Written Evidence Submitted by the Science Policy Research Unit, University of Sussex Business School
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Recommendations Summary:

A. *Models are a great way to explore questions. They are also a dangerous way to assert answers. Models' assumptions and limitations must be appraised openly and honestly.*

B. *Channels of communication for procurement in health and social care in England and Wales need to be improved to facilitate procurement of innovative products and services and/or surges in demand during times of crisis.*

C. *Continued dialogue with China (and engagement with the WHO and ICH) must be sustained as part of the UK's ongoing Covid-19 response and for our preparedness for future pandemics, without conflicting with the UK's core values. The UK Science and Innovation Network and UKRI China Office in Beijing are well-placed to support this work.*

D. *Diversity of diagnostic testing approaches is an important supporting factor for diagnostic innovation. As such, NHS pathology laboratories are a valuable source of expertise and innovation in the face of emerging pathogens.*

E. *Learning should be during and after the crisis, and processes of learning should be participatory, evidenced, and disseminated.*

F. *The UK Government and devolved administrations should maintain and build in-house capabilities for data sharing and scientific evidence communication in order to foster effective inter-governmental engagement.*

G. *The 'FiTTISE' systems established to manage Covid-19, and associated infrastructure, should be subject to open evaluation of its performance to allow learning nationally and internationally, with proven elements of the system integrated and maintained for future use within the NHS.*

Introduction

The Science Policy Research Unit has over 50 years experience in studying the UK research system and policy. We present evidence from multiple authors and research projects. Our evidence is submitted to advise the inquiry on how previous and ongoing research into science and technology studies can inform global pandemic response.

We also present findings from an ongoing UKRI-funded project comparing Covid-19 testing systems from around the world (Grant reference: ES/V004441/1). These findings illustrate lessons learned from different countries.

The overall evidence submission has been drawn together by its primary author, Dr. Joshua R. Moon, Research Fellow, SPRU

Evidence

1. The contribution of research and development in understanding, modelling and predicting the nature and spread of the virus;

Whilst both public and private research and development will be fundamental to understanding and controlling the virus, a word of caution with regards to modelling. With the pandemic, computer modelling has come into the limelight. Yet there is no substantial aspect of this pandemic for which any researcher can currently provide precise, reliable numbers. Known unknowns include the prevalence and fatality and reproduction rates of the virus in populations. We know even less about the seasonality of infections and how immunity works, not to mention the impact of social-distancing interventions in diverse, complex societies. Without reliable numbers for these characteristics, models are based upon assumptions and best guesses which, while informed by various pieces of evidence, limits the reliability of the conclusions.

Models can serve society well. However, to ensure that global uncertainty and sensitivity are reflected in the models, modellers and those who use them must allow all that is uncertain — variables, mathematical relationships and boundary conditions — to vary simultaneously as runs of the model produce its range of predictions. This often reveals that the uncertainty in predictions is substantially larger than originally asserted.

Model complexity can also be an issue. As modellers incorporate more phenomena into a model, its predictions might improve, but at a cost: quality control becomes more difficult. As more parameters are added, the uncertainty builds up, the error increases to the point at which predictions become useless.

No single model can serve all purposes. Modellers know that the results from models will at least partly reflect the interests, disciplinary orientations, and biases of the developers and can influence the outcome of the analysis. The technique is never neutral. The best way to keep models from hiding their assumptions, including political leanings, is a set of social norms.

International guidelines for this have been drawn up for several disciplines. They demand that processes involve stakeholders, accommodate multiple views and promote transparency, replication and analysis of sensitivity and uncertainty. Whenever a model is used for a new application with fresh stakeholders, it must be validated and verified anew.

A - Models are a great way to explore questions. They are also a dangerous way to assert answers. Models' assumptions and limitations must be appraised openly and honestly.[1]

2. The capacity and capability of the UK research base in providing a response to the outbreak, in terms of: b; the development of testing, diagnostic methods and technologies;

The capacity and capability of the UK's industrial and public sector research base was under-exploited in the early stages of the crisis, with reports that capabilities in universities, hospitals and industry were overlooked. This was particularly evident in regard to resources to support diagnostic testing, where weak communication between demand, as articulated by the UK Government, and supply was apparent. Industry was not clear on the needs of the healthcare sector, while the Department of Health and Social Care and its agencies were not able to process the numerous offers made to supply products and services, including offers from industry and research labs. The overlooked resources may have been useful in the early stages of the pandemic when scale up of testing systems was most urgently needed.

Industry trade associations from the life sciences sector were able to step in, providing a vital capacity to 'triage' offers of products and services on behalf of the state. It therefore seems that an improved capacity for articulating demand to industry, and channels to allow more sophisticated discussions with suppliers are needed within the state to enable clearer articulation of demand and communication with suppliers, in times of crisis.

B - Channels of communication for procurement in health and social care in England and Wales need to be improved to facilitate procurement of innovative products and services and/or surges in demand during times of crisis.

3. The flexibility and agility of institutions and processes to respond on the above during a crisis including:

b. the optimal functioning of regulatory and ethical processes;

Against a troubled historical background in regulatory harmonisation[2], the pandemic raises acute challenges for coordination of regulatory processes for novel vaccines and therapeutic treatments. The World Health Organisation (WHO) and The International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH) remain the foremost organisational mechanisms for enabling such coordination. The UK should continue to make a vital contribution through sustained membership and continued engagement and support for these fora.

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[1] Saltelli et al, *Nature* https://www.nature.com/articles/d41586-020-01812-9

[2] https://books.google.co.uk/books/about/Regulating_Technology.html?id=Wa4uAgAAQBAJ

The pace of innovation in response to Covid-19 has come alongside fast-tracking of conventional regulatory processes (e.g. China's "military specifically-needed drugs" procedure to enable testing a PLA-CanSino vaccine on its military personnel, and the Chinese government allowing Sinopharm and Sinovac to combine Phase 1 and Phase 2 clinical trials[3].) These are understandable developments, given the urgency of the need for a response and the different ethical norms informing the approach that China and other countries apply in regulating emerging biotechnologies.[4]

China has been making increasing contributions to the global health sphere[5] and the UK has - through DfID - been a partner in these efforts[6]. Ongoing UK-China research collaborations (e.g. supported by the Newton Fund[7]) are sustaining the networks that extend these partnerships upstream, however the ethical and regulatory aspects of biomedical partnerships with China have been under-emphasised. These will be vital if both countries are to benefit from each others' capabilities in combating the virus, and will have implications for the wider world.

The notion of "optimal functioning of regulatory and ethical processes" sought by this inquiry needs to go beyond conventional ethics and safety to recognise that different cultural, socio-political and institutional contexts mean that what is "optimal" will diverge across jurisdictions. Open, transparent and accountable systems will be "optimal" not only in terms of delivering safe and effective vaccines and medical therapies, but also in maintaining public trust in these products more generally.

C - Continued dialogue with China (and engagement with the WHO and ICH) must be sustained as part of the UK's ongoing Covid-19 response and for our preparedness for future pandemics, without conflicting with the UK's core values. The UK Science and Innovation Network and UKRI China Office in Beijing are well-placed to support this work.

4. The capacity to manufacture and distribute testing, diagnostics, therapeutics and vaccines: both standing capacity and capacity able to be mobilised;

Diagnostic test innovation, i.e. the development of entirely novel diagnostic tests or incremental improvement of diagnostic tests, may originate in universities, hospitals or industry. Indeed, the relatively low regulatory requirements placed on hospital-developed tests allow NHS pathology labs to innovate relatively swiftly, particularly when drawing on local research.[8] For example, hospital pathology laboratories can 'tinker' with tests, finding the most effective combination of

[3] https://www.reuters.com/article/us-health-coronavirus-china-vaccine-anal/at-war-time-speed-china-leads-covid-19-vaccine-race-idUSKBN2481NO
[4] http://dx.doi.org/10.1016/j.socscimed.2016.01.047
[5] https://globalizationandhealth.biomedcentral.com/articles/10.1186/s12992-020-00569-0
[6] https://ghrp.biomedcentral.com/articles/10.1186/s41256-020-00156-1
[7] http://www.sussex.ac.uk/spru/research/projects/chnuk
[8] Hopkins, Michael M and Nightingale, Paul (2006) *Strategic risk-management using complementary assets: organizational capabilities and the commercialization of human genetic testing in the UK.* Research Policy, 35 (3). pp. 355-374.

commercial products for a particular application, or even may develop new tests from scratch. It should therefore not be assumed that diagnostic innovation only occurs in industry, nor that an industry-developed test is necessarily the optimal basis for service provision.

The capability and capacity of well-trained pathology staff working in networks of collaborating laboratories can provide a fertile environment for the development of a diversity of approaches to testing, leading to a considerable capacity for innovation. In particular, this allows for parallel approaches to be tried in different labs. The routine sharing of test protocols, tissue samples and expertise through a professional community of practice allows for learning and improvements across the network as a whole. Monopoly provision of tests for a novel disease, i.e. a single type of service offered by a single organisation, whether commercial or in the public sector, or a narrowing of the number of labs offering a test for a novel emerging disease may be associated with the unwitting selection of a suboptimal test.

There is a longstanding debate around the "cottage industry" of pathology laboratories in the UK, with some suggesting that fewer, larger labs could provide a superior centralised service, while others suggest more numerous, local laboratories are more creative and responsive.[9] While accepting that centralisation may be associated with consistency and standardisation in diagnostic service provision, it may not be desirable to seek such standardisation at the point when tests for an emerging disease are first emerging. At such a time, there is a case for ensuring diversity of testing approaches and encouraging comparative studies of these, when undertaken in a transparent manner. Moreover, centralisation of testing in laboratories that are not embedded in well-established networks of collaborative labs, as has been the case with the Lighthouse Laboratories, risks inhibiting learning and innovation, and allows poor practice to continue unchallenged.

D – Diversity of diagnostic testing approaches is an important for supporting factor for diagnostic innovation. As such, NHS pathology laboratories are valuable source of expertise and innovation in the face of emerging pathogens.

5. The capturing during the crisis of data of the quantity and quality needed to inform:
b. And to maximise the learning afterwards

First, learning need not take place afterward because there are opportunities for learning during the pandemic. This requires a system which collects data and acts upon lessons learned in a timely manner. This requires the ability to accept that mistakes made come with a cost, and that those mistakes should not be repeated. Importantly, the apportionment of blame is not productive for learning from crisis as it causes individuals to be defensive rather than constructive in their learning.[10] Accountability is still possible without blame, but requires a recognition that learning is primarily about the future, not the past, and that there must be a focus on the taking what lessons can be learned forward.[11]

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[9] This debate is illustrated by different views provided in oral evidence to the HoC health and Social Care committee on July 6th. https://committees.parliament.uk/oralevidence/747/pdf/
[10] https://onlinelibrary.wiley.com/doi/10.1111/j.1468-5973.2009.00590.x

On learning post-crisis, public inquiries will play an important social role. A public inquiry will offer the public an opportunity to collectively process what happened and to learn lessons.[12] In order to do so, the inquiry should be participatory, evidenced, and disseminated. By maintaining an open, transparent, and inclusive process for the inquiry, the public can be assured of the veracity of the scrutiny and that the lessons can be implemented more easily.[13]

From evidence of lessons learned reporting during the Ebola outbreak in west Africa, a series of connections need to be made between the levels of policy and operational actors.[14] These two levels of epidemic response influence and are dependent upon one another.[15] However, lessons often deal with these two groups separately, not identifying lessons required for both to be more interactive – to help operations influence policy and for policy to better contextualise operational actions.[16]

This returns to the need for processes to be participatory, evidenced, and disseminated.[17] By making the process participatory, engaging front line workers and community leaders in the assessment, the operational and front-line of the response can inform policymaking. Through an expansive and open evidence base, the learning process can draw from multiple stakeholders and expertise to avoid becoming myopic. Finally, reports are not the end of the process; the delivery of an inquiry report must be followed by continued engagement by its leaders in the organisational, policy, and institutional change that follows to champion the lessons.

E - Learning should be during and after the crisis, and processes of learning should be participatory, evidenced, and disseminated.

6. The mechanisms for communication of scientific evidence internationally, within national governments and with the public, including the handling of conflicting scientific opinions;

The World Health Organisation remains the most well-positioned organisation for facilitating the exchange of medical and public health advice, however the scientific evidence of relevance to the Covid-19 response goes well beyond these areas and requires inputs from the full range of natural and social sciences.

Multi- and interdisciplinary scientific advice, when applied to different contextual settings, can be expected to yield very different policy advice to that of simply medicine and/or public health.[18]

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[11] Darling, M., Parry, C. and Moore, J. (2005) 'Learning in the thick of it', Harvard Business Review, 83(7/8), pp. 84–92.
[12] https://journals.sagepub.com/doi/pdf/10.1177/108602669000400102
[13] http://sro.sussex.ac.uk/id/eprint/84839/
[14] Ibid.
[15] https://www.tandfonline.com/doi/full/10.1080/14747731.2017.1414410
[16] Lakoff, A. (2008) 'The Generic Threat, or how we became unprepared', *Cultural Anthropology*, 23(3), pp. 399–428. doi: 10.1525/can.2008.23.3.399.C.
[17] http://sro.sussex.ac.uk/id/eprint/84839/
[18] https://steps-centre.org/blog/annual-symposium-2013/

This should be published openly, with underlying evidence, in order to enable extended peer review and mutual learning. This not only aids accountability nationally, but allows the UK to communicate with other nations about the evidence and measures being taken globally. The eradication of Covid-19 requires *all* countries to eliminate its spread. Cooperation and collaboration will be essential in doing so.

Even if faced with similar advice, policy makers (risk managers/ politicians) can be expected to diverge on their decisions due to different contextual factors and normative values. It is important that this is not necessarily conflated with conflicting scientific opinions (despite claims to being 'led by the science'), but linked to differing political judgement in the face of scientific *and* non-scientific inputs. It is also important that this not be understood as fundamentally different from conflicting scientific opinions, as those too can diverge based upon both scientific and non-scientific factors. Again, open publication of decisions, and their evidentiary and advisory basis, will assist in disentangling these and enable policy learning, especially over the long-term.

Aside from the WHO, other networks with whom the UK should be working to support the open exchange of evidence and policy learning include:

- UN bodies with an interest in science, technology and innovation, many of which have contributed to information sharing during the pandemic response e.g. the UN's Coronavirus information system[19], the High Level Political Forum[20]
- International Network of Government Science Advisors (INGSA), including through their policy-making tracker[21]
- The International Science Council - global Covid-19 Science portal[22]

Colleagues at SPRU are working with international partners to explore the differences in testing responses across the international community, understanding the contextual factors that shape the collection and interpretation of evidence.[23] Given these different contexts, there are significant risks associated with making naive comparisons of system-diagnostic analyses between countries and even more risk associated with translation of policy prescriptions. Divergences in socio-technical contexts for data generation are likely to intensify as infrastructures for contact tracing become more embedded in the fabric of different national societies.

Open sharing of evidence and data is likely to be curtailed by the reliance that the UK government has adopted to date on private sector contractors, unless open data protocols are embedded into contracts.

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[19] https://www.un.org/en/coronavirus/information-un-system
[20] https://forms.office.com/Pages/ResponsePage.aspx?id=2zWeD09UYE-9zF6kFubccHWEQWAIJnFBui91aqg4xodUMkswSFRBNTNJNURZR09ZUzBFWkk3ODI3Uy4u
[21] https://council.science/current/news/ingsa-launches-policy-making-tracker-and-calls-for-global-volunteers/
[22] https://council.science/covid19/
[23] http://www.sussex.ac.uk/spru/research/projects/diagnostic-testing

F - The UK Government and devolved administrations should maintain and build in-house capabilities for data sharing and scientific evidence communication in order to foster effective inter-governmental engagement.

7. The UK's readiness for future outbreaks, including a consideration of:
    a. the National Risk Register;
    b. the UK Pandemic Influenza Strategy; and
    c. PHE's Global Health and Infectious Diseases Strategy.

Many of the above cited documents focus on pandemic influenza - understandable for a Pandemic Influenza Strategy, but less so for the National Risk Register and PHE's generic infectious diseases documents. The National Risk Register places pandemic influenza as one of its highest risks faced by the UK. The prominent focus on pandemic influenza planning clearly influences assumptions made by the UK SAGE early in the Covid-19 outbreak, while planning for more dangerous, novel pathogens such as SARS, MERS and Covid-19 seems lacking. This represents a significant gap in terms of the UK's readiness for future outbreaks.

The adaptability of a response built on influenza assumptions to a non-influenza scenario is limited. Importantly, unstated framing assumptions can create suboptimal responses when they constrain policy choices. For example, the assumption that Covid-19 will be similar to influenza led to a number of assumptions that informed the early response, and led the UK government to conclude that 'flattening the curve' was a more appropriate response than aiming for viral elimination.

The recently established Covid-19 rapid Knowledge Exchange Hub on diagnostic testing systems,[24] led by the University of Sussex Business School and funded by the ESRC-UKRI Covid-19 programme, is working to develop an understanding of international best practice in managing future outbreaks. Building on a framework set out by Independent SAGE[25] we are undertaking an international comparison of systems associated with Finding cases, Testing individuals, Tracing their contacts, Isolating those at risk of spreading disease, Supporting them while isolating, and Evaluation of the overall system performance (i.e. 'FiTTISE systems'). FiTTISE systems are being developed across countries to manage Covid-19. The associated infrastructure for these needs to be maintained for future outbreaks of Covid-19 and other pandemics, In order to make effective use of parts of the system in between pandemics, such as testing capacity, this infrastructure should be integrated into healthcare systems, rather than sitting outside them (as was the case when NHS Test and Trace was established). Evaluation of the performance of the FiTTISE systems in real time, nationally and internationally should be encouraged to promote learning.

G - The 'FiTTISE' systems established to manage Covid-19, and associated infrastructure, should be subject to open evaluation of its performance to allow learning nationally and

[24] http://www.sussex.ac.uk/spru/research/projects/diagnostic-testing
[25] https://www.independentsage.org/wp-content/uploads/2020/06/IndependentSAGE-report-4.pdf

internationally, with proven elements of the system integrated and maintained for future use within the NHS.

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