lot of experience in either infectious disease, or the care sector. I also expressed the view to executives that PHW had no legal mandate for this role. **(JW/53 INQ000408087).** In addition the BMA wrote to PHW **(JW/51 INQ000408080)** As this 'closed settings' cell was set up by a directorate, other than Health Protection, neither its supervising staff, nor the people who planned it, had much experience of communicable disease, other than in their general training. This was apparent in the early days of its existence when data was not collected in a standardised manner suitable for epidemiological analysis. This did improve dramatically when Health Protection Epidemiologists became involved. Each shift, of the closed settings cell, was supervised by a consultant who was Public Health trained. These consultants were taken from their normal roles, not in communicable disease, and given responsibility to advise and support the lay call handlers. The call handlers had very little support and training. One consultant colleague told me, in confidence, that they found the work stressful and the whole experience was far worse than the serious symptoms they subsequently got when they contracted COVID-19. Another said that they often made the rules up as they went along as official guidance was often lacking, and what was provided was changed at short notice. This doctor said that in this time of uncertainty and lack of guidance they fell back onto their clinical skills as a medical doctor. For evaluation reports of Closed settings and call centre see **(JW/65 INQ000408094, JW/66 INQ000408095, JW/67 INQ000408096, JW/68 INQ000408097)**

107. The view that asymptomatic spread, carriage and transmission was important and significant was, I believe, not fully understood when the Department of Health in England, PHE and the CQC, published its guidance, at the start of April, on the safe discharge to care homes, a process found to be unlawful by the High Court. In Wales this document was reproduced by PHW, word for word, with an accompanying translation and a paragraph inserted directing hospitals and the care sector to contact PHW for help and guidance **(JW/47 INQ000408077, JW/48 INQ000408078, JW/49 INQ000408079, JW/50 INQ000408082)**

108. Other than the routine surveillance that was carried out by PHW and published on a weekly basis, I am not aware of other relevant work that was undertaken by TAC, TAG, Public Health Wales in the period January to March 2020.

109. I was not involved in and I am not aware of, any discussions within Public Health Wales, or the Welsh Government, in March 2020, regarding mass gatherings and

concerts and whether the Stereophonics concerts and the Wales vs Scotland Six Nations rugby match should go ahead.

110. Clearly events that bring lots of individuals together in one place is going to increase the risk of transmission of a communicable disease. The risks indoors being greater than in the open air. The initial phases of the pandemic were almost certainly driven by super-spreading events and superspreaders, as discussed above. This fits with the analysis that was carried out on international comparative data by Michael Levitt **(JW/59 INQ000408098)**. Once people had travelled to an event, and hospitality venues were open, then cancelling the events themselves, which were out doors with lower risk seemed to have little point. I think at the time of these events, the six nations and the Cheltenham races, the virus was well seeded and the events themselves had little impact on the progression of the pandemic.

111. I agree with the assessment that was given to TAC that the size of a gathering is not as much a factor for transmissibility, as time of contact and nature of activity. However, the concept of 'following the science' is misleading. Interpretation of scientific evidence is never cast in stone, or a single agreed opinion. The scientific process is one where observations lead to a theory being constructed, to explain the observations and, from this theory, predictions are made. Concordance between theory predictions and result findings reinforce confidence that a theory has merit. Disagreement between prediction and measurement should lead one to review one's theory. In many cases there are multiple interpretations of observations, which leads to scientific debate.

112. At the start of the Pandemic there were many open questions about the effectiveness, or otherwise, of:

- Facemasks and Face coverings
- The value of social distancing
- The 2 metre rule
- Indoor air quality and the risk for transmission
- Broader NPIs such as school closures, the 'rule of six'

Many of these questions remain open.

The timing of the first national lockdown

113. Much has been made, particularly by politicians, that the UK was planning for Flu and we got SARS-CoV-2. The implications of this are that we were not prepared because we planned for the wrong virus, hence lockdowns were the treatment of choice and a necessity for a coronavirus pandemic and that we should have locked down sooner.

114. The reality is that SARS-CoV-2 is an airborne virus and hence, I say this as one of the contributors to the UK's Pandemic Plan 2011, the mitigation measures that one would use for Influenza are the same as for coronaviruses. We have learnt that rather than building resilience into the NHS and stockpiling PPE etc., the UK was wholly inadequately prepared for a pandemic of any sort. In my editorial in BMJ, published on the 28th February 2020, I called for us to move from containment to mitigation and management of the impact of the pandemic, **(JW/34 INQ000408064)** a phase change that followed the recommendations of the UK's Pandemic Plan. **(JW/40 INQ000408068)** In my opinion the virus was circulating widely and in the absence of a vaccine, or anti-viral therapies, we needed to prepare for a rapid escalation in demand.

115. It is extremely debatable as to whether the national lockdown made a huge difference to the actual course of the pandemic. While recognising the differences between the UK and Sweden, in terms of societal attitudes and geography, I am still not totally convinced that lockdowns made a huge difference over and above shielding the most vulnerable and the elderly, especially those in care homes. The tsunami of deaths in care homes was, in part, due to a chronic lack of long-term funding in the social care sector coupled with a lack of a proper career structure and training of care workers. In addition, a lack of self-isolation facilities in care homes, lack of PPE and the peripatetic nature of staff, working in multiple homes, all contributed. Much of the above was discussed in the Social Care Working Group that fed into SAGE.

116. In addition, during lockdown, somewhere between 20 to 40% of the population were still leaving home on a daily basis to deliver vital services, this level of societal mixing, over and above those who did not obey the rules, would have been enough, in my opinion, to nullify the benefits of lockdowns.

117. In addition, while the stated aim of the lockdown, introduced on the 23rd March 2020, had been to flatten the pandemic curve and protect the NHS from being

overwhelmed, this initial goal was later lost and lockdowns became the go-to solution to stop the spread of disease, flawed measures of R(t) supporting and directing action.

118. While in training, Public Health Registrars are taught to carry out health impact assessments on public policy decisions to evaluate not only the positive effects of an intervention but also its consequences. I am not aware that it was ever debated, early on, or even later, to any great extent, as to what might be the non-COVID-19 related harms associated with NPIs and Lockdowns. In May 2020 I wrote a paper, **'COVID-19 Lockdown – Time to find an exit strategy and reflect on the costs and benefits'**, **(JW/41 INQ000408069)** in which I highlighted the incredible costs and consequences lockdowns were inflicting on the nation. Early in the pandemic Sir Patrick Vallance was vilified for suggesting that the country needed to get to 'herd immunity' in order for the pandemic to stop and this statement is indeed true. Vallance, however, was broadly criticised for even suggesting this even though with hindsight we can see that the herd is truly now immune from the worst ravages of infection with SARS-CoV-2 arrived at by a combination of vaccine and natural disease.

119. Lockdown was a political decision and so it is not for me to comment on when and how the decisions were made, however it is my opinion that at whatever point in time lockdown was introduced, after the end of February 2020, it would have made little difference.

120. I personally had no involvement in PMTAG until May 2020. I was aware in March of the prediction made by Neil Ferguson based on his computer model at Imperial College London, which outlined increasing levels of imposition of NPIs; closing schools and universities, banning mass gatherings, etc., and the likely effect on the progress of the pandemic. In early March 2020, even Neil's models did not go as far as suggesting a full national lockdown. My own view at the time, expressed in my editorial, was that I never felt lockdowns would be accepted in the UK, or any other western country in the developed world **(JW/34 INQ000408064)**.

121. I am not able to comment on what was in the mind of ministers in the WG regarding imposition of a lockdown in March 2020. I never discussed it with anyone in the Assembly.

122. I did not model lockdowns at all before they were imposed, I dismissed this as a bad idea that was unlikely to either work, or be accepted. When we were formulating the UK's Pandemic Plan in 2011 **(JW/40 INQ000408068)** lockdown was never a part of control measures for a novel virus based on sound reasoning, not least of which being that since the virus was likely to spread in an unexposed population rapidly, any attempts at border controls and containment, after introduction, were futile. It was also felt that school closures would have little effect.

123. The advice to lockdown in Wales came from the UK government. This was unlike the 2009 H1N1 pandemic, where Wales was cognoscente of UK Government advice but made its own judgements. However, that said, once such a monumental decision had been taken in Westminster I do not believe the WG could have taken a different course.

124. In March 2020 I am not sure that there was a significant level of maturity and cohesion in the decision making tree in Wales with regards to TAG and its scientific advisers helping to direct policy. Lockdowns were never really on anyone's agenda until the decision was taken out of Wales' hands. As is clear from much of this witness statement, I was and am personally against the concept of full lockdowns and the virtual imposition of Martial law. In addition, as I stated in my editorial in the BMJ, I never thought a mature Western democracy would even accept it let alone impose it. I also felt that the time to impose a full lockdown in early March 2020 had probably passed. I do not think there was any 'groupthink' in Wales with regards to lockdowns, at the time I felt that the UK Pandemic Plan was a good blueprint that the government should follow.

125. My views, at the time and now, are essentially the same with regard to the lockdowns. This was never on the agenda in Wales, as far as I am aware, and the decision was taken in London. I do not and did not, at the time, think locking the UK down sooner would have made any difference to the ultimate course of the pandemic.

126. With regards to Vaughan Gething's statement that if Wales had entered a national lockdown a week or two earlier in March 2020, I think it is pretty clear by now that I do not think locking down sooner would have made much difference.

April 2020 Onwards

127. In May 2020, as the first national lockdown continued, I became increasingly concerned about the ongoing human and economic costs. I had been a member of NICE Technology Appraisal Committee for well over a decade by this stage and was well versed in the methodology of cost effectiveness. Based on this, I wrote a paper contrasting the usual costs and benefits we are prepared to normally accept, between £20,000 to £30,000 per Quality Adjusted Life Year compared with the £250,000 or more each life saved was with lockdown. **(JW/41 INQ000408069)** This paper also highlighted the non-COVID19 related harms such as;

> *"….On the other side of the mortality equation they have factored in the possibility that the lockdown itself is detrimental to human welfare and wellbeing, resulting in deaths from not seeking, or being provided with, vital health services, changes in therapy, or the consequences of enforced confinement such as, increased alcohol and substance misuse, deterioration in mental health and wellbeing leading to depression, suicides, domestic violence etc., the ramifications of which can last long after isolation ends".*

128. In the Autumn of 2020, the non-COVID19 related harms were discussed at PMTAG and Janine Hole, Joint Lead for Social Care in Health and Social Care at the WG, by January 2021, produced a matrix of potential areas of harm and asked PMTAG as to how these may be quantified. On the 19th January 2021, I populated this matrix and circulated it to members of PMTAG **(JW/69 INQ000408099)**. My populated table suggested routine data that could be used to compare the impact of lockdowns and care/educational disruptions with previous years to quantify harm.

129. Between the 10th November 2020 and March 2021, I sent numerous emails to the PMTAG and the CSO for Health, the Head of TAG group, raising my concerns that, while the direct impact of COVID-19 on the healthcare system was being looked at, the socioeconomic impacts were not. **(JW/54 INQ000408093)** With my email I sent links to relevant research papers to help with this. I also highlighted that while there was a TAG Social Harms Group, I did not have sight of any of its deliberations and concerns. There was no concrete feedback to my email, no visibility as to whether this work was taken forward, either by the behaviour group or others and I know of no further work on this. There was a report by the WG on the Impact of COVID-19 on Health and Social Care by AMs which had been published in July 2020. I do not know

how this was handled, we never discussed its findings in the PMTAG. **(JW/65 INQ000408094)**

130. I do not know what role, if any, the concept of 'behavioural fatigue' played in the Welsh Government's decision to impose, expand or ease NPIs.

131. On the decision to discharge asymptomatic patients to care homes, I am not aware that this was being discussed at a WG level and I do not think that TAG would have been fully formed and able to debate this policy. My reading of this is that a decision was made in the UK Government that the NHS needed to be protected and that beds in hospitals needed to be freed up. This led to the DH, PHE and the CQC jointly publishing a document in early April 2020 on discharging patients to care homes. Matt Hancock, in his evidence to the Inquiry, said that we did not know that disease could spread asymptomatically, this is clearly not true. I and others, highlighted the fact months before. **(JW/31 INQ000408105, JW/32 INQ000408060, JW/63 INQ000408061, JW/39 INQ000408062, JW/33 INQ000408063, JW/34 INQ000408064)**

132. On publication of the DH/PHE/CQC document, PHW on its own, published similar guidance on the 9th April. In this document the English text was identical to the English document, except a paragraph had been inserted that placed PHW and its Closed Settings Cell, in the middle of the discharge process, with contact details for the call centre, managed by the Directorate of Health and Well Being, at PHW, not Health Protection. There was considerable pressure coming from the CEO of PHW for the whole consultant body to take part in supervising the lay call handlers in the Cell. **(JW/51 INQ000408080)** As explained above, I raised my concerns about PHW acting in this role, directly, with the middle management of the Health and Social Care Directorate that were in charge of the rotas and with the CEO of PHW **(JW/53 INQ000408087)**

133. The PMTAG team was not fully formed at this stage and I was personally not party to any discussions regarding this decision to discharge asymptomatic patients from hospitals into care homes, prior to the publication of the document on the 9th April 2020. I was also not involved in any discussions regarding testing before discharge.

134. With regards to the decision to introduce the 'eat out to help out' scheme during the summer of 2020, I was not involved in any discussions about the merits, or otherwise of this. What I will say is that Wales did take a more cautionary approach to opening up society than England. I am not convinced of either the benefits of this, or the merits of having divergent rules across the UK. The benefits of a more cautious approach in Wales, and for that matter Scotland, as compared to England, did not make any difference in the progress of the pandemic and may reflect the less than optimal impact NPIs have on disease transmission.

135. With regard to the imposition of NPIs, I was not party to the discussions at TAG on circuit breakers/early warning indicators. The issue was raised at PMTAG in August and September 2020 and I raised concerns that I did not think that circuit breaker lockdowns and local lockdowns and border controls would be effective.

136. Following the imposition of a national lockdown on the 23rd March 2020, having previously stated my feelings in the BMJ editorial that I did not think they would be acceptable in the UK and similar countries and would be of limited effect due to widespread community spread and asymptomatic disease, I repeatedly asked the PMTAG group as to what the end-game was that lockdowns were trying to achieve, protect the NHS? Save Lives? Eradicate Disease? in the absence, at that time, of a vaccine and a virus naïve population. Despite asking the end-game question several times and to many different groups I never got an answer as to what policy makers were trying to achieve.

137. With regard to the Welsh 'firebreak', my advice was that I did not think a disruptive 'firebreak' lockdown would work, or was necessary; it was most likely to be ineffective and could well be harmful for wider society. The later lockdown, imposed on the last shopping day before Christmas 2020, was ill conceived, caused considerable stress, anxiety and panic buying with overcrowding in shops in a rush to beat the embargo. For reasons previously stated, local and regional restrictions did not make epidemiological and scientific sense for a virus that was as highly transmissible as SARS-CoV-2.

138. Working from home, where possible, was a good idea and I had no objections to this. With regard to the decisions concerning a reduction of person to person contact/ social distancing, the 'rule of six' and a restriction on gatherings and table sizes, with the inherent policy differences between the home nations, were arbitrary and not

based on sound science. The effectiveness of this policy was further undermined by rule breaking, which we now know was rife, even amongst policy makers themselves. None of these rules seemed well thought out to me, even not taking into account the impossibility they were to police.

139. While the voluntary self-isolation of test positive symptomatic individuals you would imagine would have some effect on disease transmission and hence sensible, its overall impact was likely to be limited by transmission by asymptomatic and pre-symptomatic individuals that were likely to be in the majority. **(JW/60 INQ000408089)**

140. With regard to the closure of schools and education settings, as we had discussed in the formulation of the UK Pandemic Plan 2011, **(JW/40 INQ000408068)** I do not feel that school and university closures made a huge difference in the overall scheme of things. Closing institutions does not prevent the young from mixing in more social settings, both formal and informal. As far as infection with SARS-CoV-2 is concerned, young people are at a very low risk of infection progressing to COVID-19 and having severe adverse outcomes, while causing considerable harm to their education and life chances. My thoughts on this are summarised in my EMail to the CMO on the 26th January of 2022, **(JW/45 INQ000408076)** though I had expressed these views previously, also on the SAGE Children's Working Group that had a short existence in the Spring of 2020.

141. With regard to the use of face-coverings, from my personal observations of mask wearing by the general public, I would deduce that behaviour was suboptimal, masks often not covering the mouth and nose, ill fitting masks, wearing of visors and no masks, etc. This poor mask behaviour alone would question effectiveness let alone the evidence base for wearing them to prevent transmission, in the first place.

142. The TAC advice summary in September 2020 stated that it thought that the current R number for Wales to be higher than the SAGE estimates. This was because R is a very imperfect parameter and its estimates in a small nation like Wales, and in small borough areas down to 20,000 population size, makes its use highly problematic and unscientific as a control measure. Low case numbers and other parameters to calculate R would lead to very wide confidence intervals and hence no real statistical certainty, numbers in one borough are truly greater than another, or any confidence in trend. I considered that the R number was an imperfect measure and expressed these views many times **(JW/58 INQ000408088)**.

143. I have set out clearly above my thoughts on school closures. I did not think universities should have been closed. Colleagues in Swansea, on PMTAG, I believe, were asked to model the potential return of students from other parts of the UK and beyond. I think there was a belief that returning students would present a risk to the Welsh population as they arrived from other parts of the UK and beyond. In my opinion this was based on a false premise that SARS-CoV-2 infection was NOT ubiquitous across the UK and elsewhere. As stated earlier, the demographic of the student population was at low personal risk from COVID-19 and sero-prevalence studies, by this stage of the pandemic, suggested that high exposure rates had occurred in the young.

144. Neither I nor, to my knowledge, other members of TAG, were asked to model the application of more stringent restrictions in response to our advice. If anyone, it would be colleagues in Swansea who were asked to model more stringent measures.

145. I was not party to the formulation of TAC advice summaries in September and October 2020 that, it seems, were based on the false premise that lockdowns were the way to control disease spread. This goes back to my unanswered question of what was the actual outcome that was trying to be achieved. Surely not disease eradication? At the outset, lockdown was seen as a way to protect the NHS and slow down the spread of disease, not prevent it, or eradicate the virus, which was the belief in some circles, e.g. Scotland. Though not party to the deliberations in Downing Street, I can imagine that the idea in March 2020 was to prevent the NHS being overwhelmed such as in Northern Italy, not stopping cases as a long term strategy. I believe that a more diverse membership of TAC, from medical, infectious disease and epidemiology, as well as behavioural scientists would have addressed this misconception of purpose and taken into account non-COVID-19 related harms of lockdowns. I also believe that since a lot of mathematics, to non-specialists, seems like magic and hence there is greater credence given that the mathematicians fully take into account, in their models, the nuances and complexities of the real world, than was merited.

146.I think the scenarios presented by TAC in September and October 2020 were taken seriously by the Welsh Government and given more credence than they perhaps deserved for all the reasons I have explained.

147.I believe Swansea University was commissioned to model a "firebreak" lockdown in Autumn 2020.

148.My personal view on the "firebreak" lockdowns is that I do not think they were necessary and made little impact on the course of the 2020/2021 wave of the pandemic, for all the reasons stated above, not least of which is I am unclear what, if anything, they sort to achieve.

149. In my opinion, due to both the ubiquitous nature of the disease and Small-World Network transmission **(JW/62 INQ000408090, JW/61 INQ000408091)** it is impossible to contain disease spread in naïve populations, over connected geographical areas, especially small communities. As evidence of this we need to look no further than the rapid spread of, say, the Omicron Variant, to become the dominant strain globally despite strict border controls and universal testing. Asymptomatic spread compounding the problem, where over half the infected population are asymptomatic and future symptomatic cases rapidly spread disease before symptoms appear. **(JW/60 INQ000408089)**

At risk and vulnerable groups

150. I am not able to comment on the make-up of TAG, or its other subgroups except PMTAG. However, it is clear to me that PMTAG and its outputs in terms of modelling scenarios, held a lot of sway with TAC decision making and its scenarios were taken to be forecasts by some. The PMTAG's lack of diversity could have been addressed if there was representation from others with wider expertise e.g. clinicians, virologists, immunologists, epidemiologists, behavioural scientists, mental health professionals etc., at the formative stages of discussion about inputs into the modelling, this would have injected much needed insights to the underlying assumptions. For example, what does waning antibody levels really mean for protection against adverse outcomes to COVID-19? the role of the adaptive immune system in giving long term protection? and greater insight into the consequences of isolation on mental health etc.

151. I am not aware of what went on in other subgroups of TAG but I am sure most of the debate we had within PMTAG never reached them, or indeed TAG itself.

Communication of Scientific Advice

152. Before May 2020 I am not sure whether TAG was fully functional, however, I am not aware of the nature of any internal debate at TAG, at any time during the Pandemic, on particular topics and the range of disparate views. Any conjecture and disagreement was never communicated in a formal way, nor fed back to PMTAG. Talking to some of the participants on TAG, at times, the group was too large and unwieldy. I suspect communication and debate was also inhibited by time and the use of TEAMS, rather than face-to-face, which was restricted early on and I suspect most participants never met in the real world.

153. As stated above, following the science is a misnomer and it appears that dissenting points of view, though valid, were not necessarily welcome if they criticised policy. **(JW/37 INQ000408071, JW/56 INQ000408085).** A clearer, more open debate, would have been helpful, not necessarily in public but within the TAG structures. I personally would have invited experienced people such as Roland Salmon and Stephen Palmer into the debate more.

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: 7 February 2024