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UK SCIENCE, RESEARCH AND TECHNOLOGY CAPABILITY AND INFLUENCE IN GLOBAL DISEASE OUTBREAKS:

A RESPONSE TO THE HOUSE OF COMMONS SCIENCE AND TECHNOLOGY COMMITTEE

Summary

The Covid-19 pandemic was a predictable event, even if the timing and exact nature of the event could not be foreseen. The World Health Organisation (WHO) had identified novel coronaviruses specifically as a threat.

This raises important and wide-ranging questions for the UK Government about the identification, assessment, management of, and preparedness for, risk. While the UK's National Risk Register (NRR) acknowledges the risk of new and emerging infectious diseases occurring, it does not explicitly identify the potential threat of coronaviruses. The Science and Technology Committee should consider recommending whether the NRR should categorise more specifically emerging infectious diseases.

There has been a clear lack of testing infrastructure in the UK to deal with this pandemic, with testing having been limited due to the shortage of testing capacity. This has had adverse consequences for the ability to track and trace the spread of the virus. The decision was taken on 12th March to cease testing in the community and focus on testing principally within hospitals due to testing capacity constraints. This was a crucial decision-making moment and raises significant questions around the UK Government's strategy for mitigating the spread of the virus and the timing of the decision to implement lockdown measures.

The response to the pandemic demonstrates the importance of taking steps to build-up the UK's national resilience. Any assumption that testing capacity which is not formally retained can be scaled-up during emergencies needs to be challenged robustly on the basis of the current experience. It is crucial, therefore, that the increase in UK testing capacity that has been developed over the course of the pandemic is maintained, not least given the scientific expectation that cases will increase in the winter, and that we will need to be prepared to live with the virus for the foreseeable future.

The availability of data is crucial to gaining a fuller understanding of the nature and spread of the virus and, in turn, to informing and supporting the decision making process. However, data collection and management appears to have been a particular weakness. National pandemic management needs strong central control supported by robust, well-designed data collection flowing into real-time analysis. Having such a system in place, including continuous background surveillance to allow much earlier disease detection, should be a post Covid-19 national priority.

Summary

While governments have claimed that they are "following the science" or being "led by the evidence", the role of the scientific community is to develop and present the evidence for different options; it is the role of government to determine policy. Governments will undoubtedly have to take account of other social, ethical, legal, economic and political considerations, in addition to science. While government should make clear when it is departing from the scientific advice received, it is important to recognise that there will not always be a clear scientific consensus, especially when addressing the novel and fluid situation in which we find ourselves.

The Scientific Advisory Group for Emergencies (SAGE) and its subgroups should contain those with direct experience of how the pandemic has unfolded on the ground, which would include those directly involved in public health, clinical and care service provision. As well as directing advice towards questions posed by government, SAGE and its subgroups should be able to raise issues and questions contemporaneously. This will help ensure that government has access to the best available scientific understanding as well as minimising the risk that important matters are not addressed by the scientific advice.

SAGE and related advisory committees rely extensively on the goodwill of expert participants. The Science and Technology Committee should invite those who have served on Covid-19-related scientific advisory groups to provide feedback on their direct experiences. Not only is this important in instances where experts may be asked to serve again, it also relates to accessing new expertise and widening the pool of participants. It also brings into focus the resilience of the present arrangements given the extended period over which external scientists have been called upon to give advice.

While it seems clear that the provision of scientific advice has generally been well coordinated across all four nations of the UK, there are questions relating to how governments within the UK tap into, coordinate and makes best use of the wide body of expertise that exists both within and outwith government departments and formal structures, both on an on-going basis and in crisis situations.

Previous epidemics have demonstrated that human social behaviour is a key determinant of how any disease outbreak spreads and how spread can be contained. The independent Scientific Pandemic Influenza Group on Behaviours (SPI-B) provides independent, expert behavioural science advice to SAGE. A key issue relating to the timing of introducing stricter social distancing measures in the UK seemed to be based on a view expressed by the Secretary of State for Health and Social Care and the UK Chief Medical Officer that such measures should not be introduced too soon as this could result in behavioural fatigue, with this being presented as though it were based on behavioural science advice. Members of SPI-B have stated that this advice did not emanate from the Group. It will therefore be important to ascertain the source of this advice and the evidence underpinning it since it was critical to the timing of introducing the UK's 'lockdown' measures.

While the impressively rapid development of initiatives on vaccine development is to be applauded, it is important to be clear that the development of a vaccine that can fully protect against the virus is low. It is more likely that any vaccine would help reduce and manage the spread and severity of the virus. It will be important to ensure that there is responsible and realistic public messaging in relation to the UK's ability to develop a safe and effective vaccine, and what this means in terms of our need to live with the virus for the foreseeable future.

Introduction

1 The Royal Society of Edinburgh (RSE), Scotland's National Academy, welcomes the opportunity to respond to the *House of Commons Science and Technology Committee's Inquiry into UK Science, Research and Technology Capability and Influence in Global Disease Outbreaks*. This is a hugely important inquiry given the scale and impact of the Covid-19 pandemic. It is essential that we learn lessons from the UK's response thus far in order to increase our resilience to enable the UK to live with Covid-19 as well as to ensure the country is better placed to deal with further outbreaks and other potential large-scale disruptions and future shocks.

2 In this context, the RSE has established a wide-ranging Post-Covid-19 Futures Commission to support Scotland's longer-term response to the pandemic. Building national resilience and data, evidence and science are key areas of focus for the Commission. We would be pleased to keep the Committee updated on the work of our Commission.[1]

3 Drawing upon our multi-disciplinary breadth of Fellowship, in preparing this response the RSE convened a working group comprising experts from a range of scientific fields relevant to the Covid-19 pandemic including epidemiologists, life scientists, medical clinicians, drug developers, statisticians, behavioural scientists and public health professionals. We have also drawn upon those who have substantial experience of engaging with policy-makers and the public on the communication of science. As Scotland's National Academy, we are well placed to comment on matters arising at the UK level, and the scientific advice and policy connections and interactions between the UK Government and the Scottish Government. We would be pleased to discuss further any of the issues raised in our response with members of the Science and Technology Committee.

4 In scrutinising the UK Government's response to the pandemic, it would be useful for the Science and Technology Committee to evaluate the extent to which the Government has learned lessons from previous disease emergencies, including those set out in the Committee's report, *Science in Emergencies: UK lessons from Ebola*.[2] This report highlighted that the UK's preparation for an infectious disease emergency is less robust than it ought to be. It covered key issues that are relevant to the present inquiry, including science advice to decision makers, communication with the public, disease surveillance, data sharing, vaccine manufacturing capacity and the role of the National Risk Register. It will be important to ensure that lessons have been learned from previous experiences and in any instances where they have not been learned, the Committee is well placed to seek answers from the Government.

Questions

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

5 There is a need to develop a good understanding of how the current pandemic came about and the responses to it, recognising that the Covid-19 pandemic was a predictable event, even if the timing and exact nature of the event could not be foreseen. The World Health Organisation's (WHO) Research and Development Blueprint (2018) identified novel coronaviruses specifically as a threat. SARS-CoV-2 (Covid-19 is the name given to the disease associated with the virus) is now the third zoonotic coronavirus, after SARS-CoV and MERS-CoV.[3]

6 Being a completely new virus, it would be unreasonable to have expected the research community to have been preparing specifically for SARS-CoV-2. Having said that, arguably UK risk assessments should have shown coronaviruses to be a risk and an appropriate policy response to these assessments should have been to direct research towards ensuring there was generic capability to respond quickly to a coronavirus outbreak.

1 https://www.rse.org.uk/inquiries/rse-post-covid-19-futures-commission/

2 Science in Emergencies: UK lessons from Ebola; House of Commons Science and Technology Committee; January 2016 http://www.publications.parliament.uk/pa/cm201516/cmselect/cmsctech/469/469.pdf

3 2018 Annual review of diseases prioritized under the Research and Development Blueprint, World Health Organisation, February 2018 https://www.who.int/docs/default-source/blue-print/2018-annual-review-of-diseases-prioritized-under-the-research-and-development-blueprint.pdf?sfvrsn=4c22e36_2

7 Virology and epidemiology research and development have been crucial in generating a better understanding of Covid-19 and how to respond to it. In particular, the use of genome sequence analyses very early in the epidemic led to conclusions in late January that, since December, the epidemic had been driven entirely by human-to-human transmission. Similarly, by mid- to late-January, work by modellers to determine estimates of R_0 highlighted the potential for sustained transmission and epidemic/pandemic potential. However, modelling is only ever a guide to projecting how a disease might spread and can only be as good as the level of data available at the time. There were huge uncertainties about the nature and epidemiology of Covid-19 that persisted well into March. A key example is the infection fatality rate, which was uncertain by a factor of x3 to x10 at that time. Model projections improved as the data being used in them improved.

8 These points raise important and wide-ranging questions about the identification, assessment, management of, and preparedness for, risk, as well as the systems and infrastructure required to support resilience, including the availability of, and access to, high quality and timely data. They also make clear the importance of having in place good surveillance and effective contact tracing in order to generate a better understanding of the prevalence and spread of the virus, which would provide both scientists and decision makers with more accurate data and information on which to base their advice and decisions. It is concerning that while testing capacity eventually increased, it took a relatively long time to do so, and there remain issues related to tracking and contact tracing capability. We return to these issues in our response to question two.

9 It could be argued that in terms of learning lessons about preparedness the UK has tended to look backwards rather than forwards. The UK-wide Influenza Pandemic Preparedness Strategy in planning for and responding to an influenza pandemic was published in 2011, taking account of the experiences and lessons learned in the H1N1 (2009) influenza pandemic.[4] The UK's National Risk Register (NRR) indicates that there is a high probability of an influenza pandemic occurring. While the WHO had identified novel coronaviruses as a threat, it is notable that the NRR does not explicitly identify the potential threat of coronaviruses, although it does acknowledge the risk of new and emerging infectious diseases occurring, albeit it limits the number of fatalities to 100.[5] This points to the UK being better prepared for influenza, but not for a novel coronavirus; and also raises wider issues related to the UK's approach to risk assessment and preparedness, including whether the NRR should categorise more specifically emerging infectious diseases.

10 As a result, it seems likely that in the early stages of the pandemic, the modelling and preparedness were based on a legacy of influenza experience. In the early stages there was a lack of involvement of established corona-virologists who might have been able to grasp more quickly the potentially complex symptomology, immuno-pathology and epidemiology of the virus, making clear that we were dealing with something very different from influenza.

11 With the benefit of hindsight, the lack of specific coronavirus expertise at the outset may have contributed to problems created by an overly narrow case definition based on a very specific symptomology and history of travel. This was compounded by the limited availability of testing capacity in the UK early in the epidemic. Containment strategies based around testing and self-isolation only of people who met this highly specific case definition were likely to have limited effect, particularly given the scope for asymptomatic carriage of the virus.

12 Many of the points made above and in the rest of our response make clear that research and knowledge are dependent on data availability. While the People's Republic of China was the first country to experience Covid-19, there are concerns that it delayed making available to the WHO detailed epidemiological data in the very early stages of the pandemic. This raises important questions relating to international governance and obligations during a global crisis. It is crucially important that, in such serious circumstances, there is an obligation on governments internationally to share any data as quickly as possible with a view to informing the international response. Such data are necessary to devising proportionate international and national public health responses.

4 UK Influenza Pandemic Preparedness Strategy 2011 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/213717/dh_131040.pdf

5 National Risk Register Of Civil Emergencies 2017 Edition, Cabinet Office https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/644968/UK_National_Risk_Register_2017.pdf

Question 2: *The capacity and capability of the UK research base in providing a response to the outbreak*

Advice to government, public bodies and others on managing the outbreak

13 The quality and breadth of scientific activity and advice available in the UK to support both the UK and international response to dealing with the Covid-19 pandemic is not in question. The key issue is how the scientific endeavour is mobilised, coordinated and utilised in preparing for and responding to emergencies.

14 The UK research base has been deeply involved in supporting both the UK and the international response to Covid-19 since the outset of the pandemic. The sheer volume of publications and, especially, pre-prints produced attests to this engagement.

15 In the UK there are more than 70 standing scientific advisory committees and councils with a range of roles and responsibilities in the provision and interpretation of scientific information in support of the UK Government. The UK Government's Chief Scientific Adviser (CSA), with input from the network of departmental CSAs as well as the CSAs in the devolved nations, is a key conduit for advising government on science policy. Given this range of expert scientific advice, it is important that there is a clear understanding of the respective roles and responsibilities among the different groupings to ensure effective coordination and communication of scientific advice.

16 Government Departments routinely work with scientists in universities and research institutes, as well as in their own laboratories (where they exist), to obtain information in preparation for emergencies. The immediate UK response in the early months of the pandemic depended on standing capacity, such as the MRC Centre for Global Infectious Disease Analysis at Imperial College London.

17 While the present inquiry is focused on the relationship between scientific expertise and the decision making process, there is of course a much wider range of groupings and advisory networks covering a large number of topics, including economics, education, health and inequalities among many others that will also be feeding-in advice to decision makers. As well as highlighting the scale of the challenge, this also raises questions in relation to how scientific advice is integrated with, and assessed alongside, other important areas of advice.

18 Another important issue to consider is the essential need for transparency and the sharing of scientific information and data as a vital part of the scientific process. As part of this, it is crucial that data, including metadata, is made available as early as possible to enable other scientists to reproduce and verify the results, and to enable development of the evidence base.

19 Key to success is effective knowledge exchange, involving scientists who have a broad base of knowledge and can act as 'knowledge brokers' to improve two-way communication between government and scientists. The UK's National Academies, including the RSE, are also well placed to facilitate dialogue between experts and professionals and government. The national academies in the devolved nations are a particularly valuable resource for helping to make connections between experts, the UK Government and the Devolved Administrations.

20 The HoC Science and Technology Committee's letter to the Prime Minister in May on some of the early lessons from the UK's response to the pandemic so far sets out a range of key points on the relationship between scientific advice and government.[6] Expert scientific advice must be available to governments and decision-makers to help inform assessments and responses. It is clear to us that the Scientific Advisory Group for Emergencies (SAGE) and its sub-groups have been extensively consulted and highly influential in UK Government decisions throughout the pandemic.

6 Covid-19 pandemic: some lessons learned so far, Science and Technology Committee, 18 May 2020 https://publications.parliament.uk/pa/cm5801/cmselect/cmsctech/correspondence/200518-Chair-to-Prime-Minister-re-COVID-19-pandemic-some-lessons-learned-so-far.pdf

21 While SAGE was established in January, the Scottish Government's Covid-19 Scientific Advisory Group was not established until late March, following a recognition that there was a need for additional scientific analysis of the impact of Covid-19 in Scotland.[7] The Scottish Government has therefore been very dependent, particularly in the initial weeks of the Covid-19 outbreak, on the UK Government for scientific advice through SAGE. While it seems clear that the provision of scientific advice has generally been well coordinated across all four nations of the UK, there are questions relating to how governments within the UK tap into, coordinate and makes best use of the wide body of expertise that exists both within and outwith government departments and formal structures, both on an on-going basis and in crisis situations.

22 As the situation has evolved we have observed increasing levels of divergence across the four nations in the policy response to the pandemic, but this appears to be based on differing policy priorities, approaches, timeframes and operational capabilities as opposed to conflicting scientific advice.

23 While governments have claimed that they are "following the science" or being "led by the evidence", it is important to make clear that the role of the scientific community is not to determine policy: that is for government. The role of the scientific community is to develop and present the evidence for different options. The advice provided will be based on the scientific understanding of the evidence available at the time. It is clear that the scientific advice on Covid-19 has, and continues to, evolve, and is liable to change as new data and information become available. Scientific evidence will be part of a broader range of considerations of which governments will need to take account. Governments will undoubtedly have to take account of other social, ethical, legal, economic and political considerations. While government should make clear when it is departing from the scientific advice received, it is important to recognise that there will not always be a clear scientific consensus, especially when addressing the novel and fluid situation in which we find ourselves.

24 In the circumstances that at the outbreak of a novel pandemic where there is limited information about the nature and prevalence of the virus, and when time is of the essence, there is a difficult balance to be struck between mobilising and taking account of external scientific advice, while avoiding undue delay in decision making. Of course, there is no easy answer to this issue given the uncertainty surrounding the nature of the virus, especially in the early stages of the outbreak. This does, however, highlight the importance of having high quality data as early as possible. We return to this in our response to question five.

25 This raises issues in relation to the transparency of scientific advice and its use within the policy making process. The Committee has already taken up with the UK Government several actions related to increasing the transparency of SAGE, including its membership and publishing the advice that it provides to government. Notably, the Scottish Government's Covid-19 Scientific Advisory Group and related subgroups have operated transparently since their establishment, including the publication of all minutes and commissioned advice. These actions are important for enhancing public trust in both the science and the decision making process as well as allowing the wider research community to flag up where there may be gaps.

26 It is crucially important that SAGE is able to draw upon the breadth of scientific expertise necessary to address issues and impacts of the scale that Covid-19 has presented. The membership of SAGE depends on the nature of the emergency but typically includes leading experts from within government and leading specialists from the fields of academia and industry. This raises questions in relation to the process and approach for identifying the expertise that is required. SAGE itself relies on external scientific advice and several expert groups have been established in response to Covid-19. It will be important to ensure that SAGE and the subgroups contain those with direct experience of how the pandemic has unfolded on the ground, which would include those directly involved in public health, clinical and care service provision.

7 Scottish Government Covid-19 Advisory Group https://www.gov.scot/groups/scottish-government-covid-19-advisory-group/

27 Previous epidemics have demonstrated that human social behaviour is a key determinant of how any disease outbreak spreads and how spread can be contained. Behavioural science should therefore be a fundamental component of risk assessment, contingency planning and emergency response. It is crucial to understanding and advising on public guidance, requirements and interventions, for example, those on staying at home, social distancing, self-isolating, wearing of face coverings and the widespread take-up of any future vaccination.

28 The independent Scientific Pandemic Influenza Group on Behaviours (SPI-B) provides independent, expert behavioural science advice to SAGE. A key issue relating to the timing of introducing stricter social distancing measures in the UK seemed to be based on a view expressed by the Secretary of State for Health and Social Care and the UK Chief Medical Officer that such measures should not be introduced too soon as this could result in behavioural fatigue, with this being presented as though it were based on behavioural science advice. However, members of SPI-B have stated that this advice did not emanate from the Group. It will therefore be important to ascertain the source of this advice and the evidence underpinning it since it was critical to the timing of introducing the UK's 'lockdown' measures.

29 It is important that there is mutual understanding on the part of those providing scientific advice and those receiving that advice in terms of their respective roles and responsibilities. While it is important that the scientific advice provided is directed towards questions posed by government in order to support government responses, experts on SAGE and the subgroups should be able to raise issues and questions contemporaneously. This will help ensure that government has access to the best available scientific understanding as well as minimising the risk that important matters are not addressed by the scientific advice.

30 When circumstances allow, as part of its inquiry it would be useful if the Committee were able to undertake work that considers the direct experiences of, and feedback from, those who have served on Covid-19-related scientific advisory groups. Such experiential evidence will help to inform future approaches to convening scientific advisory groups in emergencies, particularly identifying any changes that need to be made to existing practice. Given that SAGE and related advisory committees rely extensively on the goodwill of expert participants, it is important that they feel their input has been valued and that it has been a positive experience. Not only is this important in instances where experts may be asked to serve again, it also relates to accessing new expertise and widening the pool of participants. This also brings into wider focus the resilience of the present arrangements given the extent to which external scientists have been called upon to give advice over an extended period of time. The frequency of SAGE meetings attests to this.

The development of testing, diagnostic methods and technologies

31 Surveillance is an important component of pandemic preparedness strategies. A key focus is the need to gather intelligence for monitoring the spread and severity of the virus. This requires accurate and detailed surveillance data to be gathered at an early stage. The WHO reported in February that countries should immediately add testing for the Covid-19 virus to existing surveillance systems.

32 As highlighted by the Committee's early stage findings, there has been a clear lack of testing infrastructure in the UK to deal with this pandemic, with testing having been limited due to the shortage of testing capacity. The lack of testing capacity has had adverse consequences for the ability to track and trace the spread of the virus. It is notable that the decision was taken on 12th March to cease testing in the community and focus on testing principally within hospitals due to testing capacity constraints. This was a crucial decision-making moment and raises significant questions around the UK Government's strategy for mitigating the spread of the virus and the timing of the decision to implement lockdown measures, as well as whether the UK acted quickly enough to build-up testing capacity.

33 It was apparent from the earliest stages of the pandemic that as well as polymerise chain reaction (PCR) testing, serosurveillance would be vital for tracking the spread and prevalence of Covid-19, especially given the large numbers of mild or asymptomatic cases.[8] The challenge was to develop serological tests quickly enough to be deployed. In the event, such tests were only deployed in April, and large-scale, structured surveillance some weeks later. This may have been unavoidable due to the practical constraints on testing capacity, but it left an important data gap and, in turn, placed significant limitations on the scientific advisory community and, ultimately, decision makers.

8 While PCR tests can tell whether or not someone is currently infected by the virus, serological testing is able to tell whether someone has previously been infected.

34 The lack of testing capacity initially then resulted in the ineffective and repeated use of arbitrary headline testing targets by the UK Government i.e. 100,000 daily tests by the end of April. It is clear that this target was not based on scientific advice but, rather, was set by the UK Government. While the target did help to drive the increase in testing capacity, the resulting focus during March on numbers of tests per day was a distraction and not based on a sound understanding of the role of testing, and significant concern has been raised about how progress against the target was reported by government sources. What matters is the strategy that the testing is designed to support.

35 The response to the pandemic demonstrates the importance of taking steps to build-up the UK's national resilience. Any assumption that testing capacity which is not formally retained can be scaled-up during emergencies needs to be challenged robustly on the basis of the current experience. It is crucial, therefore, that the increase in UK testing capacity that has been developed over the course of the pandemic is maintained, not least given the scientific expectation that cases will increase in the winter, and that we will need to be prepared to live with the virus for the foreseeable future.

36 This also highlights the importance of the UK being able to produce and/or access easily the necessary reagents, testing equipment and consumables given that other countries will also be trying to source the same materials during a pandemic. Maintaining and, indeed, increasing the available testing capacity as well as building resilience will require joint work across government, public sector and industry partners, and include national[9] as well as more localised infrastructure. We are aware, for example, that veterinary laboratories were offering their diagnostic facilities to both the UK and Scottish Governments to increase testing capacity but that government appeared to be slow to act upon such offers.[10]

The development and testing of vaccines; and the development and testing of therapeutics

37 Given that there are many potentially zoonotic diseases, it would be unrealistic to expect health risk management systems to be on permanent standby with therapeutics and/or vaccines for all of these. However, as we have stated in our response to question one, more should have been done in the UK to identify high risk virus groups like coronaviruses and to direct resources towards them.

38 The pandemic has highlighted in a way never 'tested' before, the ability of the UK research base – across industry and academia – to mobilise in response to the need to develop and test therapies and vaccines for a novel infectious disease in an unprecedented timeframe. The strength and depth of the UK research base and its ability to respond and collaborate in a way never see before has been a major positive of this crisis.

39 While the impressively rapid development of initiatives on vaccine development is to be applauded, it is important to be clear that the development of a vaccine that can fully protect against the virus is low.[11] It is more likely that any vaccine would help reduce and manage the spread and severity of the virus. It will be important to ensure that there is responsible and realistic public messaging in relation to the UK's ability to develop a safe and effective vaccine, and what this means in terms of our need to live with the virus for the foreseeable future.

40 While funding to develop and test therapies and vaccines has been made available quickly and at meaningful levels by government and other public bodies, we are aware of concerns that the responsiveness thereafter to review and select funding applications has been much slower than anticipated, thereby potentially hindering progress in developing therapeutic interventions. In learning lessons from the pandemic, it will be important to consider whether processes have been as effective and timely as they should be during a crisis, and what infrastructure and resource are required to ensure that government bodies and research funders are able to deliver them on the timescales required.

9 e.g. the Lighthouse Laboratory Covid-19 testing facility hosted by the University of Glasgow https://www.gla.ac.uk/news/headline_720507_en.html

10 'Let us help you with testing,' say vet labs, Veterinary Record, 16 April 2020 https://veterinaryrecord.bmj.com/content/vetrec/186/14/431.full.pdf

11 Sir Patrick Vallance, UK Chief Scientific Adviser, evidence to HoC Science and Technology Committee, 16 July 2020 https://committees.parliament.uk/oralevidence/701/pdf/

41 In particular, it would be instructive to evaluate the role and contribution of the Department of Health and Social Care's Therapeutics Taskforce in relation to expediting the trialling of potential interventions through the Accelerating Covid-19 Research and Development (ACCORD) study platform which aims to fast-track promising drugs into large-scale studies. Where there is a commitment and expectation for a fast turnaround on decision making, it is important that government and its partners are able to deliver on that.

Question 3: *The flexibility and agility of institutions, Government departments and public bodies, and processes to respond appropriately during the crisis*

42 It is clear that government and public sector organisations along with a wide range of academic and research institutions and private sector bodies have come together in response to the pandemic.

43 Our response to question two indicates that while access to funding to support the response does not appear to have been an issue, there is concern about the use of overly bureaucratic processes and delays in decision making.

44 We have also pointed to concern that the UK was not agile enough in mobilising regional and local public health expertise and testing infrastructure with a view to increasing core capacities. It is essential that testing infrastructure that has been brought on stream is maintained for the foreseeable future.

45 While there are chief scientific advisers across government departments, the pandemic has drawn attention to the role of behavioural science and the Committee should consider whether there is a need for a chief behavioural science adviser at the heart of government.

46 There continue to be significant issues related to the lack of robust data and reporting on those data which we return to in our response to question five.

Question 4: *The capacity to manufacture and distribute testing, diagnostics, therapeutics and vaccines*

47 In its Ebola Report (2016), the Science and Technology Committee raised significant concern that the UK's limited capacity to manufacture vaccines leaves the UK in a vulnerable position. The Committee recommended that the UK Government commission the UK Vaccine Research and Development Network to identify the actions required to address the UK's deficiency in vaccine manufacturing capacity.

48 The UK Government appears to have acted on this recommendation. Through the Industrial Strategy Challenge Fund established in 2017, the UK Government has committed £188m over four years in the areas of advanced therapies, medicines and vaccines development and manufacturing. A range of projects have been funded since 2018 to improve significantly the efficiency, effectiveness and scope for medicines manufacture in the UK.

49 It was announced in May 2020 that UKRI investment of £130 m will speed up the construction and increase the capacity of the Vaccines Manufacturing and Innovation Centre (VMIC), which is now expected to be ready in 2021. It is also supporting the creation of a 'virtual' VMIC temporarily to create manufacturing facilities elsewhere until the VMIC is ready.

Question 5: *The capturing during the crisis of data of the quantity and quality needed to inform decisions made during the crisis; and to maximise the learnings afterwards*

50 Our responses have highlighted the crucial importance of data in order to gain a fuller understanding of the nature and spread of the virus and, in turn, to informing and supporting the decision making process.

51 Data collection and management appears to have been a particular weakness and is arguably the greatest failing in the UK's handling of the crisis. National pandemic management needs strong central control supported by robust, well-designed data collection flowing into real-time analysis. Having such a system in place, including continuous background surveillance to allow much earlier disease detection, should be a post Covid-19 national priority.

52 A range of issues and concerns have also been raised about the UK Government statistics on coronavirus tests, cases and deaths in the UK, including: differences between the Department of Health and Social Care and the Office of National Statistics' reporting on the number of Covid-19 deaths, making it extremely difficult accurately to track the fatality rate when reporting delays are not properly accounted for and, outside of Scotland, coroner-referred Covid-mention deaths are not registered until the coronial investigation has concluded; the extent of double-counting which resulted in the UK Government suspending daily reporting on the number of tests in the community; the lack of breakdown on the number of pillar 1 tests that relate to patients as opposed to health care workers; the lack of accurate information on the number of posted tests that are actually returned and processed; and the lack of clarity over the number of people tested as opposed to the total number of tests. Worryingly, the infection fatality rate still cannot be reliably estimated even now. It is notable that the Chair of the UK Statistics Authority has written twice to the Secretary of State for Health and Social Care stating that the testing statistics fall well short of its expectations.[12]

53 These issues on the quality of the testing data mean it is extremely difficult for researchers to generate an accurate understanding of the prevalence and spread of the virus which creates major challenges for our ability to control the outbreak. They also raise significant questions in relation to the effectiveness and efficacy of the testing programme, as well as the need to ensure public trust in the approaches taken and the evidence presented by government.

54 The issues raised above also highlight the importance of researchers being able to access timeously UK health data. While the NHS, both at the UK level and across the devolved nations, has some of the richest data records in the world, much of it is very difficult to access and it is not joined up.[13] While it is important that there are robust safeguards around the collection, storage and use of patient data, researchers should have timely access to suitably anonymised, linked data.

Question 6: *The mechanisms for communication of scientific evidence internationally, within national governments and with the public*

International experience and evidence

55 While the Committee inquiry is focussed on UK capacity and capability in dealing with the pandemic, inevitably, much of what has and will be discovered about Covid-19 will be based on international developments. A key issue to consider is the extent to which the UK Government and the UK scientific community were and are capable of making best use of scientific research that is not based in the UK.

56 Given that the UK was further behind the virus trajectory compared to some other countries, including Italy and Spain in Europe, the UK had the opportunity to draw upon the approaches of other countries with substantial prior experience of responding to the outbreak, including the advice of the WHO. While there was no shortage of international experiential evidence, the Committee should consider the extent to which this informed the UK Government's response to the pandemic. The UK's National Academies are well-placed to harness this international expertise through their relationships with sister academies across the world.

57 More broadly, given the international nature of the pandemic, alignment of communications is vital. Announcements made by the WHO should therefore be consistent with advice given by the Chief Medical Officers in the UK. Where advice and approaches differ, it is important that there is clarity on the reasons for this.

Handling of conflicting scientific opinions

58 Our responses to question two on scientific advice to government are relevant here. It is clear that data limitations have impacted on the level of scientific understanding and certainty during the pandemic and, in turn, this has affected the nature of the advice that the scientific community is able to provide to decision makers.

12 Sir David Norgrove, Chair of the UK Statistics Authority, response to Matt Hancock regarding the Government's COVID-19 testing data, 2 June 2020 https://uksa.statisticsauthority.gov.uk/correspondence/sir-david-norgrove-response-to-matt-hancock-regarding-the-governments-covid-19-testing-data/

13 Access to health data for research and innovation, Health Data Research UK, January 2020 https://www.hdruk.ac.uk/wp-content/uploads/2020/01/Using-health-data-for-research-questions-for-public-January-2020-1.pdf

59 The publication of SAGE minutes and papers following earlier recommendations from the Science and Technology Committee has improved the transparency of the advice that SAGE has provided to government. It is important that this openness is retained.

60 The system for generating a scientific consensus in the advice provided, mainly involving independent scientists on SAGE and its subgroups, appears to have worked generally well. Conflicting opinions are a key part of the scientific process, particularly given the novel circumstances and the pace at which the pandemic has unfolded. It is important that the communication of scientific advice makes clear the level of certainty and where strong divergence of views exists.

Public communication

61 Covid-19 has brought to the fore the issue of public understanding of and, trust in, scientific expertise and the scientific process. This can be particularly challenging in responding to novel situations, in this case a new virus, where scientific evidence may be unclear (e.g. benefits of face coverings, required social distance) and evolving over time as new information and data becomes available. The communication of science and evidence and its use within the media and on social media assumes a particular importance at such times in supporting, or undermining, understanding and trust in science. Coordination between government and the media is vital to ensure that mixed and confusing messages are not given.

62 Public communication is a vital part of preparing for and responding to crises. It is important that the government's communication with the public is led by a spokesperson who not only has the authoritative technical competence, but also the ability to synthesise complex information and communicate it to the public in an understandable form. These attributes are crucial to ensure the trust and confidence of the public and to ensure that the public reaction is proportionate to the risk. It is therefore unsurprising that the UK Chief Medical Officer and Scotland's National Clinical Director have become household names as they have fronted the public communication of scientific and public health advice during the pandemic.

63 This reinforces the role of behavioural science to ensure that advice and interventions are based on a scientific understanding of human behaviour. While there is a view that public information needs to be controlled in a crisis to avoid panic, the contrary is true; with the evidence showing that the provision of clear and timely information is an antidote to panic. This approach ensures that the public is as well informed as can be and helps to generate public trust in the decisions being made.

64 The Science Media Centre (SMC) has said that during emergencies the public favour multiple sources of information.[14] Third-party scientists independent of government have a very important role in helping to interpret and communicate scientific evidence, advice and uncertainty to the public. The media tend to find their own "experts" based on instant availability, but in large or unprecedented emergencies, there is a need for active promotion of experts to the media by science organisations, including National Academies like the RSE. This helps to ensure the coordination and rapid mobilisation of scientific commentary from reputable and responsible experts during emergencies. It is important that those scientists who are advising government are not put in a position where they feel they cannot provide public briefings.

14 SMC submission to HoC Science and Technology Committee Inquiry, Scientific advice and evidence in emergencies; Session 2010-11 http://www.publications.parliament.uk/pa/cm201011/cmselect/cmsctech/writev/498/m25.htm

Question 7: *The UK's readiness for future outbreaks, including a consideration of: the National Risk Register; the UK Pandemic Influenza Strategy; and Public Health England's Global Health and Infectious Diseases Strategy*

65 Every two years, the UK Government produces a classified assessment of the risks of civil emergencies facing the UK in the form of the National Risk Assessment (NRA). The National Risk Register of Civil Emergencies (NRR), first published in 2008, is the unclassified version of the NRA.

66 Please see our responses to question one on the National Risk Register and the relationship with the WHO Research and Development Blueprint and the UK Pandemic Influenza Strategy.

67 In our view, based on the information available globally, UK risk assessments should have shown coronaviruses to be a risk. The NRR (including the risk assessments which accompany it) needs to be revised. Rather than basing the risk of pandemic on a base case of pandemic influenza, this needs to look across the full range of potential zoonotic disease and provide an integrated risk score of any one of those risks manifesting over an appropriate period of time.

Additional Information

Any enquiries about this advice paper should be addressed to William Hardie (whardie@therse.org.uk).

Responses are published on the RSE website (https://www.rse.org.uk/)

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