Witness Name: Louise Dyson
Statement No.: 1
Exhibits: [LD/01 – LD/45]
Dated: 23/05/2025

UK COVID-19 INQUIRY

WITNESS STATEMENT OF LOUISE DYSON

I, Louise Dyson, will say as follows: -

Introduction

1. I make this statement in response to a request from the UK COVID-19 Inquiry dated 11 November 2024 under Rule 9 of the Inquiry Rules 2006, asking for a witness statement relating to Module 7 of the Inquiry, which I understand covers the approach to testing, tracing and isolation ("TTI") adopted during the pandemic in England, Wales, Scotland and Northern Ireland from 1 January 2020 to 28 June 2022.

2. I am an Associate Professor (Reader) in Epidemiology at the University of Warwick, and a member of the Zeeman Institute for Systems Biology and Infectious Disease Epidemiology Research ('SBIDER'). I have a doctorate in mathematical biology from the University of Oxford from 2013 and was first appointed as Assistant Professor at the University of Warwick in 2016

3. I have published 47 peer-reviewed articles and have an h-index of 26 (meaning that I have 26 publications that have been cited 26 or more times). I have authored 23 peer-reviewed articles on Covid-19. Eight of my publications may be thought of as relevant to TTI:

a. Hill, E.M., Atkins, B.D., Keeling, M.J., Dyson, L, and Tildesley, M.J. A network modelling approach to assess non-pharmaceutical disease controls in a worker population: An application to SARS-CoV-2. PLOS Comp Biol. (2021) Jun 16;17(6): e1009058 (LD/01 – INQ000533211).
b. Leng T, Hill EM, Thompson RN, Tildesley MJ, Keeling MJ, Dyson L. Assessing the impact of lateral flow testing strategies on within-school SARS-CoV-2 transmission and absences: a modelling study. PLOS Comp Biol. 18.5 (2022): e1010158 (LD/02 – INQ000533213).
c. Leng T, Hill EM, Holmes A, Southall E, Thompson RN, Tildesley MJ, Keeling MJ, Dyson L. Quantifying within-school SARS-CoV-2 transmission and the impact of lateral flow testing in secondary schools in England. Nat Comms. (2022) 13, 1106 (LD/03 – INQ000533204).
d. Dyson L. Modelling results on the impact of COVID-19 testing in schools The Lancet Infectious Diseases (2022) (LD/04 – INQ000534783).
e. Enright, J.*, Hill, E.M.*, Stage, H.B., Bolton, K.J., Nixon, E.J., Fairbanks, E.L., Tang, M.L., Brooks-Pollock, E., Dyson, L., Budd, C.J., Hoyle, R.B. SARS-CoV-2 infection in UK university students: lessons from September-December 2020 and modelling insights for future student return. Royal Society Open Science. (2021) (LD/05 – INQ000533217).
f. Southall, E.*, Holmes, A.*, Hill, E.M., Atkins, B.D., Leng, T., Thompson, R.N., Dyson, L., Keeling, M.J. and Tildesley, M.J. An analysis of school absences in England during the Covid-19 pandemic. BMC medicine. (2021) Dec;19(1):1-4 (LD/06 – INQ000534780).
g. Hill, E.M., Atkins, B.D., Keeling, M.J., Tildesley, M.J., and Dyson, L Modelling SARS-CoV-2 transmission in a UK university setting. Epidemics (2021) Sep (36) 100476 (LD/07 – INQ000533208).
h. Dyson L., Hill E.M., Moore S., Curran-Sebastian J., Tildesley M.J., Lythgoe K.A., House T., Pellis L., and Keeling M.J. Possible future waves of SARS-CoV-2 infection generated by variants of concern with a range of characteristics. Nature Comms. (2021) Sep 30;12(1):5730 (LD/08 – INQ000534782).

Relevant evidence on testing technologies

4. Testing systems and strategies varied over the course of the pandemic. When assessing these strategies, it's important to be clear about the costs and aims of each part of the system. The covid TTI system comprised community testing (PCR or LFT); followed by contact tracing following a positive test; and mandatory or advised isolation (depending on the rules at the time). When financial support for isolation was provided, that required a positive PCR test, so that a confirmatory PCR test would be required if the initial positive test was an LFT.

5. Testing was the most expensive part of TTI, particularly PCR testing. The effect of testing depends on what strategy would otherwise have been employed. If people were otherwise required to isolate when they developed symptoms, then the effect of testing is to release people with a negative test from isolation. Conversely, if people were otherwise advised to behave as normal regardless of symptoms, then the effect of testing is to reduce infection in the general community. For much of the pandemic it was necessary to keep infections low enough to protect the NHS, and so one might infer that the cost of testing should be compared to the cost of individuals isolating on symptoms or to the cost of a general lockdown.

6. In contrast, contact tracing is aimed at reducing community infections. The efficacy of UK contact tracing (either manually or through the app) has been much scrutinised and is likely to be different at different times. Manual contact tracing is most effective when there are low numbers of cases. When the R number is greater than 1, so cases are growing exponentially, it is very unlikely that manual contact tracing will ever be able to keep up. This is similar to the problems with increasing testing capacity to keep up with a growing epidemic, which is similarly extremely difficult.

7. The vast majority of advice I contributed to relating to TTI was through contributions to SPI-M-O. The full range of end-users of that advice was often not communicated to us, and so it is difficult for me to know the role of scientific modelling in the development, implementation, or evaluation of TTI systems. My understanding is that the Joint Biosecurity Centre (JBC) was created to provide

analysis and advice regarding TTI systems. The JBC was later brought into the newly formed UK Health Security Agency (UKHSA).

8. I do not have any evidence in the stated time period regarding testing systems and strategies in future pandemics. I have contributed to two papers as part of the re-formed SPI-M after 28th June 2022 (LD/09 – INQ000535020; LD/10 – INQ000535021). The first is on lessons learned regarding data needs during a pandemic and has a section on testing data. The second summarises information on border control measures, including potential screening measures at the border. I have no evidence regarding the development or comparison of assays during the pandemic.

Involvement in groups between January 2020 until 28 June 2022

9. I was a participant of SPI-M-O from 6 April 2020 to its last meeting on 23 March 2022.

10. I also attended individual meetings of the following groups:
    a. SAGE Task & Finish Group on Higher Education/Further Education (August 2020)
    b. SAGE Task & Finish group on Celebrations and Observances (November 2020)
    c. Data group (23 November 2020, 18 December 2020)
    d. Children's Task and Finish Working Group (January 2021)
    e. Occasional meetings of the Variant Technical Group (VTG, 13 May 2021, 10 November 2021, 20 July 2022, 7 September 2022)
    f. Wales COVID Technical Advisory Group (TAG) (5 November 2021).

11. From January-March 2022 I had a 50% secondment to the Cabinet Office Covid-19 Taskforce. From May 2022 I have been a member of the re-formed SPI-M group.

Overview of involvement in respect of Test, Trace and Isolate

Scientific Pandemic Influenza Group on Modelling, Operational sub-group (SPI-M-O)

12. I began attending meetings relating to SPI-M-O on 27 March 2020. My participation was suggested to the academic co-chair, Graham Medley, by Matt Keeling who was, prior to this, the only participant from the University of Warwick.

13. I attended 83 main SPI-M-O meetings from 6 April 2020 until the last one on 23 March 2022, and many other side-meetings arranged by the SPI-M-O secretariat. Some of these meetings involved discussions and research related to TTI either directly or indirectly. My contributions to these meetings included: presenting research undertaken by myself and others; reading, listening to and critically reviewing others' contributions; and contributing to group discussions which were then represented by the SPI-M secretariat in consensus statements. Summaries of the work (relevant to TTI) provided to SPI-M-O are given below.

14. In general, SPI-M-O participants responded to commissions communicated to us via the SPI-M secretariat. These provided a structure for the committee to submit work relevant to policy decisions in a timely manner, but participants were also encouraged to submit other non-commissioned work that we felt to be important.

SAGE Task & Finish Group on Higher Education/Further Education

15. This was a cross-SAGE / cross-government group led by Cath Noakes. It was convened to write two papers in August 2020, one on Further Education (Principles for managing SARS-CoV-2 transmission Associated with Further Education) and one on Higher Education (Principles for managing SARS-CoV-2 transmission associated with higher education). Both papers were considered at SAGE 55 (3 September 2020), and both included discussion of the need to develop clear strategies for testing and tracing and enabling isolation in further and higher education settings (LD/11 – INQ000075804; LD/12 – INQ000573954).

UKHSA Variant Technical Group

16. The UKHSA variant technical group met to discuss variants of COVID-19. I attended 4 meetings, once (10 November 2021) to present work on the AY.4.2 variant and other times on behalf of SPI-M-O, when others have been unable to attend.

Technical Advisory Group

17. I attended one meeting of the Wales TAG to present analysis of the Immensa lab incident. This analysis had also been presented to SPI-M-O on 3 November 2021 (see paragraph 29 below).

Groups that did not discuss the Test, Trace, and Isolate system specifically.

18. SAGE Task & Finish group on Celebrations and Observances: This was a cross-SAGE / cross-government group convened to write a paper in November 2020: Key Evidence and Advice on Celebrations and Observances during COVID-19. This paper was considered at SAGE 66 (5 November 2020) but did not include any discussion of TTI specifically.

19. Data group: This group was set up to aid in communicating data needs between groups. I attended two meetings (23 November 2020 and 18 December 2020) on behalf of SPI-M.

20. Children's Task and Finish Working Group: I contributed to a document (TFC: Children and transmission) considered at SAGE 65 (4 November 2020). I also attended a meeting in January 2021, which was convened to plan future work regarding children.

Documents I contributed for the purpose of advising SAGE or subgroups relating to Test, Trace and Isolate

21. In May 2020, we were asked by SPI-M-O to prepare work considering outbreaks within schools or workplaces. In response I presented an analysis of the effect of working patterns on infections at work. That is, if people returned to work for some number of days per week, are there specific patterns of days-on and days-off that would result in fewer infections? I showed using a simple analysis that it depends on how an individual's infectiousness varies over time since their infection, and as a group we also developed a more complex network model of infection at work.

22. This more complex model was further developed over time to include the impact of testing and contact tracing. We also used it to consider forwards contact tracing (i.e. tracing contacts of a known case after they became infectious) and backwards contact tracing (tracing the potential source of a case's infection, to find other people infected by that source). These reports were sent to SPI-M-O on 18/05/20, 02/06/20 and 09/06/20 (LD/13 – INQ000533222; LD/14 – INQ000533220; LD/15 – INQ000533224) and were published as a peer reviewed paper (LD/1 – INQ000533211). This complex network model was also adapted to apply to universities to contribute to work presented to SAGE 76 on 13/01/21 (LD/16 - INQ000313420) and to contribute to work presented to SPI-M-O on 21/04/21 (LD/17 – INQ000533221) and this was also published as a peer reviewed paper (LD/05 – INQ000533217).

23. Another stream of research focused on transmission in schools, and the potential for using different testing strategies in schools using lateral flow and PCR testing strategies. One strategy considered was using what was called "daily contact testing", which allows contacts of a known case to continue to attend school (rather than isolating) so long as they have a negative lateral flow test each morning. We considered this using a model of transmission within school, and the strategy was later investigated (by another group) in a trial in a number of English institutions (LD/18 – INQ000197178).

24. I also presented the work at a meeting set up by the SPI-M-O secretariat with John Fitzpatrick, who was involved with TTI in DHSC. This discussion also resulted in some email correspondence regarding the relative efficacy and costs of the different aspects of TTI. Reports regarding this work were sent to SPI-M-O on 27/01/21 (LD/19 – INQ000561716), 03/03/21 (LD/20 – INQ000561714) (and subsequently sent to SAGE 83 and included in the SPI-M-O statement on daily contact testing, LD/21 – INQ000075004), 21/04/21 (LD/22 – INQ000561715; LD/17 - INQ000533221), 11/08/21 (LD/23 – INQ000561717) and the work was later published as two peer-reviewed publications (LD/02 - INQ000533213; LD/03 - INQ000533204).

25. In addition, I contributed to a variety of work regarding variants of concern. These used data from the TTI system, and at times suggested reactions TTI might take in terms of where to prioritise testing or sequencing. There were two main sources of data for this. Firstly, fully sequenced samples, which were then categorised into different variants of concern.

26. Sequencing incurs a significant delay, however, and a second source of more timely information arose from the choice of PCR test used in the lighthouse laboratories. The TaqPath assay targets a part of the viral RNA sequence (in the "S gene") that mutated in the Alpha variant of concern, resulting in tests that were covid positive overall, but were S gene negative. In subsequent variants, the S gene positivity flipped between variants: Alpha was S gene negative; Delta was S gene positive; Omicron BA.1 was S gene negative; Omicron BA.2 was S gene positive; Omicron BA.5 was S gene negative. This provided a useful way to track the shifts between variants, as it was possible to infer the variant from the original PCR test without waiting for full sequencing.

27. I led or contributed to a variety of work, often using the "S gene" data, relating to variants of concern:

    a. On Alpha, comparing the proportion of cases by geography and age (sent to SAGE 74, LD/24 – INQ000534794; LD/25 – INQ000534790).
    b. On Beta or Delta, developing a modelling framework for variants (SPI-M-O 23/03/21, later published as LD/08 – INQ000534782); proposing variant

scenarios for roadmap modelling (LD/26 – INQ000535019); analysing community transmission of Delta (sent to SAGE 89 (LD/27 – INQ000535018)).

c. On Omicron, modelling and data analysis sent to SPI-M-O and SAGE (LD/28 – INQ000534789; LD/29 - INQ000534791; LD/30 – INQ000534796); sent to SAGE 99 (LD/31 – INQ000534793); sent to SAGE 101 (LD/32 - INQ000217252; LD/33 - INQ000534787); and sent to SAGE 102 (LD/34 – INQ000217238; LD/35 – INQ000534795; LD/36 – INQ000534792).

28. I also contributed to work that looked more directly at TTI. Firstly, research into how to spatially target testing (two papers to SPI-M-O 12/10/20 (LD/37 – INQ000534798; LD/38 – INQ000534797)). Secondly, in response to the possibility of "moonshot" testing, where the entire population might be asked to take a test at the same time. The paper (SPI-M-O 25/11/20 (LD/39 – INQ000534799)) considers what happens when doing this multiple times, particularly if there are people who have more contacts (e.g. critical workers), and particularly if the same people are more likely to come forward each round. This was then part of a SPI-M-O note presented to SAGE 70 (LD/40 – INQ000074983).

29. Finally, an investigation into the Immensa lab incident, where one of the labs providing testing results for community PCR tests incorrectly returned some negative PCR tests that should have been positive. In response to this we investigated the spatial and age distribution of problematic tests and undertook some preliminary analysis estimating the effect of the problematic tests on the epidemic (SPI-M-O 03/11/21 (LD/41 – INQ000534800)).

30. I have contributed to the following Plus magazine articles relating to testing:

a. Testing testing in schools (LD/42 – INQ000534777),
b. COVID-19 and universities: What do we know? (LD/43 – INQ000534779).

31. Plus, the following Science Media Centre "expert reactions" and press briefings relating to TTI:

a. expert reaction to publication of SAGE minutes (29 May 2020) (LD/44 – INQ000534776),
b. expert reaction to preprint using a simulation to look at potential outcomes of regular entire-school lateral flow testing (8 March 2021) (LD/45 – INQ000534778).

Lessons Learned

32. The requirements for TTI at the beginning of a pandemic may be quite different from later on. The early testing during a new or emerging infectious disease contributes to a dataset called “the first few hundred” (sometimes abbreviated to FF100 or FFX), which is designed to collect detailed clinical information. This is used for many purposes, including estimating important quantities related to the severity and infectiousness of the disease. The FF100 is affected by who gets tested, and where to use limited tests is an important question at this stage. For covid there was a long period where only individuals that had travelled from a country deemed to be at risk (i.e. China, to begin with, and including Italy later on) would receive a test. This had implications for those trying to understand how quickly the epidemic was growing in the UK, because the majority of confirmed cases had been infected outside the country and thus primarily reflected international growth.

33. There were two main classes of tests used in TTI: PCR tests (very sensitive – i.e. a swab with virus on it is very likely to come back positive, but quite slow – it takes a few days to get a result) and LFTs (less sensitive – i.e. the same swab could be positive with a PCR test and negative on a LFT, but much faster, ~30mins result, and can be self-administered at home). The likelihood of a positive LFT is related to viral load and so, we believe, to your infectiousness. LFTs are less expensive than PCRs but increase uncertainty in the data, as they rely on people reporting the result of their test and people are more likely to report positive tests than negative tests. In addition, using LFTs requires a degree of trust that the reported result is correct. Arguably, however, the UK could have relied more heavily on LFTs in the later parts of the pandemic, and correspondingly reduced the number of available PCR tests and thus the cost of TTI.

34. The differences between PCR and LFT testing, and between symptomatic and asymptomatic testing were the source of much debate, often causing general confusion. Early worries regarding the sensitivity of the LFTs gave way to concerns regarding specificity and positive predictive value (i.e. if a person has a positive LFT test what's the probability they have covid). These were conflated with worries regarding repeated asymptomatic testing and concerns that this could lead to uninfected people being required or advised to isolate. In many ways these arguments came down to what counterfactual was being considered (i.e. what would you do if you didn't take a test), but the subtleties were generally lost to the public, many of whom simply concluded the tests were "inaccurate". It is important that benefits and concerns are communicated to the public in a clear and balanced way to avoid inadvertently harming public health efforts.

35. The problems with sending potentially infectious patients from hospitals to care homes housing vulnerable populations without administering covid tests has been extensively discussed, and was of course greatly exacerbated by the shortages of PPE for care home staff. I only wish to note here that at the outset of the pandemic, this would have need to be PCR testing (since LFTs were not yet available), which can be positive for a long time after it is likely infectiousness has abated. A strategy that prohibited PCR-positive patients moving from hospitals to care homes, therefore, would require keeping potentially large numbers of patients in hospital for extensive periods of time.

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: 23/05/2025