



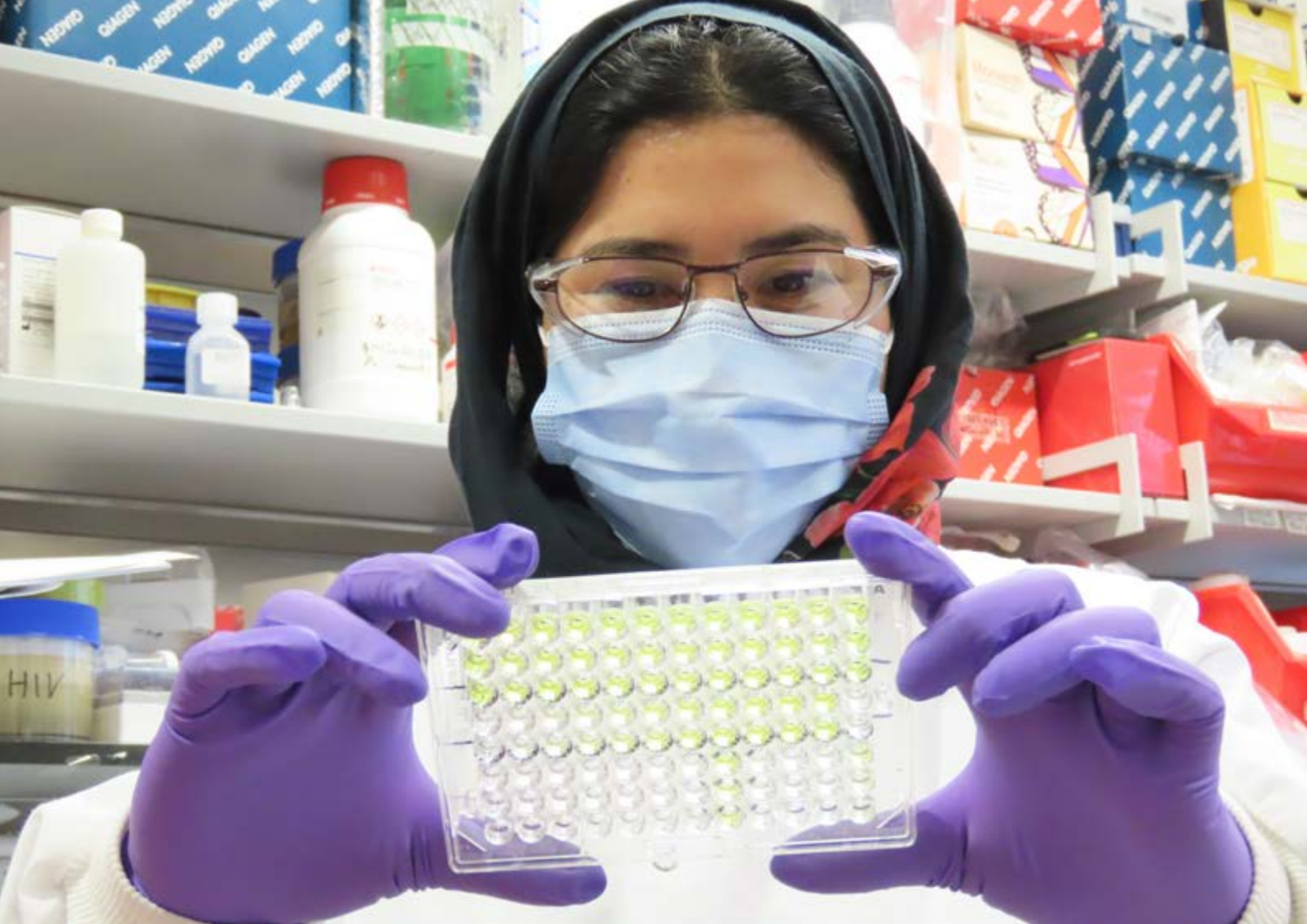
RESEARCH AT THE OUTBREAK OF A PANDEMIC

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Contents

| | |
|--|-----------|
| INTRODUCTION | 4 |
| RESPONDING TO THE EMERGENCY | 6 |
| Mass screening for drug discovery <i>Nicole Zitzmann, Professor of Virology, Department of Biochemistry</i> | 7 |
| Proving that an early COVID treatment didn't work <i>Dr Timothy Hinks, Wellcome Trust Fellow and Honorary Consultant, Experimental Medicine Division, Nuffield Department of Medicine</i> | 8 |
| Creating emergency ventilators for low to middle income countries (LMICs) <i>Mark Thompson, Associate Professor, Department of Engineering Science</i> | 10 |
| ROLLING OUT THE VACCINE | 11 |
| FEATURE: Developing the vaccine <i>Dame Sarah Gilbert, Said Professor of Vaccinology, Jenner Institute, Nuffield Department of Medicine</i> | 12 |
| Clinical trials of the Oxford vaccine <i>Sir Andrew Pollard, Professor of Paediatric Infection and Immunity, and Teresa Lambe OBE, Professor of Vaccinology and Immunology, Oxford Vaccine Group, Department of Paediatrics</i> | 13 |
| Vaccine testing for roll-out in Kenya <i>George Warimwe, Associate Professor, Centre for Tropical Medicine and Global Health, Nuffield Department of Medicine</i> | 15 |
| Scrutinising NHS data to improve patient care and assess vaccine safety <i>Julia Hippisley-Cox, Professor of Clinical Epidemiology and General Practice, Nuffield Department of Primary Care Health Sciences</i> | 16 |
| Assessing whether pregnant women should be vaccinated <i>Aris Papageorghiou, Professor of Fetal Medicine, Nuffield Department of Women's and Reproductive Health</i> | 17 |
| Identifying the reasons for vaccine hesitancy <i>Daniel Freeman, Professor of Clinical Psychology, Department of Psychiatry</i> | 18 |
| TRACKING THE DISEASE | 20 |
| Global clinical data sharing – a huge international collaboration <i>Piero Olliaro, Professor of Poverty Related Infectious Diseases, Centre for Tropical Medicine and Global Health, Nuffield Department of Medicine</i> | 21 |
| Affordable COVID testing in remote rural areas <i>Kevin Baird, Professor of Malariaology, Eijkman Oxford Clinical Research Unit (Indonesia), Nuffield Department of Medicine</i> | 22 |
| Supporting decisions using mathematical modelling <i>Lisa White, Professor of Modelling and Epidemiology, Big Data Institute, Nuffield Department of Medicine</i> | 23 |

| | |
|--|-----------|
| FOCUSING ON FAMILIES | 24 |
| Making impossible conversations possible | 25 |
| <i>Alan Stein, Professor of Child and Adolescent Psychiatry, Department of Psychiatry</i> | |
| Parenting resources to reduce family violence and abuse | 27 |
| <i>Lucie Cluver, Professor of Child and Family Social Work, and Jamie Lachman, Senior Research and Teaching Fellow, Department of Social Policy and Intervention</i> | |
| Surveying school pupils to monitor and improve mental health | 29 |
| <i>Mina Fazel, Professor of Adolescent Psychiatry, Department of Psychiatry</i> | |
| MEETING ONGOING CHALLENGES | 31 |
| Examining the long-term effects of COVID on the lungs | 32 |
| <i>Dr Nick Talbot, Consultant in Respiratory Medicine and Departmental Lecturer, Department of Physiology, Anatomy and Genetics, and Dr Nayia Petousi, Consultant Respiratory Physician and Senior Clinical Research Fellow in Respiratory Medicine, Experimental Medicine Division, Nuffield Department of Medicine</i> | |
| Measuring the immune response and vaccine effectiveness | 33 |
| <i>Paul Klenerman, Professor of Gastroenterology, Experimental Medicine Division, Nuffield Department of Medicine</i> | |
| Studying emerging variants of concern | 34 |
| <i>Gavin Sreaton, Professor of Medicine and Head of the Medical Sciences Division, Wellcome Centre for Human Genetics, Nuffield Department of Medicine</i> | |
| CONCLUSION | 35 |



Introduction

At the outbreak of this extraordinary and ongoing pandemic, you very generously supported our urgent coronavirus research. At a time of great uncertainty and widespread global challenges, you stepped up at a crucial moment to join us in our fight against this terrible disease, putting your faith in our ability to make a real difference in reducing the immense harm caused by COVID-19.

Now that significant progress has been made in this research, we are keen to share some highlights of the important work that has been going on, which was only made possible thanks to funding that you contributed to. The Coronavirus Research Fund has enabled a huge array of multidisciplinary research involving extensive international, national and cross-departmental University collaboration, to an extent that many researchers say would not have been possible anywhere except Oxford.

Applying for research funding is often a lengthy and time-consuming process, but this funding, which was made immediately available, meant that the research projects that were deemed to have the biggest potential impact on mitigating the worst effects of the pandemic could begin straightaway. This in turn enabled Oxford to make some crucial discoveries early on that had huge global impact and significantly helped the international response to this colossal challenge. By contributing to Oxford's Coronavirus Research Fund, you had a hand in enabling all this to happen.

The areas of research have been wide and varied, as many academics across all University divisions put their existing research on hold in early 2020 and immediately pivoted their expertise to focus on the best way they could contribute to the pandemic response.

Through the Coronavirus Research Fund, Oxford was able to provide support for 91 research projects. Included in this overview, we have presented only a sample of the vast amount of work that has been carried out since then, and the important discoveries that have been made.

Starting in January 2020, several experts in the field of emerging infections came together to quickly learn more about this novel virus. It eventually grew to a team of 148 leading scientists, who met online every Wednesday afternoon to discuss new discoveries and ideas, and to challenge one another. These academics, along with thousands of researchers, students and administrators, came together from across the University, allowing for a new level of interdisciplinary work to happen.

In these initial stages, while the world waited for vaccines, scientists began methodically testing a large number of drugs for possible effectiveness against COVID-19. As new drugs take years to develop and test, trialling existing drugs was the quickest way to offer relief to overflowing hospitals and patients who were dying. This saved countless lives. Parallel research crucially proved that drugs that were thought to work, in fact didn't, while in another part of the University, engineers were busy developing emergency ventilators that could be built and used by low-income countries amidst a sudden global shortage, as numbers of hospital patients needing oxygen skyrocketed.

Vaccines were urgently needed, and the Coronavirus Research Fund was vital in helping to fund the early stages of Oxford's COVID-19 Vaccine Trial, giving us the head start we needed to set up and conduct the large-scale multinational trial that would prove our vaccine to be safe and effective for millions of people worldwide – now estimated to have saved over one million lives across the globe. Alongside the roll-out of the vaccine, high-impact research was ongoing to develop specific vaccine advice for certain groups of people: identifying high-risk individuals who should be prioritised for vaccination, advising pregnant women to be vaccinated, encouraging African populations to take up the vaccine, and tackling vaccine hesitancy – all of which crucially informed governments and health policies around the world.

Meanwhile, other researchers were busy tracking the spread of the disease through collaboration with fellow clinicians around the globe, using a clinical

data sharing platform; predicting the outcome of various interventions using mathematical modelling; and finding affordable ways for communities in remote rural areas to test for COVID infection without access to lateral flow tests.

Beyond investigations into the disease itself, important studies were also conducted on the personal, emotional and often damaging impact of lockdowns, school closures and bereavement on families and children, and the extensive toll of the pandemic on mental health, particularly for young people. Important advice and guidance resulted from this research that has provided crucial support for governments, schools, health practitioners, policymakers, families and individuals all over the world.

As the pandemic continues, so does our research. Medical scientists are building on their early work in 2020, where they made detailed analyses of the properties of SARS-CoV-2, examining how it enters our system and how our immune response reacts, and looking for ways to reduce contagion and the damage it does, and to find new treatments to save lives. Long COVID is a major public health challenge affecting millions of people around the world. Oxford academics who also work as clinical doctors treating patients at the Oxford University Hospitals NHS Foundation Trust have been assessing the long-term effects of COVID-19 on the lungs, and the dual roles of these researchers are essential in ensuring that medical research and practice directly inform one another for immediate impact. Research is also ongoing into new variants of concern and the next generation of vaccines that may be needed to keep ourselves protected in the months and years ahead.

The incredible amount of valuable knowledge gained, and the tremendous impact that much of it has already had on the world, is testament to the extraordinary success of Oxford's Coronavirus Research Fund, to which you very generously contributed at such an important moment in history. We hope you enjoy reading the journeys and experiences of a few of the researchers whose work you helped to fund.

RESPONDING TO THE EMERGENCY



Mass screening for drug discovery

NICOLE ZITZMANN, PROFESSOR OF VIROLOGY
DEPARTMENT OF BIOCHEMISTRY



Research findings

In a pandemic there is little time to start drug development from scratch, and we took the decision early on to prioritise the screening of already approved drugs that could be repurposed and deployed immediately if shown to be effective against SARS-CoV-2 in our cellular antiviral screen.

We also decided to make any screening information immediately available via our SARS-CoV-2 Cellular Tracker webpage to prevent worldwide scarce resources being wasted on having to repeat experiments elsewhere. On this webpage we reported our own screening results and collected published information from anywhere in the world to report it in a single place as a useful tool for other researchers.

We screened 271 drugs ourselves and reported 1,545 results from elsewhere. We were in close liaison with clinical committees throughout this time and helped de-select, more than select, many compounds that were considered for COVID-19 human trials. We also reported potentially pro-viral compounds. In time, we had the bandwidth to also screen not yet approved drug compounds, and help develop a targeted SARS-CoV-2 main protease inhibitor drug as part of the COVID Moonshot project, a spontaneous global collaboration that came together to design a new, urgent antiviral treatment.

Personal experience of working through the pandemic

I was grateful that my and my group's expertise was needed and we could work throughout lockdown. We are indebted to everyone in the University who made this possible. Many people in decision-making positions and administration had to work very hard to enable so much important research to continue under such difficult circumstances. Having something meaningful to do and being able to contribute in a crisis also helped the mental wellbeing, to some extent, of group members and myself.

It also meant working full and often hectic days and long nights, being exhausted almost all the time, feeling helpless and frustrated that some things could not

be sped up further, and feeling overwhelmed by our unpreparedness in the face of a predictable and often-predicted pandemic, something that I hope Oxford will be instrumental in addressing ahead of future pandemics. I feel grateful for, and proud of, my research group, who pulled together and worked way beyond what anyone could have expected, and who were there for each other in these challenging times.

Working at Oxford

Setting up the antiviral screening arm of the COVID core facility in the Dunn School and later the Medawar building was no doubt an effort of many individuals and groups who gave of their time and expertise generously and selflessly, many on a voluntary basis for free and for prolonged periods of time in the midst of the lockdown, and with other difficulties weighing on their minds. This virus focused everyone's minds; people were thinking how their particular expertise might be useful and could be used to contribute to finding solutions that were needed on many different levels.

There are too many people within Oxford to mention who generously helped with their time, expertise and funding, Oxford being one of these few places where anything and anyone you could ever need is right at your door-step; people can be contacted informally and are usually quick to respond, and tend to go out of their way to help.

Funding impact

The first Coronavirus Research Fund grant enabled us to buy all the drugs we wanted to initially screen against this virus, and to set up the antiviral screening facility with all the personal protective equipment (PPE), consumables and other equipment needed. This uncomplicated and early funding was crucial in getting off to the necessary quick start. It then attracted several follow-up internal Coronavirus Research Fund grants also with collaborators.



Proving that an early COVID treatment didn't work

DR TIMOTHY HINKS, WELLCOME TRUST FELLOW AND HONORARY CONSULTANT
EXPERIMENTAL MEDICINE DIVISION, NUFFIELD DEPARTMENT OF MEDICINE

Research findings

Early in the pandemic, based on computer simulations and laboratory tests, it was believed that an antibiotic called azithromycin might be an effective treatment for COVID-19. This received widespread attention, and only a randomised clinical trial would tell if it really worked.

Our team ran the ATOMIC2 multi-centre randomised trial of azithromycin in COVID-19 at 20 hospitals

across England, Scotland and Wales. The trial clearly showed that, despite the promising background data, this drug had no benefit in clinical practice in reducing hospital admissions or severe illness with respiratory failure. Our findings are consistent with two other much larger trials from Oxford, which looked at different groups of people: those with severe disease (RECOVERY) and those with very early disease (PRINCIPLE). Our study was unique in focusing on mild to moderate disease in younger people.

This is a really important finding because across the globe this drug is being very widely used by clinicians hoping to treat the pandemic, and yet the medicine is not effective and there is a serious risk of unnecessarily inducing drug resistance to this essential antibiotic. It is recognised by the World Health Organization as a critical medicine for any healthcare system because of its powerful antibiotic effects against bacterial pneumonias, sexually transmitted diseases, preventable causes of blindness and drug-resistant tuberculosis. We hope our findings will help restrict its indiscriminate use and protect this precious medicine for future generations.

Furthermore these findings will also matter for other future pandemics. Already the medicine has been used for SARS and for the MERS-CoV pandemics, but without a trial: now we have the data suggesting this medicine should not be used for viral pandemics in general.

Personal experience of working through the pandemic

It's been busy but exciting. Everyone has done their bit. Early on I was on the wards as a clinician admitting many patients with severe and often, sadly, untreatable COVID. This was tough. There has been great camaraderie amongst the hospital staff. As soon as the ward round was over I was able to work on the trial protocol and set-up, with support from my junior colleagues. In wave 2, I worked on a high dependency unit. My lab remained open all year to work on COVID work. It's been a privilege to work with scientists producing high-quality science at breakneck speed.

Working at Oxford

It is no overstatement to say that the environment in Oxford is unique. I am a respiratory physician and immunologist with an active research interest in azithromycin, but had never led a clinical trial before. However, with just a good idea I was able to design a protocol in days with support from several of the country's most experienced clinical trialists. The trials unit worked seven days a week, flat out, to prepare the regulatory submissions, the statistical support and the contracts, and sourcing the medications in record time. The University as sponsor accepted legal responsibilities and turned round a wave of similar trial applications within a few weeks to set up a whole portfolio of COVID studies.

This capacity with no fewer than five dedicated trials units and a large and proactive research and development department, along with willing, capable and enthusiastic research nurses and principal investigators, make it feel that anything is possible here.

Funding impact

This funding was absolutely essential, and without it the trial would simply not have been possible. The nature of the pandemic meant very rapid action was required to set up studies quickly. We received some initial start-up money from the department, but we had to find all further funding. The funding from the philanthropic Coronavirus Research Fund was sufficient to fund half the cost of the trial, and because it was rapidly available this was sufficient to convince a manufacturer of the drug (Pfizer) to match the funds we needed to complete the trial and to provide us with the medications free of charge. The funding was totally transformative, and this has proved to be a highly cost-effective study.

Creating emergency ventilators for low to middle income countries (LMICs)

MARK THOMPSON, ASSOCIATE PROFESSOR
DEPARTMENT OF ENGINEERING SCIENCE



Research findings

The emergency requirement for ventilators in the UK in March 2020 drove a fast-paced response from a team of engineers and medics at Oxford and King's College London, and we produced a bench-top model within a week. In partnership with Smith & Nephew on the UK Ventilator Challenge, we identified how much additional work was required to enable approval by a regulator and manufacture at scale. When the government terminated OxVent, as the UK fortunately had no requirement for emergency ventilators, we pivoted to address the huge international need for low-cost ventilators for COVID-19 and beyond.

Our impact has been to create a new social venture spin-out, OxVent Limited, which has as its social mission to enhance health system resilience through the deployment and support of low-cost ventilators in low to middle income countries (LMICs). A deal signed with an Indian manufacturer was part of the UK government's May 2021 announcement of trade with India, and the venture is actively seeking partners in Central and South America, South East Asia and Africa, where it has made its first sale of a demonstrator model in Nairobi.

Personal experience of working through the pandemic

The OxVent experience has been an intense and hugely rewarding one with many high points. At a time when so many experienced loss of their normal work, it was a huge privilege to be able to put energy into a project with such a tangible, important and immediate impact, alongside so many talented and can-do academics and students.

Working at Oxford

OxVent has been and continues to be an outstanding collaborative effort, involving not only multiple departments and divisions but also Biomedical Engineering at King's College London. The personal connections, which are uniquely fostered by the collegiate University, were vital in allowing a team,

built from scratch, to assemble and operate at pace with a high level of trust and shared vision. The outstanding quality, dedication and enthusiasm of Oxford students was also central to the team's success, both technically and in leadership.

The Oxford name was essential in the early stages of building support and maintaining a profile as part of the UK Ventilator Challenge. Oxford University Innovation offered superb support through the processes of intellectual property packaging and spin-out using their new model of social venture. The University press office were highly responsive and helpful. I am very grateful for the sabbatical leave that I was granted for the 2019–2020 academic year and for all the support from the Department of Engineering Science and from the Mathematical, Physical and Life Sciences Division.

Funding impact

The Coronavirus Research Fund funding came at a critical moment immediately after the withdrawal of direct government funding, enabling work to continue. The ventilator had been tested independently against the emergency ventilator specification of the Medicines and Healthcare products Regulatory Agency, and it performed well, but due to the loss of status as a government project, OxVent was not permitted formally to complete the test.

The funding allowed us to complete the testing of the ventilator, on the bench, in simulation suites and *in vivo*. It supported an expert regulatory scientist who assembled and submitted the case for approval to the Food and Drug Administration (FDA) for Emergency Use Authorisation. There were many complex interlocking processes to keep running, since the application to the FDA had to be submitted by the new spin-out. The transfer of the design and manufacturing information from Smith & Nephew was a key aspect, and the funding allowed for a smooth and timely transition.



COVID-19
Coronavirus
Vaccine

08/15-2020-290v217

Corona
Vacc

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COVID-19

Coronavirus
Vaccine

SARS-CoV-2

COVID-19

Coronavirus
Vaccine

08/15-2020-290v217

SARS-CoV-2

COVID-19

Coronavirus

08/15-2020-290v217

Developing the vaccine

DAME SARAH GILBERT, SAÏD PROFESSOR OF VACCINOLOGY
JENNER INSTITUTE, NUFFIELD DEPARTMENT OF MEDICINE



In early 2020, in response to reports of a new coronavirus outbreak in Wuhan, China, Jenner Institute scientists rapidly generated a candidate vaccine at the institute's viral vector core facility. This was based on a chimpanzee adenovirus vector developed over ten years earlier at the institute and previously assessed clinically for several infectious diseases. With strong support from the UK government and many generous donors, the programme moved quickly to GMP manufacture in March and then started overlapping phase I, II and III trials in April.

We were able to persuade the Serum Institute of India to partner with Oxford on this programme in March, and we then identified AstraZeneca as a suitable large pharma partner in April. We introduced the programme to them in mid-April and agreed an unusual rapid global plan to make the vaccine available at cost should the vaccine trials be successful. Initial efficacy results were announced in November and we published our phase III trial results, including 25,000 subjects, in a peer-reviewed journal in December, the first vaccine programme to publish peer-reviewed results. The vaccine was licensed in several countries by the year end, and in over 180 countries to date, by far the world's most widely distributed vaccine.

This wide distribution and large-scale supply was enabled by an early understanding of the scale of

the required manufacturing challenge in March 2020, with seven companies from five countries engaged that month, and from May this distributed manufacturing model was further expanded to 20 sites in 15 countries by AstraZeneca. By September 2021 over 1.3 billion doses had been manufactured and distributed, and this vaccine is the major one distributed by the important COVAX facility targeting equitable supply in all countries regardless of income level.

Clinical trial work continues in Oxford, developing vaccines for other coronavirus strains; establishing a human challenge model; and assessing heterologous prime-boost immunisation regimens and booster doses, as well as a new (intranasal) route of immunisation. By the end of 2021 over 2 billion doses were made, and manufacturing has continued into 2022.

This remarkable effort has achieved widespread recognition, and has been part of a successful larger effort at Oxford embracing assessment of drug treatments (e.g. the RECOVERY trial) and non-pharmaceutical interventions, extensive viral genotyping, immunology, epidemiology and impact assessments. These efforts have now coalesced into an exciting new Pandemic Sciences Institute, which will ensure that the University is even better placed to help predict, tackle and prevent future outbreaks.





Clinical trials of the Oxford vaccine

SIR ANDREW POLLARD, PROFESSOR OF PAEDIATRIC INFECTION AND IMMUNITY,
AND TERESA LAMBE OBE, CALLEVA HEAD OF IMMUNOLOGY AND PROFESSOR OF
VACCINOLOGY AND IMMUNOLOGY
OXFORD VACCINE GROUP, DEPARTMENT OF PAEDIATRICS

Research findings

The initiation of clinical trials of the Oxford–AstraZeneca vaccine, ChAdOx1 nCoV-19, on 23 April 2020 – and rapid progress to a large-scale evaluation programme with more than 24,000 volunteers enrolled across three continents, in the UK, Brazil, Kenya and South Africa – was a

huge milestone in clinical research for the Medical Sciences Division in the University.

The vaccine is now licensed in approximately 180 countries with more than 3 billion doses distributed globally.

In the UK, tens of thousands of lives were saved, and hundreds of thousands of hospital admissions prevented due to the vaccination rollout. Recent estimates indicate that millions of lives were saved globally.

Personal experience of working through the pandemic

In many ways, it has been business as usual. Yet the pace, scale, intense scrutiny and unworldliness of working in a pandemic, has dramatically enhanced the 'experience'... it has been relentless and exhausting. Speaking with colleagues, this is a sentiment shared across the team.

Working at Oxford

This has been a huge global team effort, and we are fortunate to have a remarkable infrastructure both within the UK and globally that made this possible.

Behind the headlines has been a talented team of hundreds of clinical, scientific and support staff. Each person has worked tirelessly to make the vaccine, build the databases, book thousands of appointments for volunteers, work out the logistics of running a socially distanced research clinic in a pandemic, run tens of thousands of clinic visits, and process hundreds of thousands of blood samples – and they have done all of this to try and help us out of the pandemic, doing their best to progress this vaccine through the rigorous hurdles needed before it could be rolled out.

Across the University, and both the John Radcliffe and Churchill hospitals, many colleagues made themselves available at short notice to swell the numbers to work in the three busy vaccine clinics that popped up in Oxford – especially the doctors and nurses who worked with our trial volunteers. And we were able to build a research infrastructure across the NHS with 19 research teams to deliver the phase III programme across the UK.

The administrative staff of the University have been hugely supportive of our endeavours, with extraordinary and heroic efforts from teams in research services, divisional and departmental administration, building managers and the news and communications teams who have dealt with a deluge of additional work.

Funding impact

The rapid funding underpinned the infrastructure in the clinical laboratory needed to make this happen. It enabled us to purchase pieces of equipment and consumables that allowed us to deliver the clinical trials and to test the immunology of the vaccine. We have furthermore been able to fund the posts of key personnel, without whom the critical lab testing and logistical delivery of a clinical trial of this size would not have been possible.

On a small side note, additional funding also provided healthy food (breakfast/lunch/dinner) to the team, which allowed us to work knowing we were 'looked after' in that way – we didn't need to worry about sourcing food when we were in the lab – very important when canteens/restaurants were shut on-site!



Vaccine testing for roll-out in Kenya

BY GEORGE WARIMWE, ASSOCIATE PROFESSOR
CENTRE FOR TROPICAL MEDICINE AND GLOBAL HEALTH, NUFFIELD DEPARTMENT OF MEDICINE

Research findings

We found that the ChAdOx1 nCoV-19 vaccine was safe among adults in Kenya, where SARS-CoV-2 had spread widely. These data provided confidence in the national roll-out of the vaccine by the national Ministry of Health, and our research remains one of the most comprehensive COVID-19 seroepidemiological programmes in Africa to date.

Personal experience of working through the pandemic

The pandemic has been physically, emotionally and mentally draining. However, we have done our best and provided useful information to guide decisions by the national pandemic response team in Kenya.

Working at Oxford

The multidisciplinary collaboration supported by the award, together with the frequent meetings with

investigators at other global sites evaluating the same vaccine, have allowed sharing of experiences between sites and developing solutions for any emerging issues. As part of the collaboration, we have been able to further harmonise immunological assays, providing confidence in any assessments done on samples from the trials and other work, such as serosurveillance (monitoring levels of antibodies in the population) in Kenya.

Funding impact

The funding allowed us to begin study activities in a timely manner, and we were able to leverage this support to obtain further funding to support the implementation of the trial and conduct research on vaccine confidence in Kenya.

Scrutinising NHS data to improve patient care and assess vaccine safety

JULIA HIPPISEY-COX, PROFESSOR OF CLINICAL EPIDEMIOLOGY AND GENERAL PRACTICE

NUFFIELD DEPARTMENT OF PRIMARY CARE HEALTH SCIENCES



Research findings

We created a uniquely valuable record linkage database to support multiple research projects, which we have extended over time to include GP data, hospital data, mortality data, cancer registry data, vaccination data, transplant data, SARS-CoV-2 test results and intensive care data.

We created a Risk Stratification tool, which was in use in England in February 2021, and led to nationwide improvements in patient safety. We identified 1.5 million high risk individuals for addition to the Shielded Patient List, and 820,000 people were offered the vaccine earlier as a result. We met the highest standards of assurance for patient safety. This was the first known precision public health intervention of this nature in the world, leveraging the unique power of NHS data. It relieved the burden on the healthcare system at a time of intense pressure.

Our accompanying NHS Risk Assessment clinical tool enabled personalised care discussions. We developed, validated and implemented this new tool to help clinicians better understand how at risk a person might be of catching coronavirus and being admitted to hospital or dying with COVID-19, and how to communicate their treatment decisions with patients.

We also conducted the first study to predict risk of COVID-19 vaccine failure resulting in serious outcomes (death and hospital admission), which enables targeting of interventions to reduce risk, such as monoclonal antibodies and booster jabs.

We published the largest study on COVID-19 vaccine safety covering 29 million people having either AstraZenca or Pfizer vaccines. We looked at hospital admission or deaths due to vaccination with 28 days of the vaccine, and found that the risk of blood clots was much higher in people who caught COVID-19 than in those who had the vaccine.

Personal experience of working through the pandemic
Excellent – exhausting but very rewarding.

Working at Oxford

One word – fantastic. I had only been in Oxford for 12 months when the pandemic started, and it rapidly brought me into contact with some of the world's best scientists, with whom I have been able to work at pace and at scale.

Funding impact

We were able to start work immediately. Due to the project's success, we published high-impact papers and won several national awards.

Assessing whether pregnant women should be vaccinated

ARIS PAPAGEORGHIOU, PROFESSOR OF FETAL MEDICINE
NUFFIELD DEPARTMENT OF WOMEN'S AND REPRODUCTIVE HEALTH



Research findings

Does COVID-19 in pregnancy alter the risks of adverse maternal and neonatal outcomes when compared with pregnant women without the disease? In other words, should pregnant women constitute a high-risk group? To answer this, we rapidly undertook a very large, prospective international study involving 43 hospitals in 18 countries.

We found that, compared with women without the disease, women with COVID-19 in pregnancy had a marked increase in maternal morbidity and mortality. Maternal mortality was 1.5%, 20 times higher than amongst uninfected women, and there were increases in intensive care unit admission, preeclampsia, preterm birth and low birthweight. Newborns of infected women also had higher severe neonatal and perinatal morbidity and mortality, including intensive care stays. The good news was that PCR-positive women who were asymptomatic had similar outcomes to uninfected women, though of course it is not possible to know before infection whether one will be symptomatic or not. Finally, the study gave important safety data for normal birth and breastfeeding.

Our study was widely reported in the press, social media, radio and television, including high-profile pieces in the *Daily Telegraph*, *New York Times* and *Woman's Hour* (BBC). Thus, the message reached many pregnant individuals, highlighting the importance of taking precautions to avoid infection during pregnancy. The findings that COVID-19 in pregnancy carries major risks (with data emerging at the same time demonstrating vaccine safety) resulted in a 'tipping of the balance' in favour of vaccination.

Our study directly influenced national policies in a number of countries to prioritise (or to remove restrictions on) pregnant women becoming vaccinated. The US Centre for Disease Control (CDC), for example, used our results as evidence for prioritising pregnant women for COVID-19 vaccination.

Personal experience of working through the pandemic
Although I was already well versed in remote meetings

due to my global work, the inability to interact in person with the research team was initially difficult. However, we rapidly adjusted to this way of work, and focusing research on the effects of COVID-19 in pregnancy in this large international cohort study, through tireless work and many late nights, cemented collaborations and friendships.

Working at Oxford

The study was only possible due to the existing research infrastructure of the University, and in particular the INTERGROWTH-21st consortium (a global network of researchers and clinicians coordinated by Oxford, committed to improving worldwide fetal and newborn health and reducing preventable deaths). This was critical in enabling researchers worldwide to implement this urgent initiative in record time, and their commitment to the study was remarkable.

As an experienced researcher, it was humbling for me to see how all the cogs of Oxford University ran with incredible efficiency, ensuring that all undertakings – from highly robust ethical reviews to contractual arrangements with collaborators – were completed within days. This allowed us to recruit our first patient within days of the COVID-19 outbreak being labelled a pandemic by the World Health Organization.

Funding impact

This funding made an enormous difference. It allowed us to set up and coordinate a major international multicentre prospective cohort study in days rather than months. Specifically, the funding allowed us to mobilise existing collaborating units to shift their research efforts to this study; recruit new research units; create a sophisticated, centralised online data management system that allowed real-time quality control and data analysis; and efficiently run a 'command and control' centre that allowed the study to go from conceptualisation to execution, through to rapid data analysis and effective dissemination, and quickly influencing policy.



Identifying the reasons for vaccine hesitancy

DANIEL FREEMAN, PROFESSOR OF CLINICAL PSYCHOLOGY
DEPARTMENT OF PSYCHIATRY

Research findings

We showed the causes of vaccine hesitancy and which messaging may help reduce it. The rapid development and testing of COVID-19 vaccines has been an extraordinary scientific undertaking. What happens now is just as important: we have to ensure that people actually take those vaccines. The practical challenges of manufacturing and dispensing millions of doses worldwide are of course immense, but we also have to deal with the issue of vaccine hesitancy: the belief that a vaccine may be unnecessary, ineffective or unsafe (and perhaps all three). Unsurprisingly, individuals with these kinds of views may be reluctant to take a vaccine; they may even refuse it outright.

First, in the Oxford Coronavirus Explanations, Attitudes, and Narratives Survey (OCEANS), we aimed to determine why people are hesitant. We showed that what matters most is the way people think about a number of key issues relating to a COVID-19 vaccine, specifically: the potential collective benefit; the likelihood of COVID-19 infection; the effectiveness of a vaccine; its side effects; and the speed of vaccine development. Those who are hesitant about a COVID-19 vaccine tend to be people who aren't aware of, or especially interested in, the public health aspects of a vaccine; who don't consider themselves at significant risk of illness; and/or who doubt the efficacy of a vaccine, worry about potential side effects, or fear that it's been developed too quickly.

Vaccine scepticism, our data suggest, is linked to a wider crisis of trust. People who are vaccine hesitant are more likely to be mistrustful of doctors, hold conspiracy beliefs, and have little or no faith in institutions. They can also feel like they are of lower social status compared with others. What we see here is a combination of vulnerability and distrust of those in authority. That manifests itself in defensiveness. Unwilling to be experimented upon by people who are perceived as not caring about their wellbeing, they avoid vaccination.

Second, equipped with these insights, we tested whether we could craft messages that might shift negative attitudes to COVID-19 vaccination. For the sceptical 10%, we found that the text that was most likely to change minds emphasised not the collective but the personal benefits of vaccination. It pointed out that you can't be sure, even if you're relatively young and fit, that you won't get seriously ill or struggle with long-term COVID-related problems. And that vaccination will minimise your chances of falling ill with COVID-19. If you think vaccines may be very unsafe then you will be worried about what getting the jab will do to you. The decision-making process becomes dominated by concerns about personal risk.

We showed that the best way to counter these concerns, therefore, is to highlight the opposite: personal benefits. It is also likely to be the case that people who feel that society does not care about them are less likely to be receptive to messaging that relies for its effectiveness on a sense of belonging. Almost by definition then, for this group, messages that focus on the personal ramifications of COVID-19 are likely to be much more compelling.

Third, we also showed the contributory role of fear of needles to vaccine hesitancy. A quarter of the UK adult population screened positive for a potential blood-injury-injection phobia. Strikingly, these individuals were twice as likely to report that they were COVID-19 vaccine hesitant – that is, they would put off getting vaccinated or indeed never get the jab. In fact, if we could wave a magic wand and rid people of their injection anxiety, just over 10% of instances of vaccine hesitancy might disappear too.

Personal experience of working through the pandemic

My main research area is understanding and developing psychological treatment for paranoia.

This expertise has proved absolutely invaluable in addressing vaccine hesitancy. Therefore it has felt really worthwhile to be able to contribute.

Working at Oxford

We were able to put together a multidisciplinary team like no other for this research endeavour, comprising world-leading psychologists, virologists developing the COVID-19 vaccine, statisticians, political scientists, philosophers and methodologists. Everyone pitched in on a topic that is of obvious importance. It has been a pleasure to work on vital research with dedicated colleagues.

Funding impact

Timing is everything in the pandemic, including psychological responses. We were able to show in the first few weeks of the pandemic the corrosive influence of coronavirus conspiracy beliefs. Then, before the vaccination programme began, we determined the causes of vaccine hesitancy. This enabled us to demonstrate the messaging that could improve vaccine acceptance rates. The rapid funding was accessible in a way that no other funding was for vaccine hesitancy. Our work could not have happened without it.



Global clinical data sharing – a huge international collaboration

PIERO OLLIARO, PROFESSOR OF POVERTY RELATED INFECTIOUS DISEASES

CENTRE FOR TROPICAL MEDICINE AND GLOBAL HEALTH, NUFFIELD DEPARTMENT OF MEDICINE



Research findings

The International Severe Acute Respiratory and emerging Infection Consortium (ISARIC), whose Global Support Centre is currently hosted by Oxford, offers an international platform for researchers and clinicians to share data on patients with severe acute respiratory conditions and emerging infections. In January 2020 it launched standardised clinical data collection on COVID-19. At the point of applying for funding, the ISARIC COVID-19 clinical data platform included data on 25,000 individuals from 245 sites across 30 countries.

The rapid funding enabled the project to secure the continuation and growth of this global data hub, which now includes over 800,000 acute records for hospitalised patients (more than half from LMICs), and 19,000 follow-up records (40% from LMICs) from 1,650 sites (52% in LMICs) across 60 countries (45% LMICs). We have also been able to expand the database infrastructure to integrate new types of data from non-standard sources, and support the science to generate real-time evidence that informs clinical decision-making and public health response.

The results of these analyses are some of the most globally representative evidence currently available. As of March 2022, more than 50 novel analyses are underway or have been completed by researchers across ISARIC's global network. Sixteen public reports have summarised this evidence for the clinical and public health community, and all results are published under collective authorship involving hundreds of authors.

Personal experience of working through the pandemic

At the same time as being hugely challenging, relying solely on virtual meetings for our overseas projects, it has also been incredibly rewarding. The success of the ISARIC COVID-19 clinical data platform is a significant highlight. For 10 years ISARIC has been championing pre-prepared research tools, global collaboration and research-ready clinical networks.

The value of the ISARIC network was demonstrated throughout that decade but most acutely during 2020–2021.

Working at Oxford

The project enabled the strengthening of existing collaborations within the Centre for Tropical Medicine and Global Health, in particular with the Infectious Diseases Data Observatory. Importantly, we also embarked on new collaborations with the Big Data Institute, also within the Nuffield Department of Medicine. However, the expansion of collaborations to other parts of the Medical Sciences Division, including the Nuffield Department of Population Health, helped to reinforce the common purpose behind research at Oxford.

We have also recognised the achievement of shared goals through cross-divisional collaborations on a project of this magnitude, and are exploring collaborations with the Computational Health Informatics Group in the Department of Engineering Science and the Department of Zoology, both of which are in the Mathematical, Physical and Life Sciences Division.

We would also like to recognise the global nature of this pioneering collaboration on pandemic research response, made possible through the work of a massive international collaboration contributing data to this project.

Funding impact

The evidence generated from the ISARIC COVID-19 clinical data platform has been used to inform patient care and the public health response. Such was the success of the project that there is now interest from external sources to support the ongoing development of the data platform.

A portrait of Kevin Baird, a middle-aged man with short grey hair and glasses, wearing a light blue button-down shirt. He is looking slightly to the right of the camera with a gentle smile. The background is a blurred indoor setting with a window.

Affordable COVID-19 testing in remote rural areas

KEVIN BAIRD, PROFESSOR OF MALARIOLOGY

EIJKMAN OXFORD CLINICAL RESEARCH UNIT (INDONESIA), NUFFIELD DEPARTMENT OF MEDICINE

Research findings

We explored alternative laboratory methods to standard PCR testing for COVID-19 diagnosis in acutely ill patients seeking care at a hospital in rural Sumba Island in resource-limited south-eastern Indonesia. We found that a relatively simple and inexpensive loop-mediated isothermal amplification (LAMP) procedure performed acceptably well compared with PCR standard. We also demonstrated that a simple saliva sample performed acceptably well compared with the standard throat and nose swab sample.

The project established diagnostic testing for COVID-19 at this hospital, where prior to that samples had to be flown to faraway laboratories at great cost with wait times counted in weeks. This study provided local physicians and the health authorities with firm evidence of COVID-19 infection and transmission.

Personal experience of working through the pandemic

I have never worked harder, nor been forced to be more adaptive, than I have in working through the pandemic. It is at once thrilling and exhausting. Vitaly important work, but undertaken under the most difficult conditions of restricted movement, interactions and access to both colleagues and study subjects. The

challenge of discovery of sustainable methods and schedules of work and family has been quite difficult.

Working at Oxford

I have long worked at Oxford, albeit in Indonesia, and have always found the University to be highly supportive and accommodating of research endeavours.

Funding impact

The rapid funding made all the difference with respect to rendering diagnostic aid when it was most needed at this remote location (that is, soon after the onset of the epidemic in Indonesia), and before any certain knowledge of its presence in the local population at the study site.

By my lights, a study like this – impossible to fund by conventional means because the window of opportunity closes far too rapidly – illustrates the crucial and sometimes strategic advantage of very rapid project funding. This may be one of the lessons COVID-19 teaches us: that research in a crisis is exactly that, with vital intelligence to learn in real time, rather than in increments over years of deliberate and carefully vetted work.

Supporting decisions using mathematical modelling

LISA WHITE, PROFESSOR OF MODELLING AND EPIDEMIOLOGY
BIG DATA INSTITUTE, NUFFIELD DEPARTMENT OF MEDICINE



Research findings

Our key discovery is that mathematical modelling can be conducted pragmatically, rapidly and on a global scale with equitable partnerships, even during a pandemic, with full research leadership remaining in the hands of national experts.

The impact of the COVID-19 International Modelling (CoMo) Consortium has been the nationally contextualised support of COVID-19 decision-making in 50 countries spanning five continents, with CoMo modellers often working directly with ministers of health and in some cases with heads of state. We brought together existing capacity and supported the inception of new modelling groups, and as a consortium we have predicted the health and economic impact of multiple COVID-19 interventions, including vaccination, treatment and non-pharmaceutical interventions. In parallel with our policy and research work, we have delivered an extensive training and transfer of knowledge programme.

Personal experience of working through the pandemic

My personal journey through the pandemic has been an intellectual and emotional marathon. Necessity is the mother of invention, and the challenges of finding mathematical solutions to urgent COVID-19 questions have been met with an intensity of focus I have never previously experienced. The CoMo Consortium has proven my long-held assertion that equitable global health modelling is not only possible but is capable of immediate and high impact.

Leading the consortium has introduced me to a broader group of modellers worldwide with whom to collaborate. I have gained important insights into how the pandemic has unfolded in different countries and how the delicate balance between harm from the disease and harm from interventions to control the disease has been negotiated in different epidemiological and socio-economic settings.

The unintended impacts of interventions to tackle COVID-19 have been difficult to witness and impossible to completely avoid, even with the context-

specific approaches supported by the consortium. There is no zero-harm way out of this pandemic, and seeing the human cost of decisions made has been the hardest part of this work.

Working at Oxford

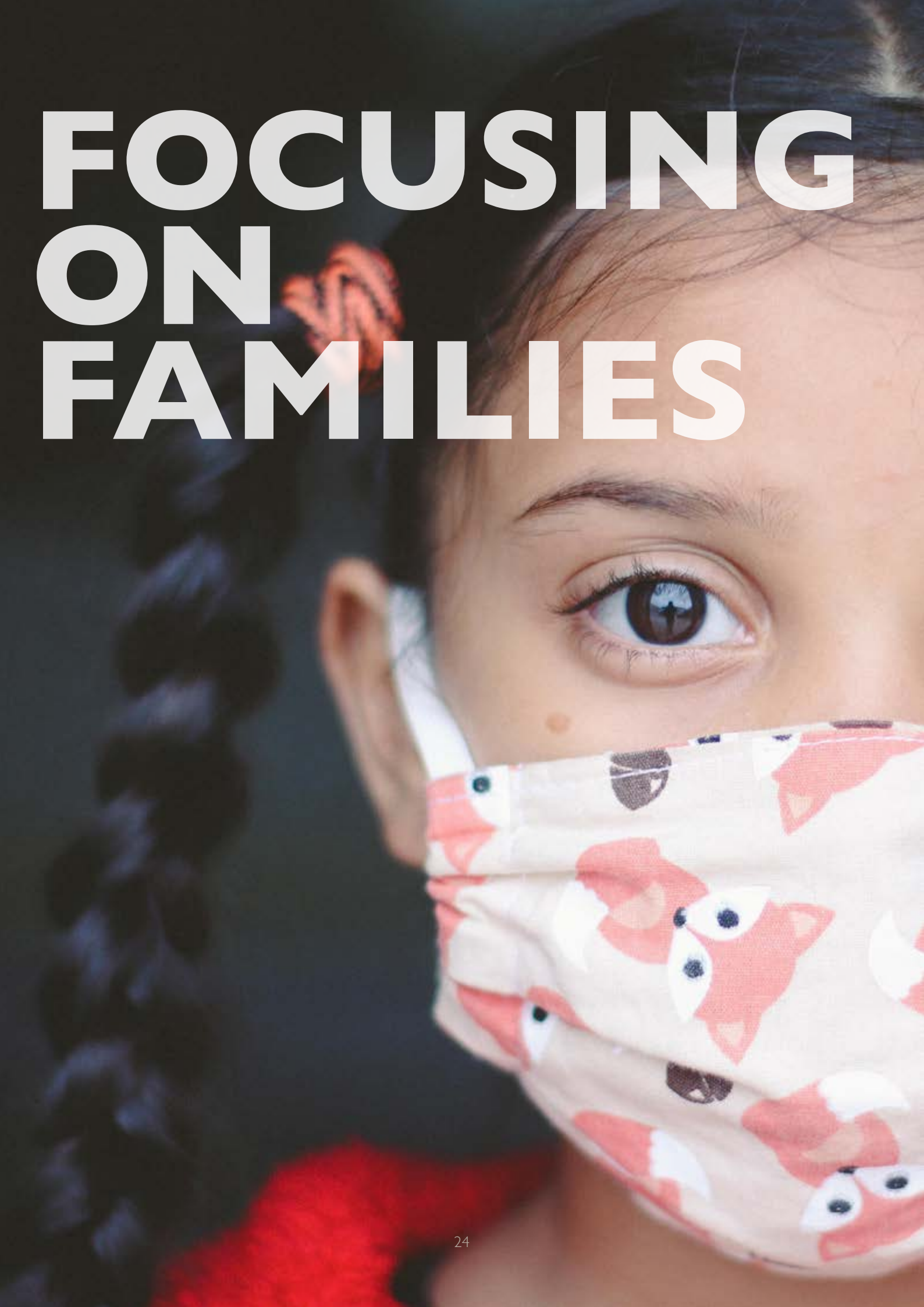
There has been a world-leading interdisciplinary response to the pandemic at Oxford. In terms of translating clinical trial results into global policy, our group has collaborated with the RECOVERY group (focusing on severe cases of COVID-19) and the PRINCIPLE group (focusing on early stages of the disease) on treatment, and the Oxford Vaccine Group and the Clinical Informatics and Health Outcomes Research Group on vaccination. We have benefitted from cutting-edge technical expertise within the Computational Biology group of the Engineering Department and students of their excellent doctoral training programme. We have received significant support from the director of the MSc in International Health and Tropical Medicine, and students and alumni of this MSc have been active members of the consortium, proving highly effective in translating research into policy.

The Oxford affiliation has been extremely useful to our LMIC partners. The association with Oxford has provided credibility when establishing channels of communication with policymakers and other stakeholders, both nationally and internationally.

Funding impact

The CoMo Consortium would have ceased to exist at the time when it was needed most without the rapid funding we received. We started the consortium on a purely voluntary basis in March 2020 and adhere to the principle of a fully equitable partnership with modellers from the Global South, prioritising rapid, practical support over academic fundraising and publishing. This novel approach to conducting global health modelling research is unfamiliar to conventional academic funders; therefore, we would not have secured funding through standard routes rapidly enough to be effective within the pandemic time frame.

FOCUSING ON FAMILIES



Making impossible conversations possible

ALAN STEIN, PROFESSOR OF CHILD AND ADOLESCENT PSYCHIATRY
DEPARTMENT OF PSYCHIATRY



Research findings

COVID-19 has brought the threat of serious illness to every household across the globe. Millions of families have had the painful task of attempting to explain to children that someone they love is ill or has died. Adults understandably want to protect children from distress, and are often unsure about how and when to talk to children. This means that these conversations are frequently avoided. Our previous work, prior to the pandemic, focused on how healthcare staff can support adult patients thinking about sharing a diagnosis with their children. This matters because effective communication with children about illness is associated with better psychological health and family functioning.

My team (Dr Elizabeth Rapa and Dr Louise Dalton) created an open access platform of step-by-step infographic guides and animations for the following:

- Healthcare staff and care home workers, for them to use when contacting relatives by telephone about the death of a loved one from COVID-19. This includes identifying whether the patient had important relationships with children (such as a parent, or grandparent) and if so, providing guidance about telling these children.
- Families, who having received the devastating news of a death then face the heartbreaking task of explaining to children what has happened, often with little time or space to prepare for this life-changing conversation.
- Paediatric oncologists, who have had to share difficult diagnoses or test results with families by telephone, rather than face to face. Parents have then been left with the overwhelming responsibility of sharing this news with children, without the direct support of the medical team.

These resources have been translated into Spanish, Urdu and Portuguese, and with our Filipino collaborators into Cebuano and Tagalog, and have been adapted for use in low-resource settings. The

platform has been accessed thousands of times throughout the world due to dissemination by Royal Colleges, the British Association of Critical Care Nursing, the Intensive Care National Audit and Research Centre, the World Health Organization, the United Nations Children's Fund (UNICEF) and the Pan American Health Organization. This project has facilitated family-centred conversations globally, which is associated with better psychological functioning for children and their families. In addition, by supporting healthcare staff we will have increased their confidence in having these sensitive conversations.

My team also produced the first national scientific publications in the research area of the experiences of bereaved relatives, health and social care professionals and children during the pandemic:

- Bereaved relatives reported that they had been entirely reliant on individual health and social care professionals to enable them to connect virtually with their dying family member. Unfortunately, these calls rarely happened. Relatives were aware of the multiple demands on professionals and felt they were 'doing their best given the situation' but identified practical changes that could have made a difference to their experience of bereavement and loss.
- Health and social care professionals described struggling with the deaths of colleagues or their own family members and the risk of passing COVID-19 on to their loved ones. Professionals had to take on the responsibility of being with patients in their final moments of life, as some families did not make it in time to 'say goodbye'. Some professionals were redeployed to other clinical areas and were less able to access vital emotional support from their unfamiliar colleagues.
- Children directly affected by a loved one's illness or death were starkly invisible, our study highlighted. Nearly 90% of relatives reported that staff had not asked whether the patient had any significant relationships with children, and almost half

felt they had not received enough support from professionals to talk to children affected by their family member's illness and death. Compounding the absence of support from healthcare staff, relatives described additional challenges of contacting bereavement charities, as many staff from these organisations were furloughed. Some relatives searched the Internet for guidance but found the information available was not appropriate for the age of their children.

Our policy recommendations were recently presented to the Department of Health and Social Care policy team and included the following:

- Staff should ask every patient at their clinical appointments: 'Do you have important relationships with children?', as telling the children about an important adult's declining health is beneficial for their long-term psychological wellbeing.
- Clarity in government guidance is required about when relatives can visit a dying family member during a pandemic. Visiting should not be delayed until death is anticipated 'within hours' but when death is expected in weeks or days. This will ensure relatives have adequate time to travel to say goodbye, potentially at a time when their loved one is sufficiently alert to respond.
- Proactive access to structured psychological support should be promoted within clinical teams before and after a pandemic. Where the redeployment of professionals is necessary, a 'buddy system' should be created between junior and senior clinicians. Strategic leadership is essential to prioritise self-care for all members of staff, including time for clinical reflection.

Personal experience of working through the pandemic

At the beginning of the pandemic we needed to make an overnight change to online, home-based working. Like the rest of the world, this meant discovering different meeting platforms and how we could transfer our work-life online. A number of our team were also attempting to home-school children and manage their children's emotional reactions to the pandemic.

Watching with alarm at the pressures on health services and the human cost behind this, we were desperate to contribute in some way. Although it was incredibly intense work to rapidly adapt our communication frameworks for COVID-19, we took huge comfort

from being able to be part of the global response. We knew from our previous work how painful and difficult conversations about illness and death are for both healthcare staff and families, so we wanted to be able to provide something practical that might help at the darkest times in families' lives.

We felt fortunate to be able to draw on our professional knowledge when talking to our own children about the situation, and wanted to make this accessible to other parents who were faced with the seemingly impossible task of telling children that someone they loved was seriously unwell or had died. We used our own experiences as parents to think about the reality of these conversations, and tried to translate this into concrete support for other caregivers who might be alone, upset and frightened after receiving devastating news about a relative's death.

The practical and emotional demands of this work meant that we relied on one another for support, and although we were physically separated as a team, we have grown stronger and even more passionate about promoting communication in healthcare.

Working at Oxford

The reputation of the University of Oxford and its global fight against COVID-19 has facilitated the widespread distribution of our communication resources and recommendations for NHS practice. Working in collaboration with other departments and groups in Oxford has been extremely positive and mutually supportive, despite the challenges of the pandemic.

Funding impact

The funding used for adapting our published communication framework meant we could rapidly respond to the huge changes to clinical practice and the associated emotional demands on healthcare staff. Professionals were not only having to telephone relatives to tell them that a loved one had died, but families were then left alone to tell the rest of their family and children this heartbreaking news. The funding allowed us to swiftly employ an experienced qualitative researcher who could dedicate time to quickly analyse the survey data from health and social care workers and bereaved relatives. Speed was essential to ensure that we could make evidence-based policy recommendations to inform the ongoing pandemic restrictions.



Parenting resources to reduce family violence and abuse

LUCIE CLUVER, PROFESSOR OF CHILD AND FAMILY SOCIAL WORK, AND JAMIE LACHMAN, SENIOR RESEARCH AND TEACHING FELLOW
DEPARTMENT OF SOCIAL POLICY AND INTERVENTION

Research findings

This research met an urgent need for evidence-based, scalable interventions, and is an example of academic research delivering clear support to millions in collective crisis. Child abuse has lifelong impacts on mental and physical health, education and employment, with costs estimated at 5% of global GDP. When COVID-19 impacts and restrictions to contain the virus resulted in a 30–50% global increase in child abuse, we responded swiftly by building a collaboration of United Nations agencies, adapting

our existing evidence-based and tested programmes and materials into COVID-19 emergency parenting resources, and delivering them to over 210 million people, in 198 countries and territories, through 34 government COVID-19 responses.

Together with UNICEF, the World Health Organization, the United Nations Office on Drugs and Crime, the Global Partnership to End Violence, the United States Agency for International Development, and the Centers for Disease Control

and Prevention, we produced an expanded suite of open-source multimedia public engagement resources, translated into over 100 languages, and culturally contextualised to COVID-19 conditions, giving families effective strategies to survive lockdown.

Through collaboration with governments, 260 non-governmental organisations (NGOs) and private-sector partnerships, these resources continue to transit the globe, through mechanisms ranging from bespoke innovative digital and hybrid online/offline functionalities to bicycle and bullock-cart carried loudspeakers.

The resources have been included in national parenting guidelines in Kenya, child welfare remote training protocols in Thailand, and COVID-19 health promotion initiatives in Guatemala; they have also been promoted by Namibia's and Paraguay's First Ladies and formed part of national casework guidance in South Africa. They are used in maternity care in Zambia and paediatric consultation in Pakistan, in phone mentoring programmes in India, and emergency parenting hotlines in Montenegro, Malaysia and the Philippines. They have been integrated into online curricula in Ghana and educational games in Nigeria, and have featured in television, radio and community loudspeaker broadcasting in Cameroon, Jamaica, Lao PDR, Kyrgyzstan, Pakistan and Zimbabwe. They have also been distributed in food parcels in displaced persons camps; targeted at families living with disabilities through the Special Olympics; developed into family support handbooks for church leaders and imams; and much more.

Survey studies suggest there have been substantial violence reductions for families using these resources. Across 15 countries, caregivers reported a 78% reduction in physical abuse and a 76% reduction in emotional abuse, and an 84% increase in confidence in protecting children from sexual abuse. Qualitative evaluation across 10 countries showed that our parenting resources equipped parents with information and practices that reduced stress, enhanced communication, and supported non-violent discipline in the pandemic.

Personal experience of working through the pandemic

Our research team experienced the same pressures and 'downsides' of home-based remote working as everyone else. Many of us delivering this global emergency parenting response did so whilst caring for our own children at home in lockdown: calls with UNICEF and the World Health Organization coincided with home-schooling and bath and bedtimes. But this also reflected a unique global phenomenon – one that we were all in together. Crises are at once exhausting and energising for those grappling with their obstacles and opportunities. Shifting focus and resources from ongoing projects to COVID-19 urgencies, the fluidity of priorities and pressures from multiple directions, and the necessity to rapidly 'staff up' within the framework of short-term financing have all presented organisational and managerial challenges.

Working at Oxford

The University's recognition and reputation provide a platform for external collaborations at the highest levels. The co-location of our research with the University of Cape Town and institutional partnerships with multiple universities in the UK, South Africa and elsewhere facilitate South–North peer-to-peer equity and exchange.

Funding impact

This rapid funding was instrumental in enabling the immediacy and flexibility of our research responsiveness necessitated by this crisis. A modest portion of the funding was allocated to a specially devised programme of microgrants, supporting 'on the ground' utilisation and dissemination of our COVID-19 parenting resources by small-scale charities and grassroots community groups to many thousands of families in their localities, primarily within Africa, Sri Lanka, Pakistan, Mexico, Paraguay and Brazil, who in turn help inform our ongoing response.



Surveying school pupils to monitor and improve mental health

MINA FAZEL, PROFESSOR OF ADOLESCENT PSYCHIATRY
DEPARTMENT OF PSYCHIATRY

Research findings

This funding has been essential in adapting the OxWell school-based survey of pupil mental health and wellbeing for lockdown so that it could be completed from the pupils' homes and have COVID-relevant measures added to it. We therefore conducted the survey in 19,000 pupils in 2020 and over 30,000 pupils in 2021.

We have been able to examine a number of important factors pertaining to the mental health of school-aged children in lockdown, such as highlighting how the provision of in-school places for selected pupils in any lockdown must take into consideration certain pre-existing vulnerabilities, in order to mitigate further mental health deterioration. We have also demonstrated a strong association of self-harm with loneliness, which

is now able to inform school-based mental health interventions, encouraging a significant shift to more whole-school and peer network approaches, rather than focusing on individual interventions.

We have been able to examine what young people do following self-harm – which people, services and websites they go to for support, and whether they find this useful (and it is not what we think!). These findings have already been used to inform the strategic thinking of a number of school services and mental health charities in England, and we have also been working with mental health commissioners in six counties to ensure that their long-term mental health planning, both during and beyond the COVID-19 pandemic, is informed by our findings.

We are currently working with the Liverpool Education Authority to conduct a systematic data-informed approach to bringing about enhanced mental health support and interventions into their schools, and are also working with young people to ensure that our dissemination strategies are reaching all the populations of need. We have mapped impacts on sleep, exercise, internet gaming, social media use, sexual health, and drugs and alcohol use, as well as depression, anxiety, paranoia and self-harm. We have most recently been analysing attitudes to vaccination, which has been informing the roll-out of the vaccine to adolescent populations.

Recent papers include an interesting analysis of those children who said that they felt ‘happier in lockdown’, as there might be areas we can learn about in terms of improving educational and pastoral provision for all children.

Personal experience of working through the pandemic

It was very mixed. I had three children being educated from home, and also had to care for an elderly relative, alongside clinical duties at the hospital where the work exponentially increased. This funding was therefore a lifeline that enabled this whole body of research to take place in a timely fashion and with the staff support that was needed to contact the many schools and local authorities involved.

Working at Oxford

The environment in Oxford and the richness of research being conducted has made a considerable contribution to what we have done and to our outputs. For example, just from some of our recent work, analysing and preparing our data on adolescent vaccine hesitancy, we were able to work with Professor Daniel Freeman (page 15) and benefit from his expertise in this area, together with Professor Sir Andrew Pollard (page 11) to ensure that our findings are able to directly inform vaccine policy and roll-out strategies. We have also been able to draw on departmental statistical experts to be able to conduct the right complex analyses.

We have experienced similar support and guidance to make the best use of our data on sleep, self-harm, bullying, internet gaming and mental health, working with specialists in these fields so that together our combined findings can better inform mental health service provision in a robust manner. We also collaborated with colleagues in the Department of Education to ensure that findings about school exclusion could inform their important work in this area.

Funding impact

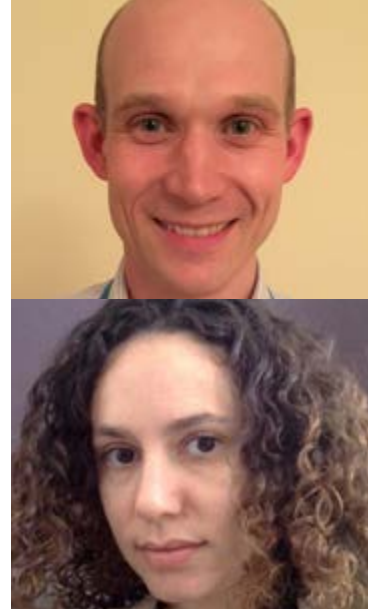
It made a considerable difference, as without it we would have had to pause the whole survey. The funding made it possible to move the survey online and then enabled us to fund the Liverpool roll-out and ensure we could reach a high-deprivation area. In addition, it facilitated our dissemination through better engagement with our stakeholders, especially school students directly. Many thanks!



Examining the long-term effects of COVID on the lungs

DR NICK TALBOT, CONSULTANT IN RESPIRATORY MEDICINE AND DEPARTMENTAL LECTURER, AND DR NAYIA PETOUSI, CONSULTANT RESPIRATORY PHYSICIAN AND SENIOR CLINICAL RESEARCH FELLOW IN RESPIRATORY MEDICINE

DEPARTMENT OF PHYSIOLOGY, ANATOMY AND GENETICS, EXPERIMENTAL MEDICINE DIVISION, NUFFIELD DEPARTMENT OF MEDICINE



Research findings

The project is ongoing, having been delayed significantly by the second wave of the pandemic, and the associated closure of departmental facilities and redeployment of study personnel to inpatient clinical work. However, we have made significant progress towards our goal of understanding more about the long-term impact of COVID-19 infection on lung physiology.

Once the study is complete, we expect the results to contribute directly to decision-making about the management of patients with and without persisting COVID-19 symptoms in the recovery phase of the illness, and potentially to teach us more about the effects of COVID-19 on the lungs during acute infection.

Personal experience of working through the pandemic

In our clinical roles, we have worked as consultant respiratory physicians during the pandemic, looking after inpatients with severe COVID-19, as well as outpatients during the recovery period. This clinical work has been challenging at times, but it has been particularly rewarding to see the excellent recovery made by many patients, and a privilege to have been in a position to help many of them to contribute to research (which they have often been very keen to do).

In our research roles, there have been challenges associated with fluctuating COVID-19 cases and the necessary closure of research facilities. However, it has again been extremely rewarding to have the opportunity to contribute to our understanding of the long-term effects of COVID-19 on the lungs.

Working at Oxford

This project relies upon close collaboration between departments and across divisions within the University, and would not have been possible outside Oxford. As principal investigators, we are affiliated to the Department of Physiology, Anatomy and Genetics (DPAG) and the Nuffield Department of Medicine (NDM) respectively, and several aspects of the project are based upon research equipment that was designed and custom-built through collaboration between academics in DPAG and colleagues in the Department of Chemistry.

In addition, this project involves the integration of research into the clinical setting, and collaboration between clinicians and academics. As principal investigators, we are also senior clinicians within the Oxford University Hospitals NHS Foundation Trust, coordinating the care of patients recovering from COVID-19, and we are also involved in the UK's national post-hospitalisation COVID-19 study.

Funding impact

Rapid funding was essential for this project, which focuses on the study of patients in the early phase of recovery after admission to hospital with COVID-19 pneumonia. It allowed us to establish new research infrastructure early in the pandemic, which would not otherwise have been possible, and to dovetail our research with Urgent Public Health projects (as designated by the National Institute for Health and Care Research), targeting a similar patient population.

Measuring the immune response and vaccine effectiveness

PAUL KLENERMAN, PROFESSOR OF GASTROENTEROLOGY
EXPERIMENTAL MEDICINE DIVISION, NUFFIELD DEPARTMENT OF
MEDICINE



Research findings

We have discovered the critical features of how the immune response controls COVID-19. We developed tests so we could measure this, in particular focusing on how the T cell response (cellular immunity) works together with antibodies. We can now measure this accurately, and have worked out how the immune system responds to different vaccines and boosters and how this correlates with protection. We know how the response is impacted by variants as they have emerged, and we can now make predictions about how effective immunity is likely to be and how long it lasts. We have shared this data rapidly with the immunology community and also the UK government and World Health Organization.

Personal experience of working through the pandemic

Quite relentless but very rewarding. Just when it seems we have finished something, a major new challenge arises. But definitely at speed, as the funding allowed us to really attack the problem quickly and make rapid progress. The teams we have put together through this process are now very strong.

Working at Oxford

I am pleased we could connect closely in this way. We can now do research at a depth and scale and speed we could not have imagined before – I would very much like to carry this through to other disease challenges we still face.

What has been really important is bringing data scientists together with clinicians, immunologists and genetics teams in Oxford's COVID-19 Multi-omic Blood Atlas (COMBAT) Consortium, which includes over 200 researchers from various University divisions, departments and institutions, all studying immunity in patient blood samples. We have excellence in all camps, and it is very powerful when it is all combined – a review of COMBAT, now published and available to the scientific community in a freely shared resource, described it as a 'tour de force'.

Funding impact

We could get started immediately and this allowed us to establish a patient cohort as well as the new tests to enable us to measure immunity. We went on as a result to get further funding through the UK Coronavirus Immunology Consortium and the Department of Health and Social Care, where we lead groups from around the country. We are also grateful for further funding from the Wellcome Trust and the Human Cell Atlas project, which is an international study to which we are contributing data.

Studying emerging variants of concern

GAVIN SCREATON, PROFESSOR OF MEDICINE AND HEAD OF THE MEDICAL SCIENCES DIVISION

WELLCOME CENTRE FOR HUMAN GENETICS, NUFFIELD DEPARTMENT OF MEDICINE



Research findings

We have made several hundred monoclonal antibodies against SARS-CoV-2 and performed a detailed analysis of how some can neutralise the virus; these are being evaluated as a potential means to treat or prevent infection. Our work contributed to the setting up of large-scale antibody testing in Oxford, where we measured antibody levels for the Office for National Statistics, UK Biobank and the Oxford University Hospitals NHS Foundation Trust healthcare worker studies.

We have also been involved in the characterisation of SARS-CoV-2 variants and how they may evade the antibody response generated during natural infection or vaccination. Our work has contributed to a large number of publications describing the antibody response to the original strains of SARS-CoV-2 and the five variants of concern: Alpha, Beta, Gamma, Delta and Omicron.

Personal experience of working through the pandemic

The pandemic has been a difficult time for the world, and I am incredibly proud of how Oxford's research community responded so quickly, and that our discoveries had such a tremendous impact around the world.

Working at Oxford

The collaboration with colleagues across Oxford and beyond has been fundamental to get access to clinical samples and the extraordinary pace at which progress has been made.

Funding impact

Fundamental to the rapid set-up of the project and its continued and successful progress.

'The Coronavirus Research Fund has been pivotal in fast-tracking the University of Oxford's response to the COVID-19 pandemic, catalysing multiple research projects across the University and enabling real and rapid research impact on the front line.'

'Without your support we simply would not be in the position we are in today. Thank you.'

Sir John Bell, Regius Professor of Medicine



Conclusion

While we are always moving forward and building on the strength of the knowledge we have built up through important research projects such as those highlighted here, much of this research is ongoing and there is still much for us to learn and a lot of progress still to be made, not only to manage the existing pandemic, but also so we can be much better prepared for the next one.

In order to realise this goal, Oxford has recently established a Pandemic Sciences Institute, which is bringing together researchers from across the University, recruited from all over the world – experts in infectious diseases, vaccinology, immunology, structural biology, diagnostics, drug discovery, clinical

trials, data science, public health, and social and political sciences. Its ongoing mission will be to ensure that the world is better equipped to create global and equitable science-driven solutions to prepare for, identify and counter future pandemic threats. We invite you to learn more about the Pandemic Sciences Institute by visiting our dedicated website here: www.psi.ox.ac.uk.

Once again, the University of Oxford would like to extend its deep gratitude to you for partnering with our world-leading academics and enabling their crucial research to take place, with results that have had extraordinary impact on countless individuals, families, communities and societies all over the world.

Thank you!

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