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UK COVID-19 INQUIRY

WITNESS STATEMENT OF PROF MARK WOOLHOUSE

This amended statement follows a process of some initial communications under Rule 9 with the UK Covid Inquiry and initial discussions with them, and it focuses on questions raised by the Inquiry, which I have addressed below.

Introduction

1. I am Professor of Infectious Disease Epidemiology at the University of Edinburgh. I previously studied biology at the University of Oxford, the University of York and Queens University (Canada) and then held research fellowships at the University of Zimbabwe, Imperial College London and the University of Oxford. I have worked as an academic researcher on infectious diseases and global health since 1985 and have published more than 400 scientific papers, including highly cited articles on emerging infectious diseases and antimicrobial resistance. I have acted as an advisor to DEFRA, the Food Standards Agency and the World Health Organization (WHO). I was awarded an OBE in 2002 for services to the control of infectious diseases and am a Fellow of the Royal Society of Edinburgh, the Academy of Medical Sciences and the African Academy of Sciences.

2. I am a member of the Usher Institute, the University of Edinburgh's school of public health and part of our College of Medicine and Veterinary Medicine. Usher contains around 400 academic and support staff. Core research themes are global health, medical informatics, population health sciences and biomedicine, self and society. Usher hosts the Edinburgh Clinical Trials Unit, a WHO Collaborating Centre on population health research/training and a working general practice, the Mackenzie Medical Centre, and is a delivery hub within the Data-Driven Innovation Initiative of the Edinburgh and South East Scotland City Region Deal.

3. I am Principal Investigator of the Epidemiology Research Group (Epigroup), comprising 20-30 postdoctoral researchers, PhD students and research assistants who report to me or who work as part of my team. We conduct scientific research on infectious disease epidemiology both in Scotland and globally. One of our main interests is novel emerging pathogens. With Epigroup and numerous national and international collaborators, I have been conducting research on emerging pathogens since the late 1990s.

4. I have contributed to several high level activities on pandemic threats and pandemic preparedness. These include: a 2006 UK Government Foresight project on the detection and identification of infectious diseases; a 2007 scientific colloquium on pandemic influenza with the Secretary of State for Health; a 2009 report for the US National Academies on sustaining global surveillance and response to emerging zoonotic diseases; a 2015 UK Expert Group on vaccines and therapeutics for the Department of Health; a 2017 meeting of the World Health Organization to set out a R&D blueprint (a global strategy and preparedness plan that allows the rapid activation of research and development activities during epidemics). Reports of these activities are provided as Exhibits {MW/347-- INQ000149098}, {MW/348 - INQ000149104}, {MW/349 - INQ000149100}, {MW/350 - INQ000149102}, and {MW/351 - INQ000149108}.

5. I am currently a member of the Scottish Government's Standing Committee on Pandemic Preparedness (SCOPP) and an advisor to the Coalition for Epidemic Preparedness and Innovation (CEPI), a global partnership working to accelerate the development of vaccines against epidemic and pandemic threats based in Oslo.

Pre-pandemic preparedness

6. 2019 saw the publication of the Global Health Security Index (a joint endeavour involving Johns Hopkins University, the US Nuclear Threat Initiative and The Economist's Intelligence Unit, funded by the Open Philanthropy Project, the Bill & Melinda Gates Foundation and the Robertson Foundation). A copy of this report is provided as Exhibit {MW/352 - INQ000149103}. The index combined information on over 80 criteria. The UK was ranked as the second highest country (behind the US) for global health security. The category 'Rapid response and mitigation of the spread of an epidemic' used 13 criteria covering emergency preparedness and response planning, exercising response plans, emergency response operation, linking public health and security authorities, risk communication, access to communications infrastructure and trade and travel restrictions. In this category, the UK scored considerably higher than any other nation, with the US second. Yet, particularly during the pre-vaccination phase, the UK and the

US were two of the countries worst affected by the Covid-19 pandemic. Two observations follow.

7. First, there is a risk of complacency. The Government could reasonably claim that the UK was well prepared for a pandemic, citing this independent evaluation. It may be that the UK was indeed well prepared for an influenza pandemic (that proposition has yet to be tested) but Covid-19 was not influenza and required a different response (see paragraph 13).

8. Second, though the criteria used by the index as listed above seemed a priori to be sensible, it proved a very poor indicator of outcomes in the face of an actual pandemic (not only for the UK and US). I take this discrepancy to indicate that we should not confuse preparedness (as defined by the index) with vulnerability and that the global health community needs to re-evaluate the relationship between the two. Until that is done, it will be difficult for any government to make an objective assessment of either.

9. As a partial explanation for this discrepancy between preparedness and vulnerability, I share the view among global health colleagues that southeast Asian countries were better positioned to respond to Covid-19 because their pandemic preparedness planning focussed on SARS rather than influenza and placed more emphasis on diagnostics, case finding and self-isolation. The viruses causing SARS and Covid-19 are closely related and their epidemiologies are similar in key respects (see paragraph 13), so those countries' planning was better suited to the crisis at hand.

10. In the event, our go-to response to Covid-19 became lockdown (implemented on multiple occasions in the nations of the UK). Of itself, that highlights a striking deficiency in the UK's pandemic preparedness: we had no plans to implement lockdown at all. On the contrary, the UK's 2011 pandemic influenza strategy document (provided as Exhibit {MW/353 - INQ000149105}) states: "During a pandemic, the Government will encourage those who are well to carry on with their normal daily lives for as long and as far as that is possible, whilst taking basic precautions to protect themselves from infection and lessen the risk of spreading influenza to others. The UK Government does not plan to close borders, stop mass gatherings or impose controls on public transport during any pandemic." Lockdown was an ad hoc public health intervention contrived in real time in the face of a fast-moving public health emergency. We had not planned to introduce lockdown and this had two serious consequences.

11. First, there were no guidelines for when a lockdown should be implemented and no clear expectations as to what it would achieve, so it is no surprise that many governments

hesitated to take such a drastic step. Countries whose preparedness planning was focussed on SARS rather than influenza had not, to my knowledge, identified lockdown as a potential intervention either. I believe that decision-making would have been easier if lockdown had been previously contemplated and properly evaluated as a public health tool, but it had not.

12. Second, because lockdowns had not been contemplated there was insufficient planning in place to alleviate any of the severe consequences of shutting down much of society for months at a time. The possibility that our response might cause damage on a similar scale to the pandemic itself was not acknowledged in preparedness plans prior to 2020. Overall, I now realise that far too little attention had been given to planning to mitigate the disruption caused by public health interventions. This includes those social distancing measures – such as working from home and school closures – that had been included in influenza response planning.

13. Though it is right that we were concerned about influenza (and that threat remains), we should have been prepared for a wider diversity of pandemic threats. The planning assumption that a response appropriate for influenza would also be appropriate for a different respiratory virus did not work out well in practice. In the event, influenza proved an imperfect model for Covid-19. The virus causing Covid-19 – SARS-CoV-2 – is entirely distinct from influenza but is closely related to the SARS coronavirus. A different response was required because, like SARS, Covid-19 is more transmissible but has a longer generation time than influenza, and it has a different risk profile. The higher transmissibility implies that a response based on social distancing (with the aim of 'suppressing the virus') would need to be more drastic (and so less sustainable) than for influenza, but the longer generation time means that response could instead have more emphasis on diagnostics, case finding and self-isolation rather than community-wide social distancing. The different and more SARS-like risk profile for Covid-19 – especially the low risk to children – indicated a need for more targeted interventions aimed at protecting the vulnerable; for example, there needed to be a much greater emphasis on protecting care homes than schools.

14. Looking beyond respiratory viruses, if we were faced with an epidemic caused by a haemorrhagic fever virus (similar to Ebola), a paramyxovirus (similar to measles), a vector-borne virus (similar to Dengue), a zoonotic pathogen (similar to plague) then many aspects of a pandemic preparedness plan based on influenza would be inappropriate and ineffective. This could be explicitly addressed in future preparedness

planning, for example by having annexes detailing pathogen-specific aspects of the planned pandemic response.

15. I had raised this issue at multiple forums prior to the pandemic, including a 2015 UK Expert Group chaired by the then CMO, Sally Davies. Notes from that meeting are provided as Exhibits {MW/350 - INQ000149102} and {MW/364 - INQ000149116}. In practice, as recognised by the World Health Organization (see Exhibit {MW/351 - INQ000149108}), there is a wide diversity of potentially pandemic viruses, and so in the nature of the challenges they pose.

16. The early stages of the Covid-19 pandemic revealed that the UK had inadequate plans for community surveillance for a novel emerging disease, culminating in the CMO's decision to abandon community testing on March 12th 2020 in order to focus limited diagnostic resources on the health care system. The need for effective surveillance during a pandemic had been repeatedly stressed, by me and many others, prior to 2020. Our paper 'Lessons from Ebola' (provided as Exhibit {MW/354 - INQ000149114}) is one example. Indeed, the same issue had arisen during the swine flu epidemic where my team was belatedly asked by Scotland's Chief Scientist Office to conduct a sero-surveillance study (a survey based on the detection of antibody responses) in the winter of 2009-10 as no such survey had been planned for or implemented. Yet with Covid-19 in February 2020 the UK either was unable to or failed to ramp up testing capacity (using the RT-PCR tests available at the time) sufficiently. The decision to ramp up testing did not have to wait, and should not have had to wait, until early April 2020.

17. The same argument applies to the surprisingly long delay before the UK rolled out lateral flow tests; these proved highly effective during the omicron wave because they allowed people to establish their own infection status and act accordingly. It is not clear to me why an established and relatively simple technology was not developed and rolled out much more quickly. When I first suggested the need for mass testing on a scale of millions (at a Scottish Advisory Group meeting in early April 2020) I was told this was unrealistic. That turned out to be incorrect but, regardless, mass self-testing was not made available in the UK until the end of 2021. This suggests to me that the need for mass testing was not fully appreciated and it did not have sufficient prominence in our preparedness planning.

18. I suspect that this failure to build testing capacity also stems from our focus on influenza. As I explained in paragraph 13, in planning for an influenza pandemic as opposed to a SARS-like pandemic such as Covid-19, there is more emphasis on social distancing rather than diagnostics, case detection and isolation.

Data and modelling

19. One notable success story from the Covid-19 pandemic was the EAVE data analysis project led by Aziz Sheikh at the University of Edinburgh. EAVE linked demographic and near real-time clinical data from almost the entire population of Scotland. The study – referred to technically as a prospective observational cohort – monitored daily/weekly the progress of the Covid-19 epidemic and evaluated the effectiveness of therapeutic interventions in approximately 5.4 million individuals registered in general practices across Scotland. A national linked dataset of patient-level primary care data, out-of-hours, hospitalisation, mortality and laboratory data was assembled and analysed using standard statistical tools. A full description is provided in Exhibit {MW/355 - INQ000149107}. Because of its large scale (5.4 million individuals), EAVE was able to make estimates of key quantities with unprecedented speed. Two high-profile examples from 2021 were rapid estimates of vaccine efficacy and of the severity of omicron infections. The other UK nations did not have an equivalent to EAVE, although a similar function was fulfilled as well as possible by Public Health England or (from April 2021) the UK Health Security Agency.

20. EAVE was conceived early in 2020 and activated in mid-March. However, it was unable to carry out large-scale analysis of linked databases until the requisite permissions for data access and linkages had been obtained and implemented, which took until June. In my opinion, had the administrative requirements been less onerous then EAVE could have started generating invaluable data – for example on risk factors – much earlier, thus making a better evidence base available to advisors and officials during those critical early months.

21. Issues with data access had been raised repeatedly by me and others prior to 2020. For example, as part of a correspondence with the office of the then CMO Scotland I wrote in May 2018: "My personal view is that the system for accessing health data in Scotland is terminally dysfunctional... This is a hugely disappointing state of affairs and one that urgently needs attention. I dread to think of the consequences if we ever find ourselves facing a health emergency such as pandemic influenza." The e-mail full exchange is provided as Exhibits {MW/356 - INQ000149111}, {MW/357 - INQ000149112}, and {MW/358 - INQ000149113}.

22. In my experience, a large part of the problem lies with the culture within the public health agencies. Over the past twenty years, I have repeatedly encountered resistance to sharing health data for research purposes apparently motivated by a strong (but in my view misplaced) sense of personal ownership of the data. More recently, this tendency

has been greatly exacerbated by a well-intentioned but ultimately counter-productive emphasis on data security concerns. Data access protocols have now become so onerous that I will no longer allocate projects requiring access to public health data to my graduate students. Unfortunately, these two issues reinforce one another because for many of my public health colleagues the sharing of data now comes with an associated risk – a hypothetical possibility of data security breaches – but no obvious benefit to them.

23. Clearly, there is a balance to be struck between legitimate privacy and data security concerns on the one hand and data access to inform clinical care and public health policy on the other. But, in my view, the pandemic demonstrated that we have got this balance wrong. I have heard this issue expressed as: 'everyone died, but at least their privacy was kept intact'.

24. I raised the need for a more positive data sharing culture in a UK Government Foresight study as long ago as 2006 (see Exhibit {MW/347 - INQ000149098}), but little had changed by 2020. A remedy would be to ensure that the successful (and secure) sharing of data for research purposes by agency staff is professionally recognised and rewarded, i.e. it is seen as a necessary and valued part of the job. In my view, future pandemic preparedness planning must directly and effectively address this issue. Otherwise, the EAVE experience in the first half of 2020 will be repeated.

25. One helpful planned activity was Public Health England's First Few Hundred (FF100 or FFX). The FF100 protocol is provided as Exhibit {MW/359 - INQ000149101}. This was an initiative to obtain crucial clinical, virological and epidemiological data and information from early cases. That was achieved, though a report was not made available to scientific advisors (such as those on the SAGE sub-group SPI-M-O) until early March 2020 – it would have been helpful to have obtained and communicated that information earlier. Early and reliable estimates of key parameters such as the basic reproduction number, the generation time and the case fatality rate improve the quality of advice that can be provided to government in the initial stages of a pandemic.

26. Epidemiological modelling is an important tool for informing a pandemic response, and the UK has considerable expertise in this area, as represented by the SAGE subgroup SPI-M-O. Prior to the pandemic there were clear plans in place to commission and deliver epidemiological modelling and well-developed systems in place to feed the outputs into policy. However, significant discrepancies between modelled expectations and reality – most clearly visible during the delta and omicron waves – indicate that there is considerable room for improved model performance in the future.

27. An important step would be to ensure that the work done by evidence-generating committees such as SPI-M-O conforms to best practice. We therefore need to agree on and adhere to best practice for epidemiological modelling. I have led in-depth work on this in the past (set out in a Good Practice Guide provided as Exhibit {MW/360 - INQ000149110}) and much of that work remains applicable, though a thorough review and re-evaluation would be timely. Best practice needs to cover all of: framing of the problem; implementation; and communication of the outputs, especially uncertainty and limitations.

28. An important specific point is that there need to be explicit recommendations regarding the role of worst case scenarios and best practice for generating them. The reasonable worst case (RWC) is an important planning tool. The RWC is not the most likely outcome – it lies at the extreme end of the plausible range of outcomes – but cannot categorically be ruled out. If we prepare for the RWC – for example, in terms of additional hospital capacity – then we shouldn't get caught out. Though it is often mistakenly treated as such, the RWC is not a prediction – we would be unpleasantly surprised if it happened. Nonetheless, the RWC is often given great weight by policy makers and media alike. Given their importance, I consider that in future more attention should be given to how worst case scenarios are arrived at and they should be subject to critique and challenge.

29. Prior to 2020, and as part of the UK's pandemic preparations, SPI-M-O's main focus was on modelling influenza epidemics. In my view, the influenza pedigree had an impact on whether or not SPI-M-O's models were truly fit for purpose. On the one hand, it was an advantage that pre-developed models were available. Even though they had to be adapted to address a different challenge, influenza and Covid-19 are both respiratory infections and the basic model structure was already there. On the other hand, the influenza models explicitly represented epidemiological features that were less relevant to Covid-19 and ignored others that were more relevant. A good example is that influenza models explicitly represented schools not care homes, though a substantial fraction of Covid-19 deaths were of care home residents, and extremely few in school-aged children. Another key issue is that influenza models tend to focus on social distancing as the preferred intervention, for two reasons. First, because influenza has a short generation time and a high proportion of asymptomatic cases, contact tracing is not considered a useful intervention and so was not incorporated into the models. It is, however, a key intervention for more SARS-like infections such as Covid-19. Second, because influenza has a lower basic reproduction number (the maximum R number) than Covid-19 the social distancing measures required to keep an epidemic manageable can be considerably less drastic than full lockdown. In my view, the net effect of the

influenza pedigree of SPI-M-O's models was to focus attention on social distancing measures rather than alternative interventions and thereby direct policy along a path that led to lockdown. I note that many countries – mainly in southeast Asia – whose preparedness planning was directed more towards SARS than influenza managed to control Covid-19 without resorting to national lockdowns.

Initial response

30. The lack of effective early actions was a striking feature of the UK's pandemic response in 2020. My reading of the 2011 influenza strategy indicates that planners were aware of this issue, so it is perhaps less a failure of planning than a failure to act on those plans. Early actions mentioned in that strategy include surveillance (i.e. large-scale testing), sero-surveillance (surveys of antibody responses), clinical studies (delivered by the FF100 studies mentioned in paragraph 25, but not quickly), information exchange nationally and internationally (noting that China did not reliably provide information in a timely manner), and identification of risk groups. All of these could have been initiated and delivered in February 2020 but were not.

31. Rather than take the above steps proactively, and plan to escalate quickly if necessary, the UK government's early response tended to be reactive or 'wait and see'. I fully accept that there is a cost to any initial over-reaction, but the nature of epidemics (specifically their propensity for exponential growth) will often mean that the cost of under-reaction is far greater. This will always be a difficult balance to get right in practice but expert opinion can be a good guide. For example, the potential threat from Covid-19 was clearly articulated by public health experts (myself included) as early as mid-January 2020 (see, for example, Exhibit {MW/013 - INQ000103367}). In contrast, no similar alarm was sounded for the outbreak of mpox in 2022; that outbreak was always unlikely to pose the same degree of threat and so did not warrant drastic interventions.

32. From late January 2020, the main bodies concerned – SAGE, public health agencies, DHSC, NHS – were fully aware of the Covid-19 and presumably were following the pandemic response protocols in place at the time. However, I share the concern that the minutes of meetings of SAGE and its subcommittees did not communicate the seriousness and urgency of the situation as it developed in January and February 2020. This attitude was echoed by Public Health England's setting of the risk level, which remained at Moderate until March 12th. This raises the question of what the risk level was supposed to communicate: on the day of March 12th the immediate risk to individuals was actually still low, but advisors were well aware that the risk of a major

epidemic developing was very high indeed and so individual risk was about to escalate extremely rapidly.

33. I believe a contributing factor to this lack of urgency was the failure of WHO to declare a Public Health Emergency of International Concern until January 30th 2020 and its failure to declare a pandemic until March 11th. I think it is self-evident that the warnings that I and my colleagues were sending to officials in early 2020 (see, for example, Exhibit {MW/013 - INQ000103367}) would have carried more weight if WHO had made these declarations earlier. February 2020 has been described as the "lost month" in terms of the world's – not just the UK's – pandemic response. This issue was highlighted in the May 2021 report by the WHO-instigated Independent Panel for Pandemic Preparedness and Response. The Panel's report is provided as Exhibit {MW/365 - INQ000177799}.

34. During the first weeks of the pandemic, there was a huge amount of early work carried out on diagnostics development, epidemiological modelling, building genomics capacity and initial steps for vaccine development. It is not clear to me why that effort was not mirrored by government-led or agency-led actions to build surveillance capability, increase health care capacity, procure PPE and plan for sustained social distancing measures. As I have said, it was apparent to advisors as early as mid-January that these would be needed (see, for example, Exhibits {MW/013 - INQ000103367}, {MW/007 - INQ000103354} and {MW/006 - INQ000103352}). I note that the UK's 2011 pandemic influenza strategy makes explicit reference to this issue (see page 28 of Exhibit {MW/353 - INQ000149105}): "it would be prudent to prepare for the implementation of the Escalation phase at an early stage of the Treatment phase, if not before". Yet the necessary steps do not seem to have been taken.

35. One early action explicitly precluded by the UK's influenza pandemic planning was border closures. This is consistent with the WHO's (long-standing) reluctance to recommend travel restrictions. Nonetheless, there was potentially a significant benefit to be gained from China closing its borders in early January 2020. Failing that, worldwide restrictions might have been imposed by early February. Though these measures would likely have been seen as extreme at the time, the disruption they would have caused was exceeded many fold over the next three years. Closing borders could have delayed the arrival of Covid-19 in the UK and elsewhere. This would have bought some valuable extra time, though I very much doubt that the pandemic could have been prevented by that means alone

36. Border closures and travel restrictions are disruptive and costly interventions. Planning needs to acknowledge this and accept that national governments may be reluctant to

implement them. However, to be effective they must be implemented very quickly indeed, perhaps within days. At that stage there may be very limited information on the nature of the threat. This leads to the paradox that a 'wait and see' strategy might well be too slow to be effective (as it was with the dispersal of a series of Covid-19 variants) but a 'just in case' strategy is likely to result in a number of costly false alarms. Finding the right balance is not straightforward but unless the costs and benefits are spelled out then it is not possible to sensibly determine what the trigger points should be for border closures or any other element of the pandemic response.

37. Overall, in my view, the UK's preparedness planning could and should have placed much greater emphasis on the need for a rapid response to an incipient pandemic. It should have been made crystal clear to Government that they might need to act extremely quickly, e.g. within days rather than weeks or months. Events of 2020 underline the need for early intervention at the beginning of a pandemic and the importance of the dictum that early action can be less drastic action. In my view, the UK's Covid-19 response was characterised by initial under-reaction and subsequent over-reaction – first we dithered, then we panicked.

Post-pandemic developments

38. An important development in Scotland has been the creation of the Scottish Government's Standing Committee on Pandemic Preparedness (SCOPP). The Committee was established "to bring together scientists and technical experts to advise the Scottish Government on the future risks from pandemics and to ensure we are as prepared as it is possible to be for these". Though the Scottish Government did set up its own Covid-19 Advisory Group in late March 2020 that committee did not meet until after a UK-wide lockdown had been imposed and so missed a vital opportunity to provide advice over the preceding 2-3 months. SCOPP should rectify the lack of any such structure in early 2020, provided it is able to make difficult calls quickly and is heeded by Government.

39. I welcome the recent publication of pandemic response strategies by various international bodies. However, I consider that these should be regarded as first drafts rather than the fully thought out finished article. The G7's 100-day mission document (provided as Exhibit {MW/361 - INQ000149099}) is a case in point. The main focus of the 100-day mission (and other strategies) is the even faster development of diagnostics, therapeutics and vaccines than was achieved in 2020. This is obviously desirable but, in my view, by itself it is far from sufficient.

40. The first problem is that the 100 days refers only to the development and approval of a vaccine and does not factor in roll-out time. This is a hugely significant omission: more people died with Covid-19 in the UK after the vaccine roll-out began than before (see the graphic provided as Exhibit {MW/362 - INQ000149115}). Part of the solution is to have plans in place for accelerated roll-out once a vaccine becomes available; roll-out is considered to have gone well in the UK, but in 2021 it still took almost 6 months before even first doses reached all target populations, and a single dose subsequently proved insufficient. Pandemic planning must address roll-out rates and how to improve them.

41. The second problem is how to plug the gap between the start of a pandemic and the completed roll-out of a vaccine – a gap likely to be considerably longer than 100 days. The G7 document makes reference to the need for social distancing measures (while some other plans make no reference to this gap at all). If, as seems likely, this means that lockdown is to be considered once again as a public health intervention then planning must include criteria for selecting trigger points and exit strategies and, importantly, for steps to be taken to mitigate the indirect harms caused by the interim response.

42. The third problem is the risk that the 100-day target will not be fully achieved. One realistic possibility is that vaccines actually take considerably longer than 100 days to develop – in which case the interim response will need to be sustained for an extended period. Another possibility is that the vaccines are delivered but they are not as effective as those developed for Covid-19. As an illustration, the Chinese vaccine Sinovac was developed more quickly than those deployed in the UK but was less effective, which contributed to a severe (though not fully quantified) Covid-19 wave once China abandoned its Zero Covid policy at the end of 2022. It is conceivable that the UK could find itself in a similar position in a future pandemic. The public health solution would be a much more gradual lifting of any interim countermeasures, again indicating the importance of these being sustainable.

43. The bottom line is that the 100-day mission is no guarantee against the UK imposing severe and prolonged social distancing restrictions in a future pandemic. To guard against that possibility, preparedness planning must cover the options for an interim response with a focus on ways to mitigate the adverse effects of social distancing or, preferably, on alternative options.

44. I stress that preparedness planning is a continual process rather than a one-off exercise. This is for two reasons. First, both our understanding of potential threats and the options available for responding will evolve over time, and planning needs to be updated

accordingly. Second, in my experience, institutional memory in government is short and needs to be regularly refreshed. The UK Government's network of Chief Scientific Advisors and Science Advisory Committees have a key role to play here. Scotland's Standing Committee on Pandemic Preparedness may be a good model to follow. I also suggest that regular (perhaps biennial) cross-government audits of pandemic preparedness, planning and response capability are warranted.

45. The UK's strong science base was undoubtedly a huge asset during the Covid-19 pandemic. I understand and fully support the emphasis on maintaining the UK's capability to deliver technological solutions such as vaccines and therapeutics, a capability that must be underpinned by the best fundamental science.

46. However, for the reasons I have set out, vaccines and therapeutics alone are insufficient. I am concerned that there is still an under-appreciation of the importance of clinical care, epidemiology and public health, as well as the crucial role played by diagnostics. These less fashionable disciplines and technologies were the ones that delivered life-saving interventions during the first year of the UK's Covid-19 epidemic and they require investment commensurate with the key role they will surely play in any future pandemic.

47. Networks for the sharing of information and best practice will be critical for optimising clinical care and public health interventions in future pandemics. Though in 2020 there were forums available for discussing available information – not least the advisory groups – there were no bodies in place charged with the systematic collation of information both nationally and internationally (though these did appear later, such as the Uncover initiative at the University of Edinburgh). The consequence was that information gathering was largely ad hoc and often poorly done.

48. Equally, there were not good systems in place for translating that information into recommendations for clinical and public health practice. It is striking that so many interventions during 2020 were introduced on the basis of observation, expert judgement and trial-and-error. There was no time, and sometimes no possibility, of clinical or field trials. The gathering, synthesis and evaluation of the mixed quality evidence available were vital tasks, but responsibilities for those tasks were not clearly allocated, especially in the early stages when they were particularly important. An effective system to manage information flows should be set up in advance of a pandemic not in response to one.

49. During a pandemic, the health services and public health agencies deliver the front-line response and it is obviously important that they are resourced and competent to do so. Those bodies also have significant capacity to conduct research, evaluate evidence and

design intervention strategies. However, there is also the capacity to conduct those activities in the higher education system.

50. The genome sequencing initiative COG-UK is a good example of those parallel capabilities being put to work together, with tremendous success. Yet it is striking that COG-UK was set up at short notice in early 2020 not because this had been planned in advance but because it was felt it would fill an important gap in the UK's pandemic response. This despite the need for genomic surveillance during an epidemic having been clearly set out by public health experts over the preceding decade (see, for example, Exhibit {MW/354 - INQ000149114}).

51. I hope that a future pandemic will find such systems for co-working by agencies and academic institutions already in place. The National Institute for Health Research has funded such partnerships in the past and an evaluation of their contribution to the Covid-19 pandemic response would be helpful.

52. I note that Scotland already has in place a government-funded, university-based centre of excellence known as EPIC. EPIC aims "to advise the Scottish Government and industry stakeholders on the risk of spread of emerging diseases and on how to prevent it". However, EPIC is concerned with animal health – there is no equivalent for human health in Scotland or elsewhere in the UK.

53. Finally, to return to the point I made earlier about the diversity of pandemic threats, we must avoid the pitfall of planning for the pandemic we have just had rather than the one we have next. Arguably, this was the root cause of the overly narrow focus on influenza in the UK's pre-Covid plans – those plans were written in the aftermath of the swine flu pandemic of 2009-10. There is an obvious danger that we now plan for another SARS-like event but that is not what we find ourselves facing when the next pandemic arrives.

54. One exercise intended to identify potential pandemic threats – especially those felt to be under-researched – is the World Health Organization's R&D Blueprint. In 2017 I contributed to a R&D Blueprint meeting that identified a number of these threats and also explicitly mentioned the possibility of the next pandemic being caused by a currently unknown pathogen. A report of that meeting is provided as Exhibit {MW/351 - INQ000149108}. The subsequent 2018 meeting designated this possibility "Disease X" and included it in a list of eight candidates for accelerated research and development of countermeasures. A report of that meeting is provided as Exhibit {MW/363 - INQ000149109}. Candidates for the type of pathogen that Disease X might turn out to be were listed in the 2018 meeting report. That list included 'highly pathogenic coronaviral

diseases other than MERS and SARS', a possibility became a reality less than two years later.

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: 27 April 2023