Microbiology Society written evidence to the House of Commons Science and Technology Committee inquiry on emerging diseases and learnings from COVID-19

Introduction

The Microbiology Society is a membership charity for scientists interested in microbes, their effects and their practical uses. It has a worldwide membership based in universities, industry, hospitals, research institutes and schools. Microbiology is the study of all living organisms that are too small to be visible with the naked eye.

Our principal goal is to develop, expand and strengthen the networks available to our members so that the science of microbiology provides maximum benefit to society.

Microbiology encompasses the study of life forms that cause infectious diseases such as COVID-19, which is caused by the virus SARS-CoV-2. Our members directly contributed to the national response to COVID-19 and possess a wealth of expertise in the area.

Throughout the pandemic, particularly the crucial early stages, the Microbiology Society provided positive and constructive assistance regardless of our views of the merits or otherwise of official policies. It was always our aim to facilitate the use of our members' expertise in supporting the national response to the pandemic. As early as 20 March 2020, at the request of staff seconded to the Office for Life Sciences and at extremely short notice, we identified and secured experts in virology and epidemiology to advise the Deputy Chief Medical Officer. In consultation with the Office for Life Sciences, we identified the researchers who initially staffed the first Lighthouse Laboratory in Milton Keynes. Through a general call to our membership, we sourced many more scientists, who were largely working on a voluntary basis, as the Lighthouse Laboratories ramped up capacity. In June 2020, the Microbiology Society held the only (virtual) scientific conference on the SARS-CoV-2 virus in Europe. Since the virus was new to science, all researchers were working with an unknown entity, and the conference allowed significant sharing of crucial information and resources. In October 2020, again on behalf of the Office for Life Sciences, we convened a group of experts from universities in the English Midlands (Birmingham, Warwick, Nottingham, Aston and elsewhere) to advise on the establishment of what became the Rosalind Franklin testing laboratory in Leamington Spa. Over the course of the pandemic, we published a range of important peer-reviewed research about SARS-CoV-2 and COVID-19, from fundamental basic biology of the virus through to practical assessments of the efficacy of testing techniques and kits. The Society also worked directly with journalists, media professionals and the Science Media Centre throughout the pandemic to provide expert commentary and advice across the print, broadcast and online media from major national outlets to a wide range of local and specialist publications.

Our submission reflects the detailed views expressed by ten members of the Microbiology Society who responded to our call for input. We present evidence provided by respondents and provide recommendations where appropriate.

Our response focusses on **pandemic preparedness**, **testing capacity and approach**, and **emerging diseases**. It is grouped into six themes:

- Strengthening investment
- Planning and practicing
- Expertise
- Building and expanding networks
- Prevention and early detection
- Emerging diseases

Pandemic preparedness

Strengthening investment

1. *Invest in the UK Health Security Agency (UKHSA)*

   Public Health England (PHE) was tasked with the immense challenge of coordinating the national pandemic response. However, chronic underfunding for years prior to the pandemic significantly reduced capacity and stretched resources[1], meaning that it was not in a position to immediately deliver. This is a major reason that the impact of COVID-19 in the early months of the pandemic was severe in the UK. PHE has now been officially dissolved and replaced by the UK Health Security Agency (UKHSA). According to the National Audit Office, the Department of Health and Social Care (DHSC) has not sufficiently supported UKHSA to resolve issues inherited from PHE[2]. The UKHSA will not be adequately equipped to coordinate a pandemic response unless investment is strengthened and sustained.

2. *Invest in expertise*

   When the SARS-CoV-2 pandemic began, the UK had a strong science base on which to draw, including in microbiology, immunology and other areas. However, this was based on historic investment and it is unclear that the same strengths could be relied on in the future. For example, the House of Commons Public Accounts Committee concluded in October 2022 that the government's main facility for research on potential zoonotic diseases, the Animal and Plant Health Agency (APHA) in Surrey "has been left to deteriorate to an alarming extent"[3]. While the expertise was there, long-term sustained funding schemes for microbiology research on diseases with pandemic potential were lacking. Funding instead

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[1] Public health funding in England: death by a thousand cuts (2021). *The lancet. Gastroenterology & hepatology*, *6*(12), p.971.

[2] *Department of Health and Social Care annual report and accounts 2021-2022,* National Audit Office. Available at: https://www.nao.org.uk/reports/dhsc-annual-report-and-accounts-2021-22/ (Accessed: March 10, 2023)

[3] *Redevelopment of Defra's Animal Health infrastructure*, Twenty-fourth Report of Session 2022-23, House of Commons Committee of Public Accounts. Available at: https://committees.parliament.uk/publications/31598/documents/177448/default/ (Accessed: March 10, 2023)

came in waves as infections with pandemic potential emerged and was not consistently deemed a national priority. Continuity of expertise is crucial and, while this does not necessarily require expensive diagnostics labs to be kept on standby, it does require consistent investment in people, particularly within the academic community that are cost-effective and generous with their time, to assess our state of readiness and pre-empt issues before they arise.

3. *Invest in research centres*

   There is underinvestment in both Public Sector Research Establishments (such as the aforementioned APHA) and UKRI funded research centres. This is largely due to investment being responsive rather than proactive. If proactive investment is not strengthened, the UK will not be equipped to tackle the next public health emergency. Strengthening investment is crucial in order to bring the UK up to the standard of other G7 countries[4].

Planning and practicing

4. *Lack of preparation*

   The UK government was not prepared at a scientific level when the COVID-19 pandemic hit. A UK Influenza Pandemic Preparedness Strategy[5] did exist prior to COVID-19, but it was reported to us by multiple Microbiology Society members that it only ever got a cursory consult and did not get fully utilised. Witnessing events in early 2020 in Italy and Spain, one could perhaps predict what would happen in the UK. The UK preparation for a national pandemic response was dominated by models based on influenza drawn up nine years prior to the emergence of SARS-CoV-2. COVID-19 is vastly different to influenza. We recommend that future preparations consider the breadth of diseases that have pandemic potential, rather than a singular disease.

   Unfortunately, the UK remains poorly prepared for an emerging disease outbreak. Surveillance across the country is fragmented, and hot spots based on dissemination data of SARS-CoV-2 are not considered for continued surveillance. The state of the health sector is currently worse than it was pre-COVID-19. The UK is currently facing the global pandemic of antibiotic resistant infections, and there are not significant efforts to tackle it despite the burden in the NHS, and the mortality and morbidity impact on the UK population.

   It should be noted that the clinical academic research sector *was* indeed prepared for this type of event as exemplified by the speed and efficiency with which experts, many of whom

[4] Anderson, M., Pitchforth, E., Asaria, M., Brayne, C., Casadei, B., Charlesworth, A., Coulter, A., Franklin, B.D., Donaldson, C., Drummond, M. and Dunnell, K., 2021. LSE–Lancet Commission on the future of the NHS: re-laying the foundations for an equitable and efficient health and care service after COVID-19. *The Lancet*, *397*(10288), pp.1915-1978.

[5]Department of Health and Social Care (2011) *UK influenza pandemic preparedness strategy*, *GOV.UK*. GOV.UK. Available at: https://www.gov.uk/government/publications/review-of-the-evidence-base-underpinning-the-uk-influenza-pandemic-preparedness-strategy (Accessed: February 13, 2023)

are members of the Microbiology Society, were able to set up nationwide clinical trials assessing treatments and developing vaccines.

5. *The South Korea model*

   The UK should look to South Korea for examples of effective pandemic preparedness measures. Following the outbreak of Middle East Respiratory Syndrome (MERS) in 2015, the country made dramatic reforms, for instance through increasing the number of infection control staff, expanding outbreak simulations and PPE training, and encouraging collaboration between medical centres and local governments. The South Korean government has since made sustained investments in public health capacity and in 2018 designated 185 hospitals as specialised regional infectious disease hospitals. These measures proved worthwhile and were effective in flattening the epidemic curve during the early months of the COVID-19 pandemic[6].

6. *Formal planning and practising*

   To better prepare for future pandemics, the government could introduce formal, regular planning and practicing procedures. For example, the Robert Koch Institute (RKI) in Germany has established a system of 20 National Reference Centres and 38 Consultant Laboratories across the country, to "play a central role in detecting infectious diseases, monitoring outbreak response and providing scientific evidence to prevent and control diseases." Of these 58, only a minority (15) are part of the RKI itself, with the majority being based in universities, federal or state institutes, private sector laboratories and other research facilities. The laboratories that form part of this network are certified by the RKI for a fixed timescale, after which they are retested to ensure quality control and consistency. There are regular ring fenced External Quality Assessments (EQA) on diagnostics. This enables laboratories across Germany to be accredited as equipped to deal with certain crises. In the UK, coordinated exercises such as this are already undertaken in veterinary labs to maintain competency and capability.

   While there have been government SAGE exercises in the UK, these have been mostly tabletop. Introducing thorough, consistent government exercises on elements of pandemic response is a way of monitoring and evaluating our preparedness. This needs to go hand in hand with sustained investment in public health and microbiology research. A small multidisciplinary panel with a broad representation of specialties across infection science and social science would be needed to annually assess the overall national state of readiness and identify gaps in our pandemic response strategy.

[6] Kang, J., Jang, Y.Y., Kim, J., Han, S.H., Lee, K.R., Kim, M. and Eom, J.S., 2020. South Korea's responses to stop the COVID-19 pandemic. *American Journal of Infection Control*, *48*(9), pp.1080-1086.

Testing capacity and approach

Expertise

7. *Utilising experts*

   In the early stages of the COVID-19 pandemic, the Microbiology Society contributed to the national response by identifying microbiologists with the laboratory capacity to support testing efforts. DHSC subsequently reported that there were many offers of scientific support. However, offers of help were often declined, more on the grounds that they were not wanted than because they were not needed. The scientific advice that was offered by experts was largely ignored. The Office for Life Sciences, PHE and NHS Test and Trace all rebuffed the genuine offers of our members' support. The justification appears to be a defeatist attitude that it would never have been possible to utilise this huge and enthusiastically willing resource[7]. In fact, with sufficient will, and if appropriate networks had been promoted by official efforts, the core scientific expertise and skills of the country could have made a far greater contribution.

   These decisions were largely in the hands of management consultants from Deloitte. The UK was paying the company large amounts of public money[8], despite their lack of virology knowledge or experience within an academic laboratory and without putting in place incentives to ensure that this knowledge and expertise was drawn upon. In future, the government should tap into the vast wealth of expertise within the UK microbiology research base, both in clinics and academia, to inform decisions related to testing, diagnostics and surveillance.

Building and expanding networks

8. *Regional teams*

   Assembling regional teams of experts in diagnostics, testing and surveillance that, if required, can be motivated and quickly mobilised would accelerate pandemic response time. For instance, in September 2020, the University of Birmingham was the first in the academic sector to successfully set up a COVID-19 testing laboratory after being requested to do so by DHSC. This involved collaboration with both the COG-UK consortia (see point 9) and PHE and is the only example of this level of connectivity being employed[9]. Continuation and expansion of networks such as this and sustaining connectivity between institutions is key. The Microbiology Society has access to a wealth of experts both nationally and

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[7] *Technical Report on the COVID-19 pandemic in the UK,* Department of Health and Social Care (2022), p.188ff.

[8] Waugh, P. (2021) *Test and trace paying nearly £1m a day to private consultants*, *HuffPost UK*. HuffPost UK. Available at: https://www.huffingtonpost.co.uk/entry/test-and-trace-900-deloittes-ps1000-a-day_uk_6005dc3dc5b6ffcab966c5c9 (Accessed: March 13, 2023).

[9] University of Birmingham (2023) *Government covid-19 testing lab to open at the University of Birmingham*, *University of Birmingham*. University of Birmingham. Available at: https://www.birmingham.ac.uk/news-archive/2020/government-covid-19-testing-lab-to-open-at-the-university-of-birmingham (Accessed: March 13, 2023).

internationally that would give up their time for initiatives such as this, and is well placed to harness expertise not just from our membership, but from the networks that our members have access to.

9. *COG-UK consortium*

   The national COVID-19 testing model was excellent and fit for purpose. The COVID-19 Genomics (COG) UK consortium[10] of Lighthouse Laboratories is an exemplary sequencing network that provides crucial epidemiological data. However, the funding to support these knowledge platforms is fragmented across the devolved nations. A more joined up funding approach is needed.

10. *Existing structures*

    There are thousands of working virology, microbiology and veterinary laboratories in the UK that were not utilised as effectively as they could have been during the pandemic. These labs have established processes from field sampling all the way through to sample submission, and standardised reporting lines to both national and international bodies (e.g., EU and WHO). These systems could have been exploited to avoid involvement of private subcontractors (who largely leveraged the work of postgraduates trained by academia) and bridge the gap between the first national lockdown and the establishment of the Lighthouse Lab Network. This capacity and expertise could be harnessed in future for the surveillance of emerging diseases.

11. *Overreliance on PHE*

    There was an enormous overreliance on and overconfidence in PHE as the organisation to coordinate the pandemic response (see point 1). The responsibility was placed solely on PHE, so much so that, in the early stages of the pandemic, PHE would not hand over SARS-CoV-2 testing protocols to clinical laboratories. This made it impossible for these laboratories to assist with pandemic response and testing efforts, despite PHE desperately needing the support. Sustained investment and delegation of testing efforts is needed if UKHSA are to respond to future crises.

12. *IT connectivity*

    In the early months of the pandemic there were significant delays when sharing data. While there are networks of NHS diagnostics labs with communication lines to clinicians, there were not clear routes for sharing data between the NHS and PHE. Processes were developed during the pandemic, but underfunding has ruptured these lines of communication. Establishing networks with processes whereby academic labs can be mobilised in tandem with diagnostic labs, as well as a system for sharing data across institutions, would accelerate pandemic response and facilitate better integration between virology research under the One Health umbrella. This could incorporate knowledge platforms that were developed

[10] *Covid-19 Genomics UK Consortium* (2022) *UK*. Available at: https://www.cogconsortium.uk/ (Accessed: February 13, 2023).

during COVID-19 and include basic researchers, epidemiologists, health economists and other specialists.

Emerging diseases

Prevention and detection

13. While investing in pandemic preparedness is crucial, it is equally important to improve our ability to prevent pandemics and detect the emergence of diseases with pandemic potential.

14. *Prevention*

    a) Continue and expand government initiatives to inform the public about the importance of masking and good hygiene.

    b) Allocate investment to metagenomic surveillance projects.

    c) Closely monitor changes in land use, for instance increased building in greenbelt areas, as this could bring humans in close contact with wildlife and increase the risk of zoonotic disease emergence.

    d) Strengthen investment in animal health and pathogen surveillance through long-term, sustained funding schemes.

15. *Detection measures*

    a) Genomic and metagenomic surveillance of specific pathogens can be used to monitor and track the emergence of new zoonotic diseases. This can be undertaken by health authorities and facilitated by research groups.

    b) Ensuring laboratories are sufficiently trained and equipped to perform molecular detection assays as well as genomic and metagenomic testing would increase surveillance capacity.

    c) Liaising with entomologists is key for monitoring arthropod vectors (e.g., mosquitos and ticks) that carry zoonoses which are likely to increase in incidence and spread further due to climate change.

Emerging infectious diseases

16. *Emerging diseases*

    Preparing for emerging zoonotic disease outbreaks is crucially important. However, we do not believe that the scope of this inquiry need be restricted to zoonotic threats. To tackle the complex global challenge of emerging infectious diseases it is crucial that we think beyond zoonoses.

17. *Climate change*

    It is important to consider that global processes such as climate change will introduce additional risks to the UK. For instance, higher temperatures lead to an increased range for diseases carried by arthropod vectors such as mosquitos and ticks. At the moment, severe infectious diseases are limited to tropical regions, but these geographical limitations will relax as global warming progresses.

18. *Antimicrobial Resistance (AMR)*

    Increasing levels of AMR will make conditions such as tuberculosis, HIV and malaria increasingly difficult to treat. The challenge is significant and will require multidisciplinary approaches across academia and policy. The Microbiology Society published a report on AMR policy in 2020[11].

19. *Global travel*

    All emerging diseases, both zoonotic and non-zoonotic, are associated with the ease and speed of global travel which is fundamental to the movement of infectious agents. We recommend that policymakers take this into consideration.

Emerging zoonotic diseases

20. Emerging zoonoses have major consequences for public health and economic productivity across the world. The Microbiology Society published a policy briefing outlining the threats associated with zoonoses, including coronaviruses, and methods to prepare for outbreaks in 2015[12].
21. Emerging zoonotic diseases of pandemic potential are likely to be respiratory or foodborne (such as the 2011 outbreak of *E.coli* in Germany[13]). Current emerging zoonotic diseases to monitor include, but are not necessarily limited to:
    a) Highly pathogenic avian influenza
    b) Circulating influenza viruses
    c) Ebola
    d) Coronaviruses
    e) Poxviruses (e.g., MPox, squirrel pox and myxomatosis)
    f) West Nile virus
    g) Crimean-Congo haemorrhagic fever virus

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[11]Microbiology Society. (2020) *A Sustainable Future: Antimicrobial Resistance Policy Report, Microbiology Society.* Available at: https://microbiologysociety.org/publication/policy-briefings/a-sustainable-future-antimicrobial-resistance-policy-report.html (Accessed: March 13, 2023).

[12]Microbiology Society. (2015) *Emerging Zoonotic Diseases*, *Microbiology Society*. Available at: https://microbiologysociety.org/publication/policy-briefings/emerging-zoonotic-diseases.html (Accessed: February 13, 2023).

[13]*EHEC O104:H4 Outbreak in Germany, 2011* (2012) *Robert Kock Institut*. Available at: https://www.rki.de/EN/Content/infections/epidemiology/outbreaks/EHEC_O104/ehec_O104_inhalt_en.html (Accessed: February 13, 2023).

Potential threats to public health worth consideration

22. Global warming will increase the spread of plant pathogens, which will increase instances of crop disease and have huge implications for food security[14].
23. Prion diseases such as Bovine Spongiform Encephalitis (BSE)[15] and Scrapie[16] are caused by unusual transmissible agents and lead to neurological dysfunction and death in animals. BSE is transmissible to humans, and is better known as mad cow disease. Prion diseases are poorly understood and should be monitored for zoonotic potential.

Final remarks

24. The Microbiology Society welcomes this call for evidence and supports the government in its aim to gather evidence on emerging diseases. We reiterate that while the threat of zoonoses is significant, the complex challenge of disease surveillance and containment requires a holistic approach that considers the broader spectrum of potential threats, for instance of antimicrobial resistant infections[17], enteroviruses such as polio[18], and bacterial infections like tuberculosis[19], all of which are not zoonotic.
25. Crucially, strengthened and sustained investment in UKHSA, in microbiology research to build on our strong foundation of expertise, and in networks of laboratories that can be quickly mobilised in crisis scenarios, is desperately needed to equip the UK with the resources and capabilities needed to respond better to future pandemics.

[14] Chaloner, T.M., Gurr, S.J. and Bebber, D.P., 2021. Plant pathogen infection risk tracks global crop yields under climate change. *Nature Climate Change*, *11*(8), pp.710-715.

[15] *Bovine spongiform encephalopathy (BSE)* (2021) *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention. Available at: https://www.cdc.gov/prions/bse/index.html (Accessed: February 13, 2023).

[16] Prusiner, S.B., 1989. Creutzfeldt-Jakob disease and scrapie prions. *Alzheimer Disease & Associated Disorders*, *3*(1), pp.52-78

[17] Microbiology Society. (2020) *Antimicrobial resistance explainer, Microbiology Society*. Available at: https://microbiologysociety.org/publication/policy-briefings/antimicrobial-resistance-explainer.html (Accessed: February 13, 2023).

[18] Microbiology Society. (2013) *Polio, Microbiology Society*. Available at: https://microbiologysociety.org/publication/briefing/polio.html (Accessed: February 13, 2023).

[19] Microbiology Society. (2012) *Tuberculosis, Microbiology Society*. Available at: https://microbiologysociety.org/publication/policy-briefings/tuberculosis.html (Accessed: February 13, 2023).