Witness Name: Dr Catherine Moore
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UK COVID-19 INQUIRY

WITNESS STATEMENT OF Dr Catherine Moore MBE BSc (Hons) MSc PhD FRCPath

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I, Catherine Moore, will say as follows: -

1. **Early Phase January 2002 to March 2020**
2. In early 2020, I was a lead scientist for Public Health Wales (PHW) in two areas, the first was the national focal point for the virological surveillance of influenza and other respiratory viruses. In this role, I provided the virological testing and characterization at a genomic level for influenza and other respiratory viruses. My other significant role was as lead for molecular service development for the laboratory network. This encompassed developing and implementing testing for both endemic and emerging infections, mostly but not exclusively caused by a viral pathogen. In addition to these roles, I also supported the delivery of the clinical virology service as part of the consultant virologist team. At the time of the start of the pandemic, this encompassed two consultant virologists (including myself) and two microbiologists with an interest in virology based in the Wales Specialist Virology Centre (WSVC), Cardiff. My roles and remit in PHW have not changed since 2020.
3. My understanding of coronavirus virology and epidemiology at the start of 2020 was good, as I had taught modules at master's degree level on respiratory viruses, where the coronaviruses as both seasonal viruses and emerging infections were integral to that learning. I had also on a more practical level previously responded to SARS-CoV-1 in 2003/4 when I verified and implemented a test for use in Wales.

4. In 2012, the emergence of MERS-CoV further highlighted the importance of this group of viruses in terms of severe infection in the general population, as well as the significant risk of spillover from animal sources. Again, I was part of the response to this infection and attended a number of incident meetings, and also implemented the test which is still used in Wales as part of the emergency response testing processes.
5. What became clear after MERS, was that there was relatively little understanding or expertise of coronaviruses in the UK with only one study from Scotland having been published on coronavirus epidemiology. Introducing routine testing for relatively mild infections is challenging, and not necessarily cost effective. In 2014, the first validation of a suite of tests for seasonal coronaviruses formed the basis of an undergraduate project, looking at incidence of the four viruses in the community and in the ICU setting. Routine surveillance started in 2017 and testing more widely in Wales for seasonal coronaviruses started in 2018.

6. Early Phase January 2020 to March 2020

7. I first became aware of what became known as the SARS-CoV-2 virus in late December 2019. There had been some discussions amongst my virology colleagues on social media about a cluster of severe pneumonia cases that were associated with a wet market in Wuhan, China. I recall there were thoughts that perhaps the virus was SARS-like. This rumour was confirmed by Pro-Med Mail (a rapid infection news sharing service) and a few other sources and a few days later, work in the region confirmed it was a new coronavirus.

8. There were very early conversations in PHW about preparing for potential cases and incident meetings were set up during the first few days of 2020. I was not directly involved in these meetings.
9. At the time there was no specific testing, however as the viral genome was published quickly it was only a matter of time that tests would be made available. In the interim, protocols were put into place to send samples to PHE in London for testing using a broad coronavirus PCR test.
10. My initial focus was to work on, and implement testing in Wales. What should be made clear is that commercial tests are rarely available in the first few weeks of

any new pathogen emerging, so early tests are what are described as 'laboratory developed'. The user is provided with details of a molecular test that can be used to detect the pathogen DNA or as in the case of a coronavirus the RNA. This area is where my expertise lies and so my clinical commitments were reduced to allow me to concentrate on this matter.

11. On the 15th January the WHO published the first SARS-CoV-2 specific tests that had been developed by Christian Drosten, Charite, Berlin, who also developed the test being used in Wales for MERS-CoV. I immediately ordered all the required test reagents to start the validation process. At the same time as ordering the primers and probes, I contacted the European Virus Archive and ordered the positive control material.
12. On the 21st January 2020, the start of the time period covered by this statement, it would be correct to say that I, along with my microbiology and public health colleagues in PHW, were primarily working on preparing for the possible arrival of the novel coronavirus into Wales. Meetings had already been convened in the first week of January 2020 at the UK national level under the umbrella PHE NICC30 meetings, mostly concerned around the increasing numbers of cases globally and then in terms of the testing in the UK, this eventually evolved into the wider UK virology cell meetings. Similarly, WHO Euro/ECDC were calling meetings of the laboratory network (the laboratories that are part of the Global Influenza Surveillance and Response System - GISRS) to discuss the response in the different countries around Europe. As it was acknowledged early, although we were dealing with a coronavirus, the laboratories in GISRS were likely to be forefront in the wider global response. In the early phase of the pandemic these meetings acted as an information sharing arena, some basic science was shared, but detail was often lacking due to the low number of cases in Europe.
13. On the 23rd January I went to a preplanned workshop in Vienna organized by the European Society for Clinical Virology on emerging infections. It was at that meeting where some key people in the field of emerging infections were last able to meet in person before the pandemic really started. Christian Drosten was supposed to talk about coronaviruses at this meeting, however he had already cancelled as he was advising the German Government on the response. On the second day of the meeting, we reviewed the increasing case count and discussed what we knew about the fast-evolving situation and emerging science. We were

all in no doubt that this had the potential to be a significant global public health problem if not controlled quickly.

14. During my trip, I was frequently messaged by my manager in PHW to update on the situation with the test development, I expected all the required reagents to be available when I returned the following week.
15. The required test components were delivered to Cardiff the week commencing 27th January which enabled the test to be validated. This was completed by the week starting the 3rd February.
16. On the 5th February, PHE convened a technical meeting regarding assay validation across the PHE, NHS and DA laboratories. It was at this meeting when it was discussed that we in Wales had an assay already validated, and that both N. Ireland and Scotland had also performed some work and could likely start testing soon. This was not taken well, with queries from PHE about process and why we should use a universal test. It was at this meeting when indications of problems with test specificity were raised for the first time, something that neither we in Wales nor Scotland had experienced. The test in our hands (Wales) achieved comparable sensitivity and specificity as that published by the WHO, and as a consequence I was satisfied that the test was suitable for diagnostic use.
17. This issue initially caused some impasse in terms of starting testing in Wales, and was raised to the four CMO level. With the full support of PHW, we were able to start routinely testing Welsh patients on the 6th February 2020.
18. From January until March 2020, It would be true to state that I was not involved with any of the Welsh government advisory groups, my role was only to support the test delivery and to navigate some of the difficulties we faced with supplies of materials to perform that function.
19. In the first few months of the pandemic, the increasing reagent shortages, the limited availability of commercial options, and the need to continue to perform other routine tests put considerable pressure on the NHS laboratory system, and whilst it might have been possible to very quickly upscale testing the infrastructure and critical supplies were not at that time in place to support it.
20. There was also very little engagement at the UK government level with the clinical virology laboratory services across the UK from the very start. Had there been, this may have enabled some critical insight into those challenges and to provide some of the guidance to support increased testing by switching off certain services

sooner, that would have freed up key equipment. Most if not all high throughput testing for infectious diseases in the UK is performed by clinical virology laboratories, and it is the very reason that clinical virologists ultimately ended up having clinical oversight of the NHS lighthouse laboratory network. Clinical virologists importantly also have the skills and expertise to understand the limitations of PCR testing and to apply it to the clinical management of patients. This was a significantly underutilized resource, with academic virologists often being asked to advise in an area (routine test delivery) that they had little expertise in. I'm not sure how you would improve this engagement going forwards, perhaps by direct communication with the UK- clinical virology network (UK-CVN) or via the Royal College of Pathologists, who rather belatedly set up a steering group of virologists. Outside of the UK, it was very clear that leading clinical virologists were central to government responses including in Germany, New Zealand and Sweden, whereas they were largely absent in the UK in the early phase.

21. Without comprehensive testing, it was then very difficult to gain any wider knowledge of the biology and dynamics of SARS-CoV-2 infections. Very early data was being published, but it was often of poor quality with small numbers of cases included in the data set making drawing concrete conclusions challenging. I knew nothing specifically in terms of SARS-CoV-2 asymptomatic infections or transmission, except what could be drawn from the understanding of other seasonal respiratory infections. It is well documented that respiratory viral infections do not always present with symptoms and that asymptomatic infections can occur. What was less clear, is the role that they play in the propagation of any outbreak. This is because testing for respiratory viral infection is not routinely performed on asymptomatic individuals, so to presume that all infections will lead to symptoms is shortsighted, but asymptomatic testing is hard to justify when the data does not exist to prove it plays a significant role in transmission, particularly when testing even the symptomatic at the time was causing issues.
22. I was not involved in advising on key policies at that time at any level from PHW through to WG or UK government. I found out about the first lockdown at the same time as the wider public, I wasn't privy to any of the modelling nor science that underpinned that decision. My opinion on whether locking down earlier would have reduced COVID deaths is a matter of conjecture, with a heavy dose of the benefit of hindsight and knowing full well that by stopping people moving about and mixing

the number of opportunities for transmission would of course significantly reduce. In terms of events held in Wales, although there was general discomfort amongst my PHW colleagues about the decision to hold the rugby match and the Stereophonics concert in March 2020, simply by the basic public health principle of crowded spaces leading to more infections, with which I concur, this was not an area I was involved in advising on.

23. April 2020 onwards

24. I was aware that above the PHW Incident Management Team (IMT) meetings (, PHW were advising WG on the response - I wasn't clear about who was sitting on these groups, nor what the terms of reference or remit were.
25. In late April 2020, I was invited to attend a WG technical advisory cell/group meeting by my direct line manager, who was the clinical and national virology lead, as her deputy. I'm not quite sure if I was a member of both TAC and TAG or whether the group names were interchangeable. From my recollection from the first meeting I attended, the group included people who were not known to me, so I had no idea whether they were WG policy leads or advisors or from other areas of expertise. It became quite clear that beyond those individuals I knew from PHW, very few in the meeting had expertise in a pandemic response, but also many did not have any basic understanding of the virus they were dealing with. Public Health Wales were very clearly the main advisors on that aspect, which wasn't surprising as I understood that in Wales, PHW held that function and the expertise.
26. I note that the membership was updated in May 2020 to include both myself and my direct manager, we were listed as microbiologists, when in fact we are both pure virologists, which might reflect some of the confusion around people's roles, especially as the group expanded.
27. In terms of accountability and flow of information to ministers, I have no appreciation of that at all, I was there purely to discuss the science and not be involved directly in messaging or policy writing. The questions posed often came from a position of no understanding, but whilst I was often bemused by why a question was being asked, I also realized very quickly that fundamentally ministers and indeed many of the people in policy are not scientists and those that were scientists were not virologists. Everyone was on a very steep learning curve, and I think one of the major frustrations when you are stressed and busy, was that in

the middle of a crisis you were often having to explain the first basics of virology and the human immune response to an infection, before being able to respond to a question. In truth, I'd much rather be asked the question and be able to give an answer based on what I understand the current science says, than not be asked at all, and then a poor decision made due to lack of knowledge. If the decision is made with full knowledge, then at least ignorance can't be blamed if the decision is wrong.

28. I did feel that you could challenge the outputs from TAC/TAG but when you are a minority voice, that it was sometimes hard to be heard, especially when we first joined as virologists, as our expertise in this area was largely unknown by non-PHW members. This did however improve over time.
29. I and a number of epidemiology colleagues were sitting weekly on various WHO/ECDC meetings but were never asked to give an update to TAG, data was presented on the international situation by someone from WG who wasn't at those meetings with us, which was a little strange. The emergence of omicron was a point at which the experience of international countries should have been fully considered, in terms of potential impact on Wales. Data was very quickly shared that showed despite the antigenic differences that in fact the severity being witnessed was low. This had been presented at a WHO meeting on the emergence in South Africa, so it was available. This, however, was not the tone of the meeting on omicron, where the external invited speaker proceeded to give a very gloomy prediction for the likely impact of its arrival, despite being challenged with the available data from the very country the virus emerged in.
30. Attending meetings was often difficult especially throughout 2020 into 2021, even if we were present it was also hard to participate fully, as being based on the hospital site we also had to deal with the day to day running of the service. Also in March 2020, the virology clinical staff moved to a shift system that included very late and early shifts that would not have allowed me to attend all the meetings in my diary. My line manager and myself attended as and when we could.
31. In June 2020, Rob Orford requested that sub-groups of TAG were set-up to specifically look at key areas of the response. I was first invited to sit on Testing TAG (TTAG) with a remit to discuss the science of the testing being offered, and how the evolving epidemic would affect test performance in light of changes in the levels of population immunity and changes in the virus at the genetic level.

Requests were made to this group to specific queries by policymakers on areas such as the use of LFDs and immunity screening. The group itself was much smaller than the main TAC/TAG meetings and included people from not only PHW (epidemiology, microbiology, genomics and virology) but also immunology, and point of care testing leads. This allowed more in depth discussions about the science and the tests being used in Wales. It was this latter area where we were able to be pragmatic about the implementation of certain tests that often were being proposed for use in Wales from the UK government level but came with little data to support their use. This is one area where our advice was largely listened to, allowing us then to focus better on those tests that would work for Wales. Sometimes it would be fair to say that policy leads were present at meetings when specific questions were being asked, which did risk blurring the boundaries between giving scientific advice and writing policy. In most cases the process was that advisory notes written by PHW, were then taken to TTAG for further scrutiny and then to TAC/TAG for approval or sent back for further amendment.

32. I don't know how many sub-groups there were, but all outputs were brought to TAC/TAG for review and discussion before sending back to the subgroup for amending or up to the next level (?TAG).
33. It was sometimes hard to determine if a policy had already been drafted and we were to fit the science to the policy, but I was always very clear on my remit, I was there to share the science as I understood it and was happy to be challenged or challenge any aspect that went against that. I acknowledge that this stance may have been harder for people more senior than me in PHW, who were also drafting the advisory notes for PHW which then ultimately came back to them for review if they sat on TAC/TAG.
34. The Testing Clinical Advisory and Prioritisation (TCAP)Group was I believe set-up at around the same time, this had a remit for the clinical aspects of the response, including infection control, treatments and testing protocols including test to release. I initially was asked to attend this meeting whereas my line manger was requested to attend NERVTAG, she had started to attend in April 2020. We acted as deputies for each other at these meetings.
35. I'm unable to comment fully on the adequacy of information sharing, advice sought, coordination, or strategy or planning as none of this was in my remit. I attended TAC/TAG and the subgroups as a virologist to share what I knew in that area to

the best of my ability. I was never party to the workings of the advisory pathways nor chaired any of the meetings to begin to understand it.

36. Of the other key policies at this time, I don't recall TAG discussing eat out to help out, presumably because the policy was already made by UK government and we were generally there to discuss the science. I contributed to discussions around advice given for a number of the NPIs, but purely from a virological aspect, I am not an expert in infection control beyond my understanding of first principles and would defer to my colleagues who are experts in this area and who were present at meetings where these were discussed. I didn't sit on any of the infection control sub-groups. I did sit on environmental TAG (eTAG), which reviewed the literature and science around face coverings but as part of a large group of scientists. This was after face masks wearing was already implemented in Wales.
37. I can't comment on whether advice was taken seriously by Welsh government as I wasn't present when it was discussed. It's difficult to be drawn into supposition of such matters without being an actual witness. It's also accepted that not all advice will be taken.
38. Together with my senior epidemiology colleague, we did provide the evidence of the arrival and spread of the alpha variant into Wales, that precipitated the third lockdown in December 2020. I can attest having been present at the meeting that this information was taken very seriously and swiftly acted upon. I'd like to imagine that should similar evidence have been presented before and after this event, that it would have been considered in the same manner.
39. In July/August 2020 my line manager and myself swapped meetings. I became the main person to attend NERVTAG and she attended TCAP. I attended a few TCAP meetings, but she was the main attendee.
40. Our role on NERVTAG was purely as observers. We both found this role confusing, because my manager had asked when she started to attend what observer status meant and was told that she wasn't to participate but simply to observe the meeting. PHE/UKHSA also attended NERVTAG as observers, yet they were very active participants not only in providing updates but also in discussing the science. This in my mind skewed the data and epidemiology being presented to very much a UKHSA view of the pandemic, a theme that was repeated in many of the UK meetings that I attended. I fully accept that England has greater than 50 million residents, but the pandemic affected the whole of the UK and when health is

devolved and different approaches are used, there is always learning to be had whether your population is 50 million or 3 million. This also applied to regions of the UK where UKHSA does not have a laboratory present, such as those covered by NHSE. All the clinical virology services across the UK were participating in research and also involved in the management of complex cases. We were also all trying to do the best we could with the limited availability of tests. Whilst the virology cell meetings were attempting to be as inclusive as possible, the focus was always that of the situation in England, and then mostly that of UKHSA. This is not the fault of those in UKHSA who led the meetings, but it fundamentally reflects the size and scale of the situation that could never be fully covered in weekly 4 hour meetings, with 5 minute slots given to an entire region or country of the UK. I think it would be fair to say that our own TTAG in Wales, was as close to the virology cell as it could get, bearing in mind, there are not that many virologists in Wales and we were on both groups.

41. Should Wales have had a presence on NERVTAG prior to the pandemic? Probably. Would it have made a difference in terms of the level of science we had access to? Very likely. Would it have made a difference to the response in Wales? No. Major policy decisions were largely made despite the science, and the priority very quickly became delivery of as many test results as possible putting untold pressure on an already under resourced laboratory system. Funding for the testing came into Wales from UK government with a requirement to spend it, to reach ever increasing testing goals. The rhyme and reason for testing was very quickly lost and despite trying to keep a handle on it by WG and by PHW, for the most part, the microbiology services across Wales and the UK became testing factories with very little time for anyone to fully analyze the data being produced, to essentially provide the science that was desperately needed to manage the pandemic. For example, in Wales we set up rules in our laboratories to capture low level positives, that very likely reflected clearing/past infection. That was not the case for the lighthouse laboratories where results were issued as blanket positive, negative or indeterminate. This invariably would affect modelling if acute cases could not be differentiated from past infections. Many attempts were made to do this work using the threshold crossing point (ct) value of the PCR, but then that also had to be issued by the testing laboratory and standardized across the multitude of different

testing platforms deployed in the UK, some of which used technology that wasn't PCR so ct value was never available.

42. The UK did very well in rapidly assessing treatment options, sequencing millions of viral genomes and rolling out the vaccines, but basic science was lacking to enable a full assessment of the testing decisions, and importantly understand the dynamics of an infection in the human host which could potentially have been determined from analysing all the test data in real time beyond what was demanded for the daily testing dashboards. UKHSA and some study groups and consortiums were active in this research area, but the limited funding and availability of staff always meant delays in publishing the data. This was even clear at NERVTAG where interim and early non peer reviewed data was used, often with that peer review happening in the meeting. It should also be said that the science was moving quickly globally, so often the science was already out of date before you wrote the manuscript ready for peer review. So following the science probably was truth, but in the sense that you were running after it or using science that was so new, nobody had a real chance to review it fully before it became a part of policy.
43. In terms of communicating the complexities of the government response in Wales and the role of the advisor and policy maker to the public, it wasn't very transparent or clear about roles and responsibilities. Whilst there is a risk that being too transparent does open individuals to public scrutiny and sometimes unpleasant backlash for unpopular decisions, transparency is important for trust, especially when decisions are being made that impact lives. It's important that there is a clear delineation between those who are asked to assimilate complex information for the lay person (the expert advisors), to enable policies to be made by the policymakers based on all the available information. Being an advisor is difficult job, made more challenging during the pandemic because that clarity wasn't communicated effectively to the public meaning that there was blurring in the public perception about who the key decision makers were. TAC/TAG did not write policies, but provided a consensus opinion about the science that was available at the time, I'm not sure that remit was ever fully shared with the public nor that the members were often the same people who were frontline workers on the response itself. They not only were caring for patients and were also having to live by those same policies

they advised on. That level of communication needs to be better in the future, otherwise experts will be less likely to advise based on this experience.

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: 22/09/23