UK Research and Innovation

Priority areas

Modelling, AI, digital and data approaches to understanding of the COVID-19 pandemic and mitigating its effects

- Data: preparation of data sets to defined quality standards for research; trusted research environments to make data widely available and enable data linkage for research with appropriate levels of privacy, security and transparent acknowledgment of representativeness; development of highly efficient data storage and transfer systems for rapid joint analysis of large data sets.
- Machine learning, deep learning and AI: to make actionable predictions from data and understand and mitigate against further waves of infection. Examples could include trust, data privacy and other ethical issues related to contact tracing, virus testing, workplace and wider societal monitoring, or predicting human behaviour.
- Modelling - new models and their optimised implementation for bio-molecular simulations, epidemiology, transmission in different environments, and effectiveness of barriers to infection; model validation, reproducibility and uncertainty quantification.

Engineering and physical sciences approaches for national recovery and transformation

- Technology development and adaptation to aid national recovery and new ways of working, including within industry and new working environments (e.g. home working).
- Understanding the effects of the pandemic on the energy transition towards net zero and how the UK will meet its energy demand and production requirements.
- Adaptable and reconfigurable manufacturing, to allow scale-up of COVID-19 related products quickly, efficiently and at volume.

Understanding, monitoring and controlling COVID-19 transmission

- Understanding, monitoring and controlling COVID-19 transmission in health and social care settings and systems: projects should include information on the effectiveness of current interventions and suggest the optimum raft of interventions
- Understanding and monitoring how viral transmission occurs: particularly indoors and within transport systems; projects should include information on the effectiveness of current interventions and suggest the optimum raft of interventions.
- Controlling transmission through better design and manufacturing of PPE or other protective materials (including recyclable and reusable), new anti-viral surfaces or cleaning methodologies; managing air and people flows and adapting urban environments and Control engineering approaches to preventing transmission within the built and urban environments

Diagnostics

- Adaption of existing medical imaging and diagnostic tools to support the robust and sensitive detection of COVID-19 via rapid analysis
- Engineering and physical sciences approaches to develop new diagnostic tools for the rapid identification of COVID-19 from human and environmental samples

Mechanistic studies of the disease and its sequela

- Virology, immunity and pathophysiology: research focused on defining critical biological/pathological drivers of infection and disease. This includes understanding viral genotype/phenotype relationships including host tropism and pathology, with a need for an integrated and coordinated approach for animals and humans. Studies should ensure they include relevant links to epidemiology or clinical expertise and where appropriate the established large-scale studies and consortia in this area.

Epidemiology

- Transmission - Research that will enable better understanding of the nature of transmission of and exposure to the virus, including quantifying the infectious dose, understanding the relationship between viral RNA and the amount of infectious virus, duration of viral shedding, transmission from asymptomatic cases and children, and understanding the role of aerosols, surfaces, buildings and their features.
- Settings: community epidemiology in non-health or social care settings, including universities, breeding facilities and meat production facilities
- Disease susceptibility and severity: Characterization of the spectrum of disease manifestations, both acute and longer term, in community cases, including potential contribution of pre-existing immunity, viral load, kinetics and genotype, sites of infection and associated immunopathology, variability in immune responses, collateral tissue damage, and associated factors (demographics, etc.).

Intervention development and early evaluation, including experimental medicine studies

- Diagnostics: development of strategic frameworks to prioritise technological solutions.
- Primary, adjunctive and supportive therapies: development and evaluation, including experimental medicine studies, of the effect of primary, adjunctive and supportive interventions and therapies, including immune modulators. Collaboration with industrial partners is encouraged.

Policy and behavioural change

- What behaviours exacerbate transmission (including transmission within buildings/design of buildings – offices, households and care settings) and what behavioural responses are most effective – singly and in combination – at reducing infection in different risk environments (work in this area should include consideration of viral load)?
- What are the most effective communication and intervention strategies with regard to public health messaging (including how messages are best conveyed to different groups) so as to achieve sustainable and high levels of public trust and population wide behaviour change to control the spread of COVID-19. This could include international comparative work and learning from other crises.

Economic impacts and micro-, macro- and fiscal economic policy

- Identifying policies which will be effective in restarting the economy and encouraging recovery and long-term renewal (including macroeconomic policies and green recovery opportunities).
- How to limit the 'scarring' effects of the pandemic, and its damage to human, natural, physical and social capital (including vulnerable groups and across the regions and nations of the UK), and how economic analysis and policy can ensure improved future outcomes.

- What impact has the pandemic already had on: different parts of the UK; different organisations and sectors including specific types of organisations such as SMEs (including work at the firm/sector level); work patterns, the make-up of the workforce, current and future demand for jobs, skills; inter-sectoral flows and supply chains; and economic assets (such as office space and transport infrastructure)? What future impacts are anticipated, and what are the appropriate policy responses? What are the effects of the regional variation in the 'second wave' and how can the risks to different parts of the UK be mitigated?

Social impact upon vulnerable groups and regions

- Research on the uneven epidemiological, economic, psychological and social impacts of the pandemic across society, with a focus on identifying those most at risk and how they can best be supported. Applications should address broad groups of people with an eye to how findings will scale and avoid being too specific or niche in their approach. Particular gaps are noted in relation to secondary education, university students and the prison population.
- Research on communities and how they help support vulnerable people, families and groups. This includes research to understand how civil society, the voluntary sector and faith groups have acted and how their actions have influenced community resilience.

Animal-human interface

- Understanding the dynamics of infection in animals, including interspecies and intraspecies virus transmission. This will require research into the modalities of transmission between animals, and from animals to humans, including how the virus may survive in the environment (e.g. on coats/fur/bedding) to sustain transmission in domestic or husbandry environments, and including understanding the role of animals as fomites
- Systematic monitoring and surveillance in animals: SARS-CoV-2 can infect a variety of mammalian species including cats, dogs, tigers, mink, ferrets, hamsters and non-human primates and evidence suggests that the host range may be even broader. Research to understand the frequency and extent of animal infections, and the environments where they occur, will be essential.
- Understanding dynamics of one health interventions and identifying opportunities and gaps. Studies might include understanding the role of the outbreak in driving people to other protein sources. Dynamics at wet markets, farms, in wildlife trade etc., also need to be understood and navigated.

Basic understanding of SARS-CoV-2 and coinfections with other pathogens, including:

- Understanding host specificity, including virus-level, cellular-level and host-level adaptation events that may facilitate cross-species and within-species transmission, and how the virus is sustained within hosts/reservoirs
- Interactions of SARS-CoV-2 with other in-host pathogens and its effect on disease severity. Including understanding recombination and reassortment of SARS-CoV-2 and factors that drive these events.
- Developing tools for serological diagnosis: Given that viremia may be transient in spill-over species, there is a need for serological assays as well as molecular tools to detect past as well as current infection in livestock, wildlife, captive and companion animal species.

Design

- particularly design research related to recovery and long-term solutions, e.g. service design for post-COVID-19 settings

Ethical, Regulatory and Human Rights issues in responses to COVID-19

- particularly, applied ethics, including questions around vaccine hesitancy, immunity passports, surveillance, and individual rights and consent.

Recovering Better

- Research on emerging from COVID-19, focused on community resilience, cohesion, and equity. Including how can the COVID-19 pandemic make us a more resilient society? How can community resilience and social cohesion be facilitated? How can changes in societal behaviour be built on that benefit the environment?
- COVID-19 highlighted existing inequalities in our society – how can this learning be used to make a more equitable society as we emerge from COVID-19?

Communication and Public Health during the pandemic

- Including understanding and designing public health communication strategies, combatting COVID-19 conspiracy theories, collecting and communicating diverse experiences of COVID-19.