**Drug Discovery During a Pandemic:**

**Key Lessons from the Covid-19 Pandemic**

**Centre for Science and Policy**

**Policy Workshop Report**

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# 1. Introduction

In June 2021, the Centre for Science and Policy at the University of Cambridge convened a workshop with the aim of exploring key lessons and themes which have emerged in drug discovery throughout the Covid-19 pandemic. The session offered an opportunity for relevant stakeholders from academia, government, and the private sector to participate in a frank and open conversation reflecting on their experiences throughout the ongoing Covid-19 pandemic, while capturing key lessons learned about therapeutics discovery and development in pandemics. The goal of this discussion, and this report, is to inform national and international policy with respect to pandemic preparedness and drug discovery during pandemics.

Throughout the discussion, participants took a ‘landscape view’, exploring the whole drug development pipeline from preclinical through to phase three research. They emphasized the need not just for just focusing on short-term horizons and repurposing medicines during pandemics. Instead, we need to take holistic approaches to the future of research in this area. This will involve addressing regulatory and bureaucratic elements of the current system including the state of regulation, data governance, and data sharing.

Several key themes emerged throughout the workshop, including the importance of platform trials and of central coordination points for research; the need to embed clinical research and research within clinical care as a core business within the NHS; the importance of incentivizing research while creating the conditions for research capacity; and the need to build agile systems capable of switching from grassroots to top-down approaches to research at the onset of acute health emergencies such as pandemics. Workshop participants also emphasized a need to develop a sustainable model of research and supporting infrastructure – including relevant manufacturing - which can contribute to pandemic preparedness, while serving other purposes outside of pandemic conditions. Here, participants repeatedly returned to the analogy of ‘building roads, rather than roadmaps’, as a recommended approach going forward.

Workshop participants also identified several weaknesses within the current systems which should be addressed going forward, including improving and diversifying pandemic preparedness, strengthening phase 2 trials, addressing diversity issues, and a current shortage of networks and new partnerships which are genuinely global in their reach. With respect to pandemic preparedness specifically, participants stressed the need to ensure that our approach going forward spreads a lot wider than traditional threats such as flu, and that it is built with the flexibility and agility to adapt to novel pathogens and pandemic threats.

Ultimately, participants expressed their hope that the lessons from the Covid-19 pandemic will provide an opportunity for the UK to make improvements across the whole of public health, research, and medicine, with the end goal of assembling structures that can prepare us for future pandemics while leading the UK to become the place to do clinical trials and treatment development globally.

# 2. Reflections on the Covid-19 pandemic response in the United Kingdom

*How strong was the United Kingdom’s overall Covid-19 pandemic response? What were the key areas of strength and weakness in this response?*

Participants in this workshop were asked to rate the United Kingdom’s response to the Covid-19 pandemic thus far on a score of 1-10, with one being a poor response, and 10 being a strong response. While there were outliers – with the lowest given score of 2 and the highest given score of 8 when rating overall pandemic response – the mean average score from participants was 5.4, with most participants assessing the UK’s pandemic response at roughly a 5 or 6.

At a more granular level, participants were quick to highlight that the strength of the UK’s response had varied widely between different elements of the response, and that there have been areas where the UK has demonstrated its capabilities and strengths throughout its Covid-19 pandemic response. Areas of strength cited by participants included a solid science base, robust clinical networks and collaboration, a strong response on therapeutics, amazing progress on vaccination, high-quality hospital trials, regulatory flexibility, and flexibility on payment from industry and government. Reflecting on their experiences during the pandemic thus far, participants stressed the extent to which the last 18 months have been challenging. National infrastructure, coordination, and partnerships between academia, the NHS and industry have been critical cross-cutting themes in successes experienced during this period.

Conversely, participants also noted that the UK fared very poorly with respect to pandemic preparedness, infection control, public health management, and on managing systems-wide resilience and challenges such as existing health inequalities and critical care capacity in the NHS. Other areas with room for improvement cited by participants included international collaboration, outpatient trials, and testing. One participant also caveated the previously mentioned list of strengths, particularly with respect to the strong therapeutics response, by noting that the United Kingdom did well under the circumstances given the lack of preparedness, while stressing that a similar response to a future pandemic would be rated poorly, given what we have now learned.

# 3. Pandemic Preparedness

*What steps can the United Kingdom take to improve pandemic preparedness in the area of drug discovery?*

Participants in this workshop consistently rated United Kingdom’s level of preparedness for a novel pandemic threat very poorly, with one participant stressing that “lack of preparation…put us in such a difficult position to begin with. We actually didn’t do too badly in that context, but we should never be in that context again going forward.” Others noted that, for example, there was very little preparation for a national test, trace and isolate programme in the United Kingdom prior to the pandemic, although capabilities in this area have grown throughout the pandemic.

Meanwhile, with respect to drug supply, historically the United Kingdom has considered itself to be well prepared for influenza, based on the stockpiling of antivirals and antibiotics, and on having contract arrangements for vaccine supply. Participants in this workshop recommended that we expand this approach to preparedness, ensuring going forward that public health preparedness efforts go well beyond pandemic influenza, and have the built-in flexibility to adapt to novel pathogens and pandemic threats.

Reflecting on pandemic preparedness more broadly, one participant noted that we do not have structures that allow large chunks of infrastructure to remain unused and at the ready just in case they are needed. Instead, the participant suggested a good model for pandemic preparedness would be to create hubs of capability. This model would work by extending the idea of a ‘roadmap’ for pandemic response beyond the map, creating the metaphorical roads called for by such a map while ensuring that these roads also serve a purpose between emergencies while maintaining the ability to pivot these capabilities rapidly when required. The participant encouraged policymakers looking to the future to identify what this roadmap would look like, and what the critical elements we may need to pivot or scale up in a future health emergency might be expected to be.

Finally, with respect to research and drug discovery for pandemic preparedness, participants highlighted a series of tensions between the ways in which pandemic and pre-pandemic research might be best carried out. While coordination comes into the fore during pandemics, many participants cited a need for research during the preparedness phase to be open to more organic and creative approaches. Consequently, approaches to research need to be flexible, and capable of shifting toward central coordination during crisis situations. Moreover, research into pathogens with pandemic potential and related medical countermeasures needs to be incentivized, stressed participants. For example, there could be an open call looking for researchers to develop new antiviral drugs against the major families of viruses which are known to cause pandemics in humans. Here, some participants also noted that clinical phenotyping and surveillance work should consistently occur in parallel with this process of drug discovery. These suggestions were caveated by the acknowledgement that traditional market models of incentivizing drug discovery are unlikely to be a successful approach to pandemic preparedness because many of the resulting drugs may never need to be used for their designed purpose, but still require a lot of development. Consequently, other mechanisms for incentivizing work in this space are needed.

# 4. Conducting Research and Clinical Trials During the Covid-19 Pandemic

*What lessons have we learned about conducting trials and research into therapeutics throughout the Covid-19 pandemic?*

## **A. Collaboration and Partnership**

Reflecting on their overall experiences conducting research and clinical trials during the pandemic, workshop participants highlighted the value of the clinical network within the NHS. The government has been able to focus on supporting researchers, who in turn have been able to rapidly translate their findings into treatment thanks to networks of clinicians and other stakeholders. This was echoed by other participants, who emphasized the importance of partnerships, sector-wide data sharing, embedding research into the NHS, and treating the NHS as a major stakeholder in research during this period.

Participants also emphasized that while academia is often driven by competition, pandemics are not a time for competition within the scientific community, instead emphasizing the need for collaboration while citing the role competition may have played in failed studies during the pandemic. As we move forward, it was suggested that the UK might learn from the experiences of the Covid-19 response, which have relied on a central coordinating infrastructure to which different investigators could bring their ideas while keeping intellectual ownership, when moving beyond the current pandemic. The UK approach to national clinical trials in Covid19, with a central therapeutic expert prioritisation committee (UK-CTAP), was not done anywhere else in the world.

Participants also stressed the importance of international collaboration in the context of pandemics, suggesting that trials need to be started through partnerships wherever a pandemic threat first emerges. This was an area where there was insufficient success during the Covid-19 pandemic. Although some trials were started in China in the early days of the pandemic, they failed to recruit sufficient patients to obtain answers about potential therapies such as remdesivir. Supporting international structures and large platform networks going forward is one of the ways in which we can be better prepared for future international health crises.

## **B. Medicines in the Pipeline: Phase 1 and Phase 2 Studies**

Throughout this discussion, workshop participants emphasized that we need much better drug pipelines to come into trial phases. Participants praised the work which has emerged from phase 3 trials, however some participants expressed concern around efforts earlier in the pipeline (phase 1/2), emphasizing that in the future we need to do a better job of effectively transitioning drugs through all phases of clinical development and into clinical practice, where appropriate.

Here, participants suggested that researchers seeking to find appropriate therapeutics throughout the Covid-19 pandemic often set their sights on too short a time horizon – focusing on what was 6-8 weeks down the line, rather than 3-6 months down the line. That contributed to ‘less zeal’ in establishing phase one trials and preclinical work, speculated one participant. Another participant noted that in the early stages of the pandemic, there was no clinical support for phase one studies, and that as a result, we are now a year behind where we could have been with respect to some therapeutics, given that we had too short term a focus at the start of the pandemic. Moreover, too little research during the early stages of the pandemic focused on prophylactic type trials, therapies for pre-hospitalization, or potential syndromes such as long Covid.

Participants acknowledged that early in a pandemic there is uncertainty about the time scale ahead, as well as competing demands for what is invested in. However, they also suggested that we need to incentivize the system to conduct discovery and put in place the building blocks for phase one, two, and definitive phase three trials so that promising candidates can be moved forward in a coordinated manner. Ultimately, participants emphasized that it is worthwhile to invest in the discovery element during pandemics, because pandemics last much longer than one might expect, and with the right incentives you can bring novel therapies through within a meaningful timeframe.

Getting Phase 2 trials right for the future is particularly important, one participant stressed, because robust phase 2 trials during the Covid-19 pandemic could have excluded some of the drugs that were subsequently proven not to be successful in phase three. A phase 2 study with reasonable endpoints can have a tremendous impact in terms of the resources used and can allow more resources to be directed towards phase three trials of therapeutics which are much more likely to succeed. Lack of coordination and agreement was also identified by one participant as another challenge during phase 2 studies. The participant suggested that there were too many small, less coordinated, unaligned endeavors, and that in future pandemic scenarios we should try to increase integration and system efficacy, with a joined-up national approach base, similar to the approach taken to phase 3 trials in the UK.

Participants also noted that the pharmacology of dosing was a missing element throughout phase 1 and 2 trials in the Covid-19 pandemic. While several early trials were conducted using the clinical dose of therapeutics used for something else, the evidence suggests that you often need a much larger dose to have an antiviral effect, and this was not something that was initially explored. Moreover, while responses during this pandemic focused on the prospect of repurposing drugs, one participant emphasized that this does not need to be the case in future pandemics. The evidence is clear that you can prepare in different ways with toolkits of drugs that have plausible activities against a family of viruses, and which may not have been previously used on a wide scale.

## **C. Lessons from the RECOVERY and REMAP-CAP Trials**

Workshop participants repeatedly cited the RECOVERY trial and REMAP-CAP trials as key successful trials from which lessons can be drawn for the future of research into drug discovery during pandemics. Particular praise was given to the ‘extraordinary work’ of those working on the RECOVERY Trial, namely Professors Martin Landray and Peter Horby.

The REMAP-CAP trial was cited by participants as a good example of an international platform trial which worked well, and which can offer lessons on how to export internationally platform trials which can have day to day utility. The REMAP-CAP trial was designed around patients in ICU experiencing respiratory failure.

Meanwhile, the RECOVERY trial was a national platform trial, with the critical alignment of regulators, the government, procurement, and the trial being key to the programme’s success. While some participants suggested that a national platform as the only route to do trials in the NHS would be somewhat restrictive for the traditional way industry conducts trials, others emphasized that the UK model during the pandemic successfully challenged the existing paradigm. RECOVERY worked because it was structured in a way that was much closer to the day-to-day work of the NHS, because it was made explicit to relevant stakeholders that this trial was a priority over other things, and it offered a good value of roughly £300 per patient while delivering visible benefits for patients in NHS trusts. RECOVERY demonstrated the value of very pragmatic platform trials, while revealing flaws in a system which sometimes focuses on over-regulating things that are not important for safety or efficacy.

Most of the successful therapeutics which emerged in the UK during the Covid-19 pandemic have come out of the RECOVERY trial, and workshop participants expressed frustration about the small number of successful therapeutics to emerge from other trials during the pandemic. Here, participants also noted that the UK had not sufficiently prepared drugs for viral epidemic threats, instead focusing on other areas such as bioterrorism threats.

Pandemics are, by definition, international phenomena, and another problem raised by participants was that RECOVERY was – until recently – very much a national study. This was in part because it took much longer to get approvals for trials outside the UK, with participants in this seminar suggesting we need international support for these types of trials.

While RECOVERY’s top-down approach was successful, the downside was that it stopped UK clinicians from engaging with other big international studies, which participants suggested was a ‘problem for the place of the UK in the world’. RECOVERY have been clear that it is not ethical to do a trial to show something does not work but other trials have not taken such a robust stance.

Moreover, the RECOVERY trial became front and centre for academics looking at repurposing existing compounds in the pandemic, and at the start of the pandemic, many people thought that new therapeutics would be the answer before the vaccine. Participants stressed that we need pharmaceutical companies to look through their drug libraries, and also to ask whether they have better compounds that would target what we know about the disease. While there are important questions to ask about existing compounds and repurposing them, there is also an argument for investing in *de novo* drug discovery in the next pandemic.

Finally, throughout the course of the Covid-19 pandemic, successful trials such as the RECOVERY REMAP-CAP have focused on hospital care settings, leaving a gap in terms of therapies that are designed to address mild illness in the community. Consequently, participants also questioned how we can improve trials which focus on the earlier phases of disease.

## **D. Endpoints and Underpowered Studies**

Workshop participants raised concerns about the large number of ‘underpowered’ studies which occurred during the Covid-19 pandemic – studies which collectively used vast resources, and which by sticking to a traditional playbook of a highly complex small trial with 30-40 endpoints ultimately failed to answer the primary endpoint properly and may have eliminated drugs that could have been potentially proven useful if the trials had been bigger.

Conversely, other participants expressed considerable dissatisfaction with the notion of relying on top-down platforms which focus on a single, easy measure endpoint such as mortality. Given what we now know about syndromes such as long Covid, simple trials with mortality as the only endpoint may not be fit for all purposes. One participant also suggested that understanding the natural history of the disease in detail is also vital for defining the endpoints which will be relevant in phase 2 studies. Consequently, they suggested that natural history studies will be crucial at the onset of future pandemics. It is also important to recognize that phase two endpoints are ‘signal detection endpoints’, emphasized some participants. They are not definitive failure but are rather designed to identify things which will possibly not be useful and get them out of the way. Here, participants stressed that a trial’s phase two endpoints need to be sufficiently convincing to the people running phase three trials for them to be willing to take it on. Ultimately, participants agreed that there is a greater need for building widespread consensus around endpoints for trials, with the goal of ensuring easier comparison across trials.

## **E. Regulation and the Role of Data**

A final key theme which has emerged over the past 18 months was the importance of partially rewriting some regulatory elements, including those related to data and processing drugs through the development pipeline. One of the incredibly powerful things about the NHS is the ability to collect data on routine clinical care and trials on a national scale. Participants in this workshop noted that a more permissive regulatory environment in the data space has created space for important discoveries over the past year, while noting that this has already started to tighten up as society emerges from the pandemic. Workshop participants also identified remaining barriers to data sharing as a significant barrier to making clinical research easier throughout the pandemic.

Participants noted that while clinical researchers are often approaching the same problem from different angles, inefficient data sharing is a significant barrier to collaboration and discovery. Participants in this discussion noted that regulatory sensitivities and the NHS digital sensitivities at the moment also make it incredibly difficult to link data from patients, hospital stays, clinical trials, and other datasets. This means that if a patient is enrolled in a clinical trial at one phase of an illness, that data may not presently be linked with their routine data, phenotyping data from other stages of their illness, or information on drug trials they may previously have been enrolled in. Moreover, genomic studies often require two rounds of consent, which introduces additional barriers for researchers. Consequently, workshop participants called for an exploration into how we might better move data around the system, with the goal of making clinical research more efficient and more easily embedded within NHS frontline clinical work.

Others spoke of the value of platforms embedded in routine care which could offer the opportunity to answer many questions within one framework without having to redo and retrain data systems between trials. One example of an area where this is already at work within the NHS is in stroke platform trials, where it is already routine to enroll every stroke patient in a platform trial with multiple interventions.

Participants acknowledged throughout this discussion that the concept of data sharing is interconnected with the realities of regulatory frameworks, while emphasizing that this ‘multi-dimensional’ challenge must also address intellectual property issues, the technical management of partial data, and the ethical issues around data sharing. Here, one participant posited that regulatory bodies are often more nervous about sharing data than the majority of the public, when it comes to sharing data for the public benefit. Consequently, they urged regulatory guidance to reflect public perception, utility, and a risk-benefit calculus, rather than assuming data security is the primary overarching objective.

In addressing these challenges, participants also acknowledged that there may be distinctions needed between the management different kinds of data. For example, there are likely to be different approaches needed to the management of routine healthcare data such as testing data and clinical records which can help researchers to understand a disease and recruit for trials, as opposed to data generated through centrally commissioned research activities such as genetic or phenotypic data. Moreover, there are separate questions about how to best manage the sharing of data internationally. One participant emphasized that the pandemic has demonstrated the benefits of international data sharing in areas such as genomic sequencing. However, while international data sharing can be a valuable component of preparedness and pandemic response, working with aggregated data – as occurred in some areas of research during the Covid-19 pandemic – can make it extremely difficult. Consequently, the ideal solution would be to find an honest, reliable, and acceptable broker for individual patient data, so that meta-analyses from different trials can be undertaken in order to obtain increased certainty surrounding the evidence of effects that have been seen. Were the UK to engage with such international efforts, this would need to be accompanied by tools such as data directories.

# 5. Research Beyond the Covid-19 Pandemic

*What can the lessons learned during the Covid-19 pandemic tell us about how we should structure research and collaboration, and areas we should potentially focus on, in the post-pandemic period?*

## **Research Structures and Cultures**

As we transition towards an era beyond the Covid-19 pandemic, participants noted that relevant stakeholders will need to think strategically about the future of the structures built specifically to respond to Covid-19, and how they might be repurposed for a longer-term future. This will require strategic thinking, which should be grounded in lessons learned during the past 18 months and informed by a goal of building resilience in the United Kingdom’s life sciences sector. In this future, participants stressed a need for there to be system-wide incentives to ensure that research remains is a core part of delivering high quality clinical care, and that all stakeholders – including the Department of Health and Social Care – understand the importance of delivering research in clinical settings. Here, participants noted that this recommendation does not align with the current NHS 10-year plan, which contains very little about the role of research or clinician scientists. This reflects a broader trend over the past 20 years during which participants suggested research has shifted from ‘a core business’ within medicine to a ‘slightly marginalized activity’. Moreover, others noted that while people were willing to ‘pitch in’ and take on additional responsibilities in the context of a national crisis, ensuring that research and engagement remain embedded within clinical roles will likely require job restructuring (and associated administrative and budgetary adjustments) in the post-pandemic period, to ensure that workloads and engagement remain sustainable.

Participants also emphasized the need to continue to work to improve equity and diversity within research, acknowledging that UK research is presently ‘dominated by certain groups and certain individuals’, and that there is presently a lot of talent out there that is not being used optimally. Consequently, there is a need to ensure that the networks built to deliver the aforementioned research objectives are diverse and inclusive. Alongside this, participants argued that we need to ensure access to clinical development plans become less restricted, and to make sure that there are clearer pathways for non-traditional players seeking to advance the development of therapeutics through partnerships with more traditional stakeholders. Participants also noted that under the current framework, it is only the largest pharmaceutical companies which have been able to move fast and generate the packages needed to move novel drugs into new areas where they become available for patients. Meanwhile, small biotech companies which have candidate therapies are currently often unable to access patients in which to test their potential treatments.

Workshop participants also emphasized the need for different models of research going forward, balancing the need to create space for creativity and competition while also improving coordination and cooperation. Hybrid or mixed models were advocated for by some participants, with one citing the example of the NIH rare diseases initiative which funds clinical research networks, coordinating centres, statistical centres, and data monitoring centres to support individual investigators who can apply to test their hypotheses. Funding platforms through services is a model others believed we should consider, while some also argued that charitable or governmental resources may need to be banked prospectively and then applied to hybrid models, so that researchers can quickly identify central resources and access national mechanisms when needed to ‘get stuff done.’ Here, some participants also suggested that we should consider mandating open sharing of data that is generated from projects funded by major public research bodies.

As relevant stakeholders work to implement findings and improve their work based on lessons learned during the pandemic, workshop participants emphasized that there will be a need to make a strong business case to government in order to ensure that therapeutics and research remain a public spending priority. This will need to be accompanied by discussions with the government on how clinical research can be managed alongside the other challenges the NHS will face during the recovery period and while addressing case backlogs.

## **Areas of Interest**

As we look to the future, participants in this workshop suggested we should focus more on the structural work which would help us to pivot and accelerate drug discovery. They also pointed to the possibility of strengthening pillars in areas of technical promise, such as the diverse potential applications of messenger RNA vaccine technology or progress on treating influenza. Participants also emphasized that a moment when there are no emerging infections of concern would be a prime opportunity address questions around infections such as respiratory syncytial virus and influenza, with one participant grimly noting that “we came out of the 2009 pandemic with no new information about treatments for hospitalized patients with influenza, and that’s something we should fix.”

Beyond improving pandemic preparedness, researchers also suggested that some of the lessons learned about the nature of health research during the pandemic – particularly with respect to an energizing ‘focus factor’ which encourages rallying behind a common cause – could be applied to strengthening research into ‘low hanging fruit’ and other public health challenges such as strokes, antibiotic resistance, or dementia. In advancing these research agendas, participants also acknowledged that there will be a need to put forward strong business cases for investment, particularly given the economic constraints governments are likely to face during the post-pandemic recovery period.

Meanwhile, the future of research into therapies for treating Covid-19 and post-Covid-19 syndrome should involve an assessment of the ‘potpourri of different treatments’ developed thus far. Treatments currently in use will need to be compared against one another, de facto combination therapies will need to be assessed to ensure that the combinations are the most appropriate options, and we will need to deepen our understanding of the relative effectiveness of available treatments. Other areas of potential focus may include further research into inflammation, antivirals, and immunology.

## **International Engagement**

The success of the UK’s clinical work, particularly with respect to leadership in trials, offers an opportunity for international leadership. Participants emphasized that the United Kingdom has a good track record internationally for interval trials, vaccines, and drugs. They consequently identified a potential role for the UK as a facilitative broker, trusted convenor, and a potential host country for databases. Participants were less enthusiastic about the possibility of the UK acting as a technical lead in running projects, while suggesting that the country would be well-placed to set standards, while working with partners in federated networks through grassroots partnerships of institutions and people who are bound to a common purpose.

Participants noted that any work by the UK in taking on international leadership in such areas would have to be sensitive to the political tensions of perceived colonialism, data sharing issues, and sensitivities around international trials. With that said, the pandemic has also demonstrated that data sharing internationally can be enormously beneficial, with participants citing the importance of international platforms and the sharing of genomic sequencing data sets throughout the Covid-19 pandemic.

As we go forward in exploring possible future partnerships, workshop participants suggested that there is much which can be learned from industry, which has a long history of running trials across multiple countries.

# 6. Participants

**Chair:**

**Professor Patrick Chinnery**, Chair of the UK COVID-19 Therapeutics Advisory Panel and Clinical Director for the Medical Research Council

**Convenor:**

**Dr Charlotte Summers,** Reader in Intensive Care Medicine, University of Cambridge

**Participants:**

​**Nicola Buckley**, Associate Director, Centre for Science and Policy, University of Cambridge

**Dr Alexander Churchill**, Deputy Director, Therapeutics Taskforce, Department of Health and Social Care

**Dr Rob Doubleday**, Executive Director, Centre for Science and Policy, University of Cambridge

**Dr Adam Heathfield**, Pipeline Excellence, Patient and Health Impact, Pfizer

**Professor Sir Peter Horby**, Professor of Emerging Infectious Diseases, Director, Pandemic Sciences Centre, University of Oxford

**James Hynard**, Head of Pandemics and High-Consequence Infectious Diseases, Department of Health and Social Care

**Dr Sir Michael Jacobs**, Consultant and Hon. Associate Professor of Infectious Diseases, University College London

**Professor Duncan Richards**, Climax Professor of Therapeutic Sciences, University of Oxford

**Dr Estee Torok**, Honorary Senior Visiting Fellow, Department of Medicine, University of Cambridge and Senior Program Officer, Bill and Melinda Gates Foundation

**Dr Mark Toshner**, University Lecturer in Translational Respiratory Research, University of Cambridge

**Dr Joe Watts**, Senior Team Leader, Department for Business Innovation and Skills, Office for Life Sciences

**Dr Colin Wilson**, Deputy Director, Department for Business Innovation and Skills, Office for Life Sciences