



UK Health
Security
Agency

UKHSA Science: Securing Health and Prosperity

2024 Review



About UKHSA

The UK Health Security Agency prepares for and responds to infectious diseases, and environmental hazards, to keep all our communities safe, save lives and protect livelihoods.

We provide scientific and operational leadership working with local, national and international partners to protect the public's health and build the nation's health security capability.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care (DHSC).

For most of UKHSA's work, our remit covers England as health protection is largely a devolved policy area. We hold some UK-wide responsibilities on reserved matters where the UK government has retained policy responsibility.

UKHSA recognises the cross-border nature of health threats and health inequalities and works in close partnership with the devolved governments on common challenges.

Contents

Foreword	4
Introduction	5
Advancing our vision for health protection science	6
Our science is impactful	30
Prepare	32
Respond	42
Build	50
Looking forward to secure better health and prosperity	56

Foreword



Science has transformed our lives. Public health and medical advancements have led to large increases in life expectancy and given us vaccines that protect us from diseases and medications to treat them if we become unwell. The World Health Organization (WHO) estimates that global immunisation efforts have saved at least 154 million lives over the past 50 years, and antibiotics are one of the key reasons why we are living longer. In fact, it has been estimated that improving access to antibiotics in parts of the world where access is poor will prevent more than 50 million deaths by 2050.

We now live in an era of rapid scientific advancement. Genomic technologies are helping us detect and control outbreaks more effectively and understand better the risks from new and emerging pathogens, and we live in a golden era of vaccines with exciting new developments.

Science is at the heart of the UK Health Security Agency (UKHSA). Through our scientific work we detect and understand threats to health. Our scientists work in partnership with academia, industry and other public sector organisations to develop effective tools and interventions to protect health. In 2023 we set the vision and ambition for better health outcomes and greater prosperity through our science and we remain committed to collaborative working to secure major public health victories.

Personal Data

Isabel Oliver
UKHSA Chief Scientific Officer

Introduction

UKHSA set out its vision for securing health and prosperity in its Science Strategy published in May 2023. The ambition and commitment to work in partnership to maximise the public benefit from our science was warmly welcomed. This review summarises progress with the implementation of the strategy and considers the impact of our science.

UKHSA serves as the nation's expert health security agency, providing the UK's permanent standing capacity to prepare for, prevent and respond to health security hazards, with a remit for system leadership on all aspects of health protection. UKHSA is also a Public Sector Research Establishment (PSRE), forming part of the Government's science capability. Science underpins UKHSA's operational and policy functions. Through the implementation of our [Science Strategy](#), we will make faster and greater progress towards the strategic objectives set out in our [Strategic Plan 2023 to 2026](#) to save lives and protect livelihoods. We contribute to the Government's growth mission directly through research and development and by supporting and enabling the work of life sciences industry partners, and indirectly by maintaining a healthy population and reducing the burden on the NHS and social care.

UKHSA science is insightful, inclusive and impactful. Our scientific activities provide the best data and evidence to inform health protection services, policy and guidance. Our scientists work across disciplines and sectors to secure better health outcomes for all and reduce health inequity.

Advancing our vision for health protection science

We have established a Centre for Climate and Health Security (CCHS) to protect health in the context of our changing climate. CCHS leads the work on the assessment of health effects of climate change and effective approaches to prevent adverse impacts and build resilience. The Centre provides a focal point for partnerships and collaborations and is building strong relationships with local government, academia and the devolved administrations.

We have also established the Vaccine Development and Evaluation Centre (VDEC), strengthening our partnerships with industry and academia to make sure that we have the vaccines we need to protect health from current and future threats. With these developments we have strengthened our scientific capabilities to prepare for and respond to public health emergencies.



UKHSA Science Strategy – our journey so far

- Publication of the Science Strategy



- Launch of Vaccine Development and Evaluation Centre

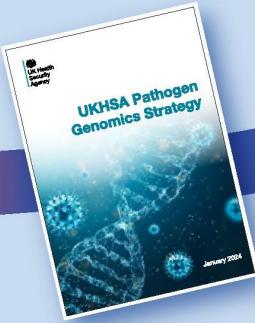


- Talent for Science Workforce Plan



2023

- Publication of Health Effects of Climate Change in the UK report and Single Adverse Weather and Health Plan



- Publication of the Data Strategy

- Publication of the UKHSA Pathogen Genomics Strategy

2024

- Developed a pilot of the National Biosecurity Network, as part of the UK Biological Security Strategy



- Activated and led research and scientific evaluation cells for national incidents

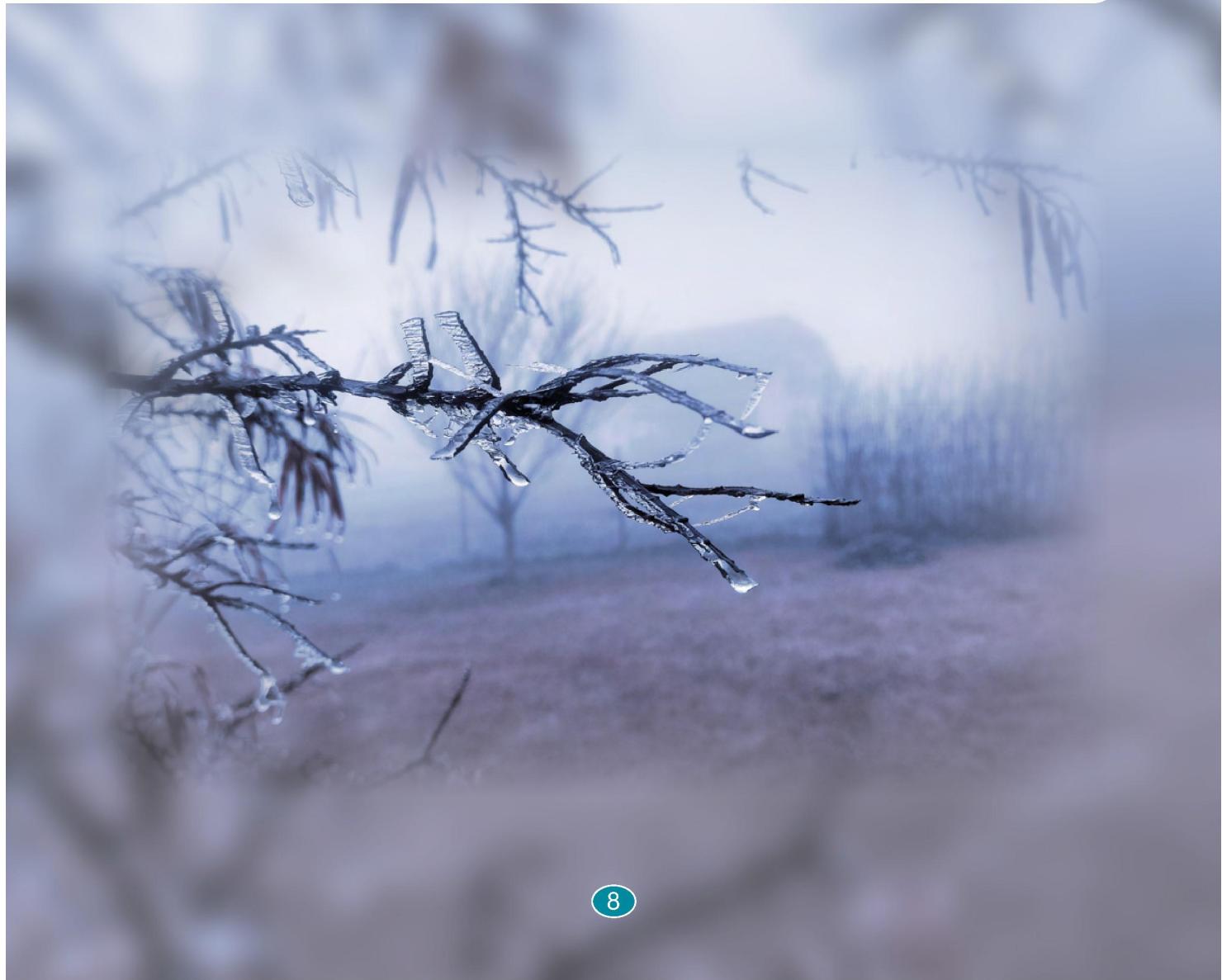
- Set up experimental toxicology laboratory

Centre for Climate and Health Security

Climate change is the context in which we will need to protect health from infectious diseases and environmental hazards. With many infectious diseases being climate sensitive and the frequency and severity of heatwaves, flooding and other hazards to health increasing, it is vital that we understand and anticipate the impacts of climate and environmental change on health and that we develop the evidence on effective interventions to protect health and strengthen health security. In fact, many of the adverse health effects that are expected are avoidable through effective mitigation and adaptation measures.

We established the Centre for Climate and Health Security to provide a focus for strong and sustainable global, national and local partnerships to ensure that our communities are resilient to and protected from the health effects of climate change and to reduce inequalities. The centre has expertise in areas such as health risk assessment, medical entomology and adverse weather and health.

CCHS@ukhsa.gov.uk



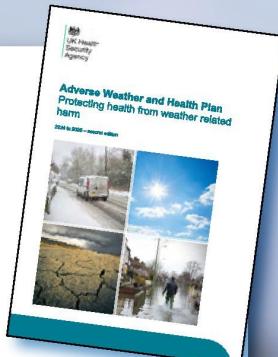
CCHS works in partnership to protect health in the context of our changing climate.

Our scientists partner with academia, public sector organisations and international partners to develop and facilitate access to the evidence on health impacts and effective interventions to protect health.

Cutting-edge surveillance is used to proactively detect and monitor climate change-related threats to health. We use our world-class science and data analytics to determine how best to mitigate and adapt to these threats, and take rapid and effective actions locally and nationally.

Adverse Weather and Health Plan and related health alerts

Released in partnership with the Met Office in April 2023, to protect communities from the health effects of adverse weather. The initiatives continue to receive positive feedback and have high levels of engagement.



Health Effects of Climate Change report

Published in December 2023, drawing together the latest evidence to increase our knowledge of climate risks to health. It has been well received and the evidence is being translated into policy and action.



Expansion of Vector-Borne Diseases (VBD) surveillance

UKHSA has received UK Research and Innovation (UKRI)/Defra funding for six research projects on VBD, collaborating with UK universities and virology, pathogenesis and genomics experts.



Vaccine Development and Evaluation Centre

Vaccines are critical to protect health now and in the future.

We launched the Vaccine Development and Evaluation Centre in August 2023 to strengthen partnerships with industry and academia, building on the legacy of the COVID-19 pandemic.

VDEC's high containment biosecure and 'good practice' compliant laboratory capabilities (biosafety level 2, 3 and 4), are the most extensive of their kind in the UK. They provide a focal point for accelerating the development of preclinical models, in vitro assays and disease countermeasures, including therapeutics and vaccines.

In its first year, VDEC has received £6.4million research income and generates £2.4million commercial income.

vdec@ukhsa.gov.uk

[UKHSA's Vaccine Development and Evaluation Centre](#)



VDEC brings together all the functions needed to support the development of vaccines and therapeutics.

Our scientists are developing immunological assays to measure the effectiveness of vaccines against bacterial infections and viruses with pandemic potential in order to strengthen our preparedness.

The research capabilities at VDEC have enabled breakthroughs to be made against severe and/or high-consequence infectious diseases, including Crimean-Congo haemorrhagic fever – against which a world-first vaccine is now in Phase 1 clinical trials – and avian influenza.

We are at the forefront of work to support the development and licensure of vaccines for pathogens for which a vaccine does not currently exist, is not licensed for use in the UK or could be improved.



Diagnostics Accelerator

Effective diagnostics are essential to detect and control infectious diseases. UKHSA has unique capabilities in the research, development, evaluation, validation and clinical and public health applications of diagnostic assays. These assays include antigen-based, molecular and serological tests, which can be performed at a range of biological containment levels, and at various levels of scale proportionate to the risk posed by the pathogen. The rapid evaluation of antigen lateral flow devices (LFDs), both in the lab and the general population, during the COVID-19 pandemic was a prime example and which led to widespread use of such tests to reduce onward transmission.

Over the past year, we have implemented plans for a diagnostics accelerator that will build on this capability by pursuing partnerships with industry, academia, non-governmental organisations and others in diagnostics development. The accelerator will use these partnerships to strengthen preparedness against priority pathogens and new epidemic threats. The accelerator team has already played an important role in the response to avian influenza A(H5N1), swine influenza H1N2 and mpox. The accelerator team have mapped existing polymerase chain reaction (PCR)-based testing capabilities across UKHSA and the NHS and assessed the UK availability of diagnostics across 24 pathogen families (16 viral and 8 bacterial families) covering 43 notable pathogens. More than 2,000 diagnostic assays or products were reviewed covering laboratory-based PCR and serology, molecular point of care tests, antigen and antibody LFDs and inactivation buffers at point of sample collection.

The availability of diagnostics in the UK is not uniform across the priority pathogen list, with some pathogens lacking commercially available diagnostic tests.

Most pathogens of pandemic and epidemic concern are either hazard group 3 or 4 which presents a problem for diagnostic testing or industry laboratories that lack the containment facilities needed to handle clinical samples. Whilst UKHSA has assays for frontline testing covering almost all of these pathogens, fewer than a quarter of the 24 pathogen families have a diagnostic available that allows testing to be scaled to give high throughput laboratory PCR testing in an emergency scenario. This is below 20% for high throughput serology testing.

Only 58% of the priority pathogens have a commercially available diagnostic for molecular point of care on the UK market and just 33% have a commercially available antigen lateral flow device available.



Pathogen Genomics

The agency uses its expertise in genomics to detect and understand infectious disease threats and transmission networks. This guides the development of diagnostics, vaccines, treatments and other public health prevention measures. Our capabilities in genomic sequencing have positioned UKHSA as a leader in surveillance and pathogen characterisation. Our Pathogen Genomics Strategy, which was published in January 2024, describes how we will continue to strengthen genomics in UKHSA.

Our [Pathogen Genomics Strategy](#) sets out our 5-year ambition to transform the use of pathogen genomics in the response to health threats.



We will realise this ambition by transforming the genomics workforce within and beyond UKHSA. We are providing enhanced technical training courses across all our automated robotic platforms providing new skills for laboratory staff and reducing reliance on external suppliers for interventions and method developments. We will work collaboratively with the NHS, academia, industry, other government departments and across all of the UK's home nations, including sharing infrastructure and expertise with partners.

We will support the integration of genomics into every aspect of infectious disease control using genomic data to optimise clinical and public health decision-making, from local to global settings, and we are developing accredited, resilient genomic services for target priority pathogens. Genomic data will be used to drive continuous improvements in diagnostics, vaccines, therapeutics and non-pharmaceutical public health interventions.

Through our strategy we will transform the use of pathogen genomics in response to health threats.

In July 2024 we launched a new validated whole genome sequencing (WGS) method for Group A *Streptococcus*, validation of WGS to replace traditional PCR/Sanger methodology was completed this year and the WGS service launched in July 2024.

WGS has been incorporated into our Group A *Streptococcus* typing service, enabling better detection of outbreaks and better assignment of cases to clusters, both of which are important to inform public health interventions. A meningococcus WGS service has also been established with work continuing to validate the assay for use directly with clinical samples.

Metagenomic sequencing, a pathogen agnostic approach, is being implemented to support the critical frontline diagnostic work of the Rare and Imported Pathogens Laboratory. Returning travellers presenting with illness could be infected with any of a number of pathogens necessitating the use of multiple diagnostic tests. Metagenomic approaches can confirm that the correct tests have been used and provide information on pathogen evolution improving infectious disease surveillance and diagnosis and enabling adaptations to existing testing repertoires.

We are also exploring the possibility of sequencing viral genomes directly from self-test devices such as antigen LFDs. This has the potential to enable epidemiological data and insights into viral evolution to be acquired in situations where point-of-care tests are widely adopted as part of the diagnostic testing response to an infectious disease outbreak. Insights from this work could also inform the design of the next generation of LFDs, with the aim of making it easier to obtain samples from positive tests for sequencing.

In 2024 UKHSA became the custodian of the UK HIV Drug Resistance Database, a central repository of HIV sequence data generated as part of routine clinical care. The HIV sequence data will be linked to clinical and epidemiological data collected in the HIV and AIDS Reporting System at UKHSA. This system developed through partnership with external stakeholders including HIV community representatives, will provide up to date genomic surveillance on HIV drug resistance and near real-time tracking of transmissions to inform public health responses.

Implementation of the UK Biological Security Strategy – National Biosurveillance Network

UKHSA is working with government partners in a One Health approach to implement the [UK Biological Security Strategy](#). We lead the development of new surveillance capabilities, known as the National Biosurveillance Network (NBN).

The NBN will facilitate the sharing of data on human, animal, plant and environmental health to identify known and emerging high-consequence biological threats faster and more effectively. It will provide collated data to experts from relevant government departments, academic institutions and private sector organisations who will use the information to assess and characterise the threat level. In doing so, the NBN will provide a vital early-warning system for health threats with pandemic potential and a joined-up view of health surveillance data enabling swift and robust response action to enhance global health security.

Data strategy

UKHSA's data underpins our public health risk assessments, and its high quality is recognised across the world. Our [Data Strategy](#) published in September 2023 sets out how we are ensuring our data and analyses remain robust, trusted and impactful, and how we are developing the necessary infrastructure to facilitate data sharing with partners.

Our data and insights are a national strategic asset that underpin policy and action. Guided by the 5 principles of responsibility, trustworthiness, efficiency, accessibility and innovation, and through the use of data maturity action planning, we are continuing to extend our ability to extract value from our data assets, including our genomics data.



Strengthening capabilities to protect health from environmental hazards

Over the past year we have enhanced our scientific capabilities to protect health from environmental hazards, including from chemical, radiation and nuclear emergencies, expanding our analytical toxicology facilities. We have published evidence-based advice and guidance for the public on radiation and chemical incidents. Our radiation protection advisers, toxicologists, environmental epidemiologists and other scientists have conducted research to provide evidence-based advice to policy makers aiming to combat long-term threats to health from exposure to hazards in the environment. They developed, together with partners, the UK's first targeted high air pollution alert system for healthcare which was launched in February 2024 to provide email alerts to GPs and emergency departments the day before a high air pollution episode is forecast, to inform healthcare professionals that people in London may be affected.

Our experts in noise and public health have developed the first spatial assessment of the health burden due to transportation noise in England to inform policies and decision-making on transport infrastructure and residential development at a national, regional and local level.

Our science-driving reductions in health inequalities

In UKHSA, we are committed to reducing health inequality, and we published our [Health Equity for Health Security Strategy](#) in December 2024.

Through our science we identify and understand the differential impact that threats have on the health of groups in our population. We develop the evidence to protect the health of all individuals and communities, including co-designing public health interventions and campaigns with those groups and communities most affected, to secure better outcomes, as we did during the mpox outbreak of 2022 to 2023.

Our science is driving reductions, we assess the effectiveness of public health interventions in reducing health inequalities. For example, our scientists, working with partners, have shown that the high coverage achieved by the HPV vaccination programme in England, by school-based delivery, has not only been associated with a substantial reduction in incidence of cervical cancer, but has also reduced inequalities associated with socioeconomic deprivation.

Strengthening the foundations to grow our science

Realising our ambition to increase the impact of our science is dependent on 4 enablers:

- our people
- our partnerships
- our scientific facilities
- access to the research funding, evidence and knowledge we need

Our people

UKHSA employs around 3,000 scientists and public health professionals with a broad range of professional backgrounds. The diversity of our scientific workforce is one of our strengths with more than 30 scientific disciplines represented in UKHSA, but we face challenges in retaining scientific talent due to uncompetitive pay. As part of our Science Strategy, we have established our Talent for Science programme to ensure that UKHSA is a place where scientists can thrive and develop, delivering high quality science while feeling supported and valued.



Figure: Talent for Science building blocks

- 1 Recruitment and Valuing our Employees**
Be an employer of choice for external recruits; Create and promote an attractive brand for the scientific and specialist professions
- 2 Retention, Succession Planning and Deployment**
Increase internal recruitment (vacancies filled via talent management processes) over time – growing and retaining our own expertise
- 3 Workforce Development**
Establish career pathways and succession pipelines, supported through robust planning approaches. Have strengthened specialist programmes of development to support all areas of the science and research workforce
- 4 Leadership Development**
Ensure there is a diverse, capable and evolving leadership across all levels and all professions
- 5 Career Management**
Ensure the organisation has an excellent reputation for career development
- 6 Continuous Improvement**
Create a performance aligned culture through building a process of continuous improvement; where poor performance is tackled and all staff are supported through a clear and consistent system to succeed
- 7 Equality Diversity and Inclusion**
Create a culture of equality, diversity, and inclusivity where everyone is supported to achieve their best, valued for their contribution, and where talent is nurtured and celebrated so that we deliver world class science
- 8 Employee Engagement and Staff Wellbeing**
Improve engagement, collaboration and employee experience

Scientist profiles

Professor Katy Turner

(Principal Epidemiologist)



I've always been fascinated by biology, evolution and disease, and I've been fortunate enough to have built a career doing what I love working on a range of diseases, methods and animal and human systems. Key interests include understanding what interventions will be most effective to control infectious diseases, and, looking ahead, applying our science through UKHSA to tackle upcoming challenges such as antimicrobial resistance (AMR) and climate change.



Eileen Gallagher

(Bioinformatics and Genomics Talent Partner)



I was keen to find a career with an immediate impact on people's lives. I discovered a passion for public health bioinformatics as part of the NHS Scientist Training Programme. In my current role, I was part of the genomics cell during the COVID-19 pandemic that played a crucial role in tracking the virus and its impact on health outcomes. As a talent partner, I am also dedicated to shaping the future of our genomics workforce ensuring they have access to development opportunities and community support.



Developing the health protection scientific workforce of the future

We have strong links with academia. In 2023 to 2024, we have collaborated with over 500 universities globally and have provided 252 academic honorary contracts to academic colleagues from across 55 institutions. A total of 146 UKHSA scientists have honorary or joint appointments with universities and other institutions.

UKHSA works to develop the scientists of the future. We have over 200 experienced PhD supervisors, and 260 scientists who currently teach or lecture in undergraduate and postgraduate courses. Our PhD programme supports 36 studentships addressing UKHSA research priorities, and we support a further 108 postgraduate degree students including 85 PhD students who are funded through other routes.

Felix Effah

(PhD student)

I have dedicated my professional life to studying pharmacology and toxicology. As a PhD candidate at UKHSA, I am investigating the pharmaco-toxicological effects of e-cigarette flavours by analysing in-vitro 3D models of the human lung. I am driven by my research's potential for public health and the safety implications of e-cigarette usage, which aligns well with UKHSA's Science Strategy.



Our scientific facilities

UKHSA's specialist scientific facilities are situated in three scientific campuses and a network of geographically dispersed laboratories. We have made infrastructure investments to support cutting-edge science, and we continue to work to secure the longer-term future of some of our specialist capabilities including the highest containment microbiology laboratories.

UKHSA scientific facilities, 2024



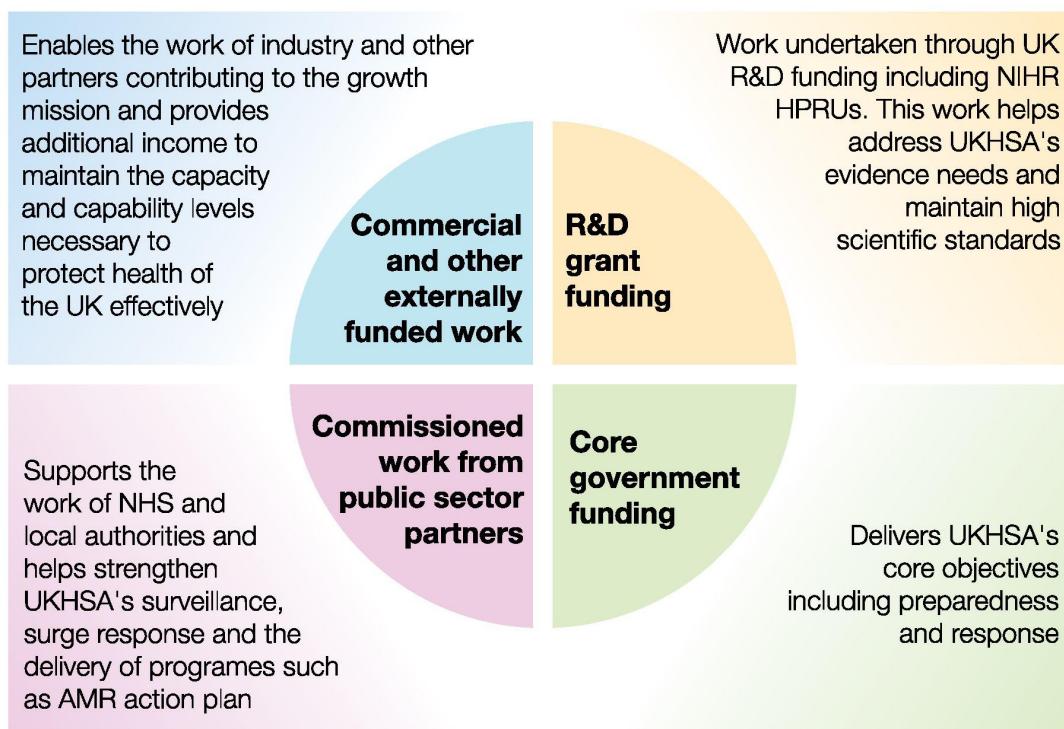
UKHSA continues to develop plans for its site in Harlow, Essex, whilst continuing to invest in current facilities to support UKHSA science.

Our scientific partnerships

At UKHSA we know that to save more lives we need to work in partnership with academia, industry and other public sector organisations. Our Science Strategy outlined our commitment to being an open and collaborative organisation, and we are transforming our approach to partnerships, so that our collaborations are more strategic and impactful. We have set up 20 new partnerships under our Science Strategy and provided access to our scientific assets to support and enable the work of industry, academia and other organisations to deliver greater public benefit.

The data that we generate and collate as part of our health protection activities, including our clinical, epidemiological and genomic data, is used by industry and academia globally. We are exploring strategic partnering opportunities and working to strengthen our capabilities to share this data more effectively. We have developed arrangements for the sharing of pathogen genomics data that acknowledge how sharing of this data has the potential to lead to faster discoveries in understanding pathogens, developing diagnostics and creating effective treatments or vaccines.

At UKHSA we deliver a range of commercial functions and services to partners who want to access our specialist skills and expertise. The income we generate strengthens the health security services provided by UKHSA. In our collaborations with industry, the UKHSA Commercial Partnerships Strategic Framework provides the foundation for longer-term strategic partnerships that deliver greater public benefit.



UKHSA scientific offer to partners



Our radiation personal dosimetry service issues and processes around half a million dosimeters per year.

Our regional laboratories carry out around 4 million tests supporting public health outbreaks and front-line NHS diagnostics.

Our reference services processed over 350,000 samples including the detailed follow up of specific pathogens.

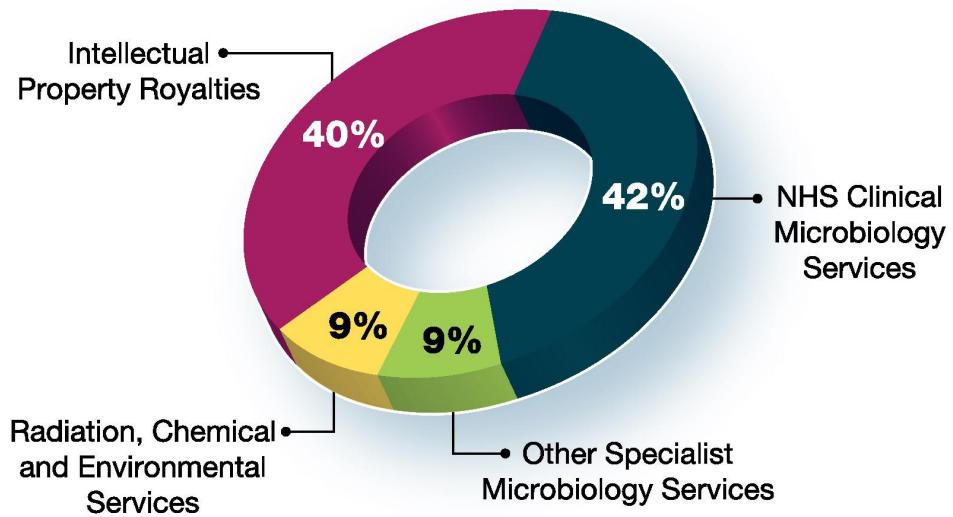
Rare and Imported Pathogen Laboratory received 40,000 referrals from the NHS.

Annually we process 90,000 genomic samples using next generation sequencing in addition to 100,000 samples using Sanger sequencing.

Much of our reference testing supports the NHS and UKHSA services with around 5% providing specialist services to the devolved administrations and a similar volume supporting commercial activity.

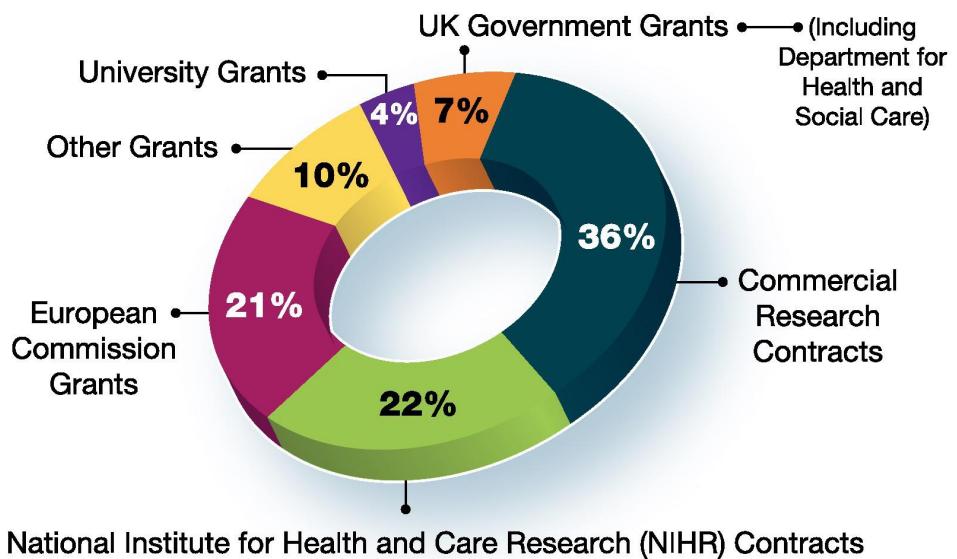
UKHSA Science generates income from a range of services. Supported by our commercial team, we hold 165 patents and 64 registered trademarks.

2023 to 2024 income - £143 million



Additionally we receive grant income from a variety of sources to support scientific activities.

Grant income total £16.5 million



UKHSA scientific partnerships with academia, industry and other stakeholders

AstraZeneca: UKHSA is working with the wider biotech industry to accelerate developments of new capabilities to improve public health and to support growth in the life sciences sector. Our partnership with AstraZeneca (AZ) includes the development of a mucosal vaccine evaluation consortium bringing together vaccine experts in UKHSA, AZ and Imperial College London to develop and evaluate mucosal vaccines, understand better how they work and their benefit for public health including reducing transmission of viruses.

Moderna-UK Strategic Partnership: UKHSA leads this 10-year partnership on behalf of the UK government to ensure better UK preparedness against future pandemic threats. Under the Moderna-UK Strategic Partnership, Moderna is building an mRNA manufacturing facility and clinical laboratories in Harwell, Oxfordshire – the Moderna Innovation and Technology Centre, due to be regulated by autumn 2025.

Moderna has committed to investing over £1 billion in mRNA research and development in the UK. Through the partnership, Moderna has launched 15 trials (8 in 2023 and 7 in 2024). This includes the 2 large phase 3 trials; on seasonal flu and [norovirus](#), that opened in October 2024. A phase 1 [individualised cancer therapy](#) trial also opened in August 2024.

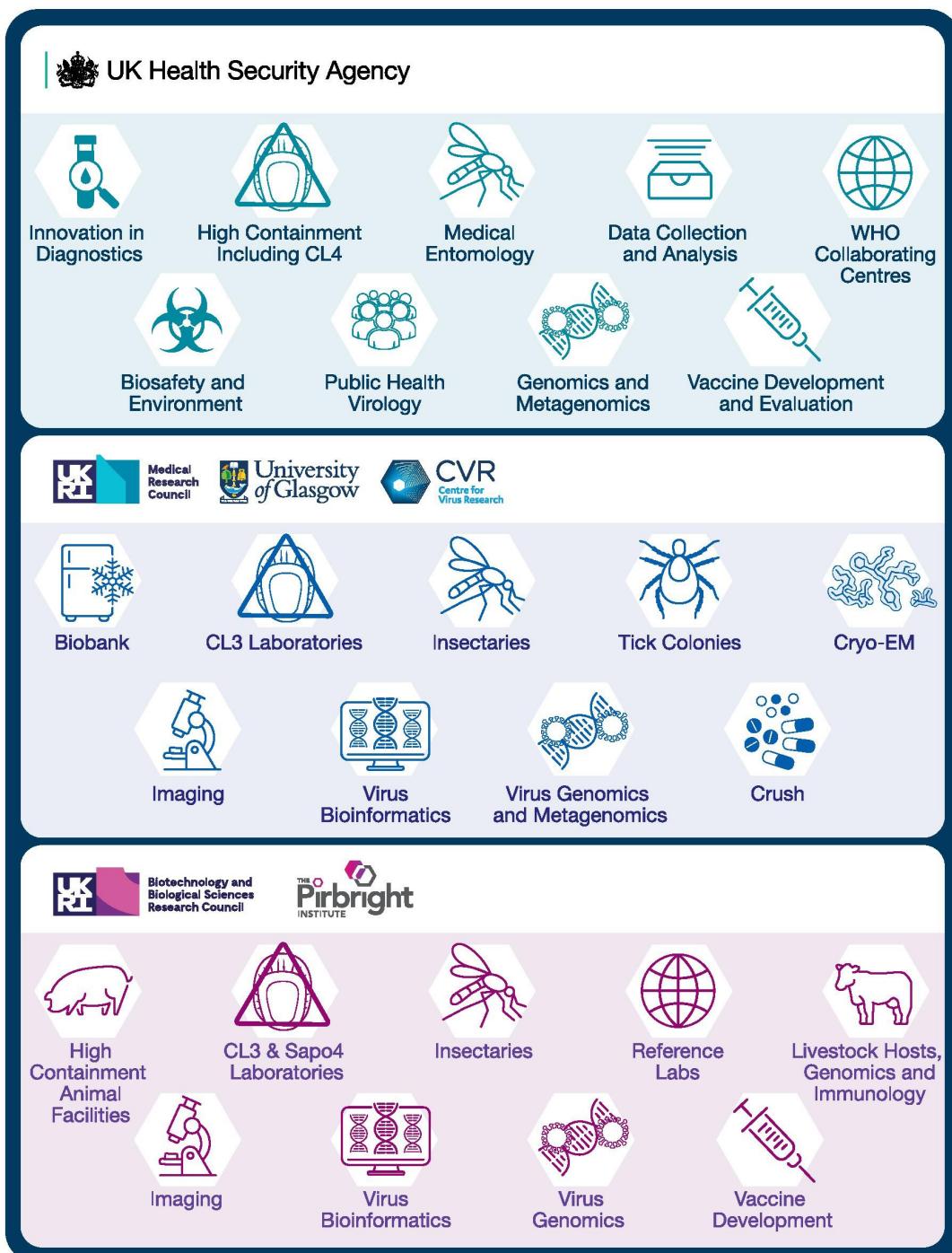
This partnership includes the UK's first mRNA vaccine development facility, with the capacity to rapidly produce up to 250 million vaccine doses, in the event of a health emergency.



UKRI Virus Research Institutes

UKHSA has developed a partnership with the MRC-University of Glasgow Centre for Virus Research (CVR) and the Pirbright Institute to form the UKRI Virus Research Institutes, strengthening the UK's capability in virus research and epidemic preparedness by linking 2 world-leading centres dedicated to studying the fundamental biology of viruses and viral diseases.

Figure: UK Virology Institutes consortium brings together key infrastructure at CVR, Pirbright and UKHSA



Our research

Our research generated 735 publications, 664 (90%) of which were published as open access. Our publications have been cited 3,232 times, with 1,830 mentions in social media.

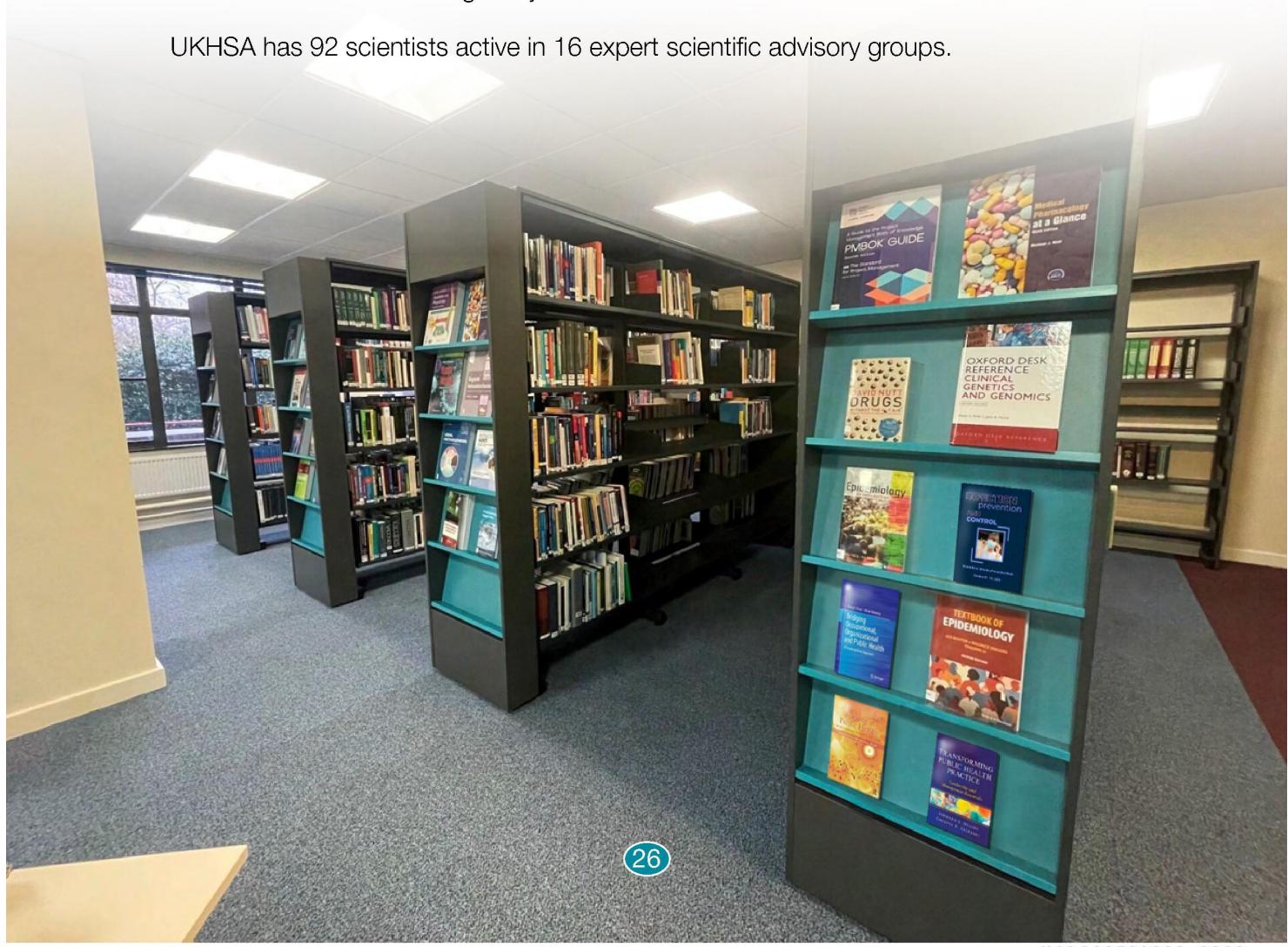
UKHSA is committed to open science, transparency and dissemination of knowledge and evidence. We ensure that our research meets priorities and is ethical, lawful and conducted with integrity. This includes ensuring that our published outputs meet required standards and are quality-assured, but also that patients and the public are involved in their design and the conduct of our research.

We have 20,000 publications and over 450 research expert profiles available to view via our public-facing [UK Health Security Agency Research Portal](#).

We have established an evidence synthesis service to produce rapid reviews of evidence for public health action. An example is our rapid mapping review of the [health equity impacts of climate change in the UK](#) and the accompanying [interactive evidence gap map](#).

We have informed the research priorities for the NIHR Health Protection Research Unit (HPRU) 2025 competition. Priority topics within the 13 HPRU themes were identified in line with strategic objectives.

UKHSA has 92 scientists active in 16 expert scientific advisory groups.



UKHSA works to robust principles of integrity of scientific research which underpin high-quality research practice and promote trust in the research process:

- we have committed to the [Concordat to Support Research Integrity](#)
- we have also committed to the [Concordat on Openness in Animal Research](#) – most of UKHSA's research does not involve animals, but animal models provide necessary insights in a few areas of our work, for example vaccine development. UKHSA is fully committed to the Government's '3Rs' principles of replacing, reducing and refining use of animals in research wherever possible, including through the development of advanced cell models that reduce the necessity for animal studies
- our Research Ethics Committee approved 35 research studies last year, an increase of 68% from the previous year

Case Study



Organ on a chip

In collaboration with Coalition for Epidemic Preparedness Innovations (CEPI), the US Food and Drug Administration and Biomedical Advanced Research and Development Authority we have developed Organ on a Chip technology to produce two- and three-dimensional cellular constructs that aim to mimic the function and structure of an organ or a tissue as a replacement for animal models. Using this technology in collaboration with the Quadram Institute, we have established a model that recreates how SARS-CoV-2 infects lung cells, in a contained laboratory environment. The model adapts current technology to allow cells that line the human lungs to be grown in a way that mimics physiological conditions, with one end based in a liquid and the other exposed to the air – and potentially the virus.

This is a powerful new way to study in the laboratory how SARS-CoV-2 infects lung cells and has the potential to guide future clinical research and help fight back against COVID-19 and its devastating impact on health and mortality.

Most of our research is done in collaboration with academic partners and other PSREs. The NIHR HPRUs are partnerships between UKHSA and academic research institutions designed to address UKHSA's research needs and key public health challenges. [Fifteen HPRUs](#) are currently operating until March 2025, covering 13 priority topic areas contributing to the development of evidence for health protection policy and practice, and providing capacity, including during emergencies.

A window into the work of our HPRUs

The HPRU on Emergency Preparedness and Response, including UKHSA behavioural scientists, provided evidence-based policy insights on the application of quarantine, informing communication and minimising harm. The high number of citations for this paper ([The psychological impact of quarantine and how to reduce it: rapid review of the evidence – The Lancet](#)) is an indirect measure of the impact that the rapid review had at the time, as plans for quarantine, self-isolation and lockdown were developed and implemented. As a result, the paper has now become among the most highly cited research papers in the entire 200-year history of King's College London.



Case Study



Nanoplastics

Scientists at UKHSA are collaborating with other research institutes to study the effects of micro- and nanoplastics on human health.

They have studied the effects of small particles of a plastic known as polyethylene terephthalate (PET) on the cells that make up the blood-brain barrier. Dysfunction in these cells is associated with neurodegenerative diseases such as Alzheimer's and Parkinson's disease. The researchers found that exposure to PET particles adversely impacts the normal function of these cells, but they also observed that cells adapt over time.

Their research continues to better understand the effects on health of micro- and nanoplastics exposure, and how it might be possible to mitigate these impacts. The publication of this research can be viewed at [PET micro- and nanoplastic particles affect the mitochondrial efficiency of human brain vascular pericytes without inducing oxidative stress.](#)



Our science is impactful

Our science secures health and prosperity, directly by informing and enabling our health protection action but also indirectly by reducing the burden on the NHS, helping maintain a healthy workforce and enabling the work of industry.

Our scientific evidence, and the expert advice on policy development and implementation that is informed by this evidence, is essential to reduce ill health and mortality from infectious disease and environmental threats to health. Our scientists work with communities to co-develop public health interventions and advice to achieve greater health equity.

Our science contributes to economic growth in two ways. The first is through directly enabling the life sciences sector, by providing access to our data and other scientific assets and working with industry and academia to develop new products. The second is through our health protection work, keeping the population free from illness, reducing demand on health and care services and enabling a productive national workforce as the bedrock of the nation's economic growth.

Figure: The impact of our scientific work

Health

Improvements in health outcomes in line with our strategic objectives including informing policies that secure progress towards these.



Prosperity

Generation of additional income to advance UKHSA's mission, enabling the work of industry and academia, reducing the burden on the NHS and social care and helping maintain a healthy workforce.

Scientific advancement

Contribution to science through high quality new evidence and developments



The impact studies included in this review are examples of our work. We have aligned these with the UKHSA strategic priorities **Prepare**, **Respond** and **Build**. Further case studies are available at the [UK Health Security Agency Research Portal](#).

Prepare

Through our science we are better prepared. Our aim is to prevent and, when not possible, minimise the impact that infectious diseases and environmental hazards have on our lives.

Our scientific work ensures that we understand these threats and how to control them before they have a major impact on health and society. In practice, this means knowing what threats are on the horizon, understanding their impact on health and ensuring we have evidence-based policies, plans, tools and interventions in place to protect the whole population.



Predicting and anticipating threats

Our investment in data analytics and surveillance using established and new technologies enables our work to **predict and anticipate threats to the public's health.**

Case Study



UKHSA working with CEPI to enhance vaccine evaluation in the Global South

We are supporting the [CEPI Centralised Laboratories Network](#) in their COVID-19 vaccine development programmes through the training of scientists and transfer of technologies. We have transferred our validated live virus neutralisation assay to laboratories in Africa, Asia and Central America.

Technology transfers aim to grow capacity to enable sample analysis in support of vaccine clinical trials to take place in the endemic countries where the vaccines are being tested.

Our partnership with CEPI has been expanded to cover other pathogens including mpox and others of pandemic potential.

This work will help to address risks to global health by strengthening pandemic preparedness and contributing to rapid response to future public health emergencies.



Case Study



UKHSA's whole genome sequencing service is supporting achievement of UK and WHO Hepatitis C (HCV) Elimination Goals

Our HCV whole genome sequencing (WGS) service, which uses cutting-edge sequence-capture technology, was developed in collaboration with academia and is the first accredited service of its kind anywhere in the world. Shortly after its launch in 2020, the value of this service was proven in the rapid response to a major HCV outbreak among people who inject drugs in Northern Ireland.

As demonstrated during the outbreak in Northern Ireland, this service enables the strain of the HCV virus responsible for an infection to be determined and its full drug resistance pattern to be identified in one step, replacing the previous inefficient multi-step process.

The data obtained from the service is now being used to inform surveillance of the prevalence and patterns of HCV antiviral drug resistance, drive clinical guidance and support HCV vaccine development. The assay has now been implemented in the clinical pathway of England's NHS HCV treatment programmes, representing the first validated HCV WGS pipeline in clinical service anywhere in the world.

Findings from HCV WGS helped characterise treatment-resistant HCV strains that are rare in the UK but more widespread in the Global South. These findings contributed to discussions at a WHO Stakeholders meeting to develop an integrated Global Action Plan on Drug Resistance for HIV, viral hepatitis and Sexually Transmitted Infections.

We anticipate that the development of this service will play a key role in achieving UK and WHO targets for HCV elimination by 2030, through enabling monitoring of transmission networks and providing important data to inform public health measures to control transmission.

Creating a more secure environment

Therapeutics are essential to protect people from infectious diseases, but antimicrobial resistance (AMR) threatens the effective treatment and control of many infections. UKHSA has a major role in the Government's [5-year \(2024 to 2029\) AMR National Action Plan](#) which was published in May 2024.

UKHSA is at the forefront of the new national AMR action plan, working with NHS England and the UK home nations to develop ambitious and measurable targets for addressing the threat of AMR to the lifesaving power of antibiotics.

UKHSA will provide its unique expertise, knowledge and national and international leadership to help implement the plan over the next 5 years, including:

- surveillance and threat detection by applying cutting-edge analytical modelling methods to track and analyse AMR and monitor trends across the country
- developing evidence-based interventions and targeted public interventions
- embedding infection protection and control in healthcare settings
- translating research into policy outputs and public health campaigns



Case Study



Replica hospital ward – generating evidence to improve design of healthcare settings to reduce AMR

In collaboration with NHS and academic partners we are using our replica hospital ward at UKHSA Porton to study how healthcare settings can be better designed to reduce transmission of antibiotic-resistant infections. This dedicated research facility bridges the gap between the laboratory and the real-life clinical setting, enabling us to study how antibiotic-resistant bacteria could reach patients via surfaces, water or the air and assess the effectiveness of existing, modified and novel infection prevention and control practices and interventions.

Studies have assessed the type of surfaces likely to become contaminated during patient care, the ease with which bacteria can be transferred from surfaces to hands, and how effectively these surfaces can be cleaned. They have subsequently assessed how modification to surface materials can help reduce bacterial transfer and/or improve cleaning efficacy.

Similarly, we have investigated how modifications to sink design or the installation of novel decontamination devices can reduce or prevent multiplication of antibiotic-resistant bacteria known to be present in hospital sinks or their splash back into the clinical environment, therefore reducing risk to patients.

This work is contributing to delivery on our commitments to prioritise infection prevention and control and to ensure that the design of healthcare facilities is informed by evidence-based insights into the threats associated with AMR.



Case Study



Clinical network implementation of diagnostic assays

Our clinical laboratories develop and implement diagnostic assays that are suitable for frontline NHS clinical use, as well serving public health needs.

A recent example of innovation in assays is the use of chromogenic culture media to enable detection of strains of *Escherichia coli* that cause illness in humans – including strains that might have been missed by traditional culture methods.

We are implementing molecular platforms for the detection of enteric pathogens to improve accuracy of detection and reduce test turnaround times. Other innovative rapid molecular assay platforms are now being used to screen patient samples and bacterial isolates for the presence of antimicrobial resistance genes. This has enabled rapid screening of patients who may be carrying antibiotic-resistant bacteria, so helping to facilitate outbreak management and reduce pressure on the NHS.



Case Study



Applying cutting-edge analytical and modelling methods to monitor trends in AMR across the country

An interactive dashboard on a group of multidrug-resistant pathogens called carbapenemase-producing Gram-negative organisms (CPOs) was developed in 2023 to visualise data from mandated reporting of CPOs by English laboratories to UKHSA's Second Generation Surveillance System.

Through the CPO dashboard, CPO data can be filtered by week, by carbapenemase mechanism, by specimen type (for example sterile site) and by region or laboratory. It incorporates two models to aid understanding of trends in the spread of these bacteria and has helped with epidemiological investigation and supported assurance of data quality as part of the work of the multidisciplinary UKHSA CPO Oversight Group.

The dashboard has been made available to regional and local UKHSA colleagues who work on CPOs.

Regional and local teams are able to visualise their data in a timely manner and can use the tool to check for increases in positive CPO samples in individual laboratories within their region and/or local area to inform their local CPO surveillance. Rapidly addressing outbreaks minimises admissions and investigations within health and care settings.



We face increasing risk from vector-borne disease (VBD) as a result of climate and environmental change. Our medical entomology team undertakes vector surveillance to detect and control risks from mosquitoes and ticks that carry pathogens, helping to create a more secure environment.

Developments in vector surveillance

As part of UKRI-funded One Health research, the UKHSA medical entomology team are working with the Animal and Plant Health Agency and partners in bird health and bird conservation to conduct surveillance and research on mosquito-borne Usutu and West Nile viruses. We are developing new insights into the emergence of Usutu virus and West Nile virus in the UK which are informing government emerging disease risk assessments and contingency planning.

We are working with Glasgow, Exeter and Liverpool Universities and the Centre for Ecology and Hydrology on understanding Lyme disease ecology, with new insights into the drivers of tick and *Borrelia* transmission and the role of gamebirds in transmission cycles. This work, funded by UKRI and National Environment Research Council, has also led to the development of new modelling insights into at-risk communities for tick-borne encephalitis virus, which is driving local public health action on awareness and vaccination policy.



Every day we are exposed to substances and organisms that have the potential to damage our health with new chemicals being introduced into the market. Our teams monitor and investigate the health effects from exposure to environmental hazards informing policy, legislation and public health action.

Case Study

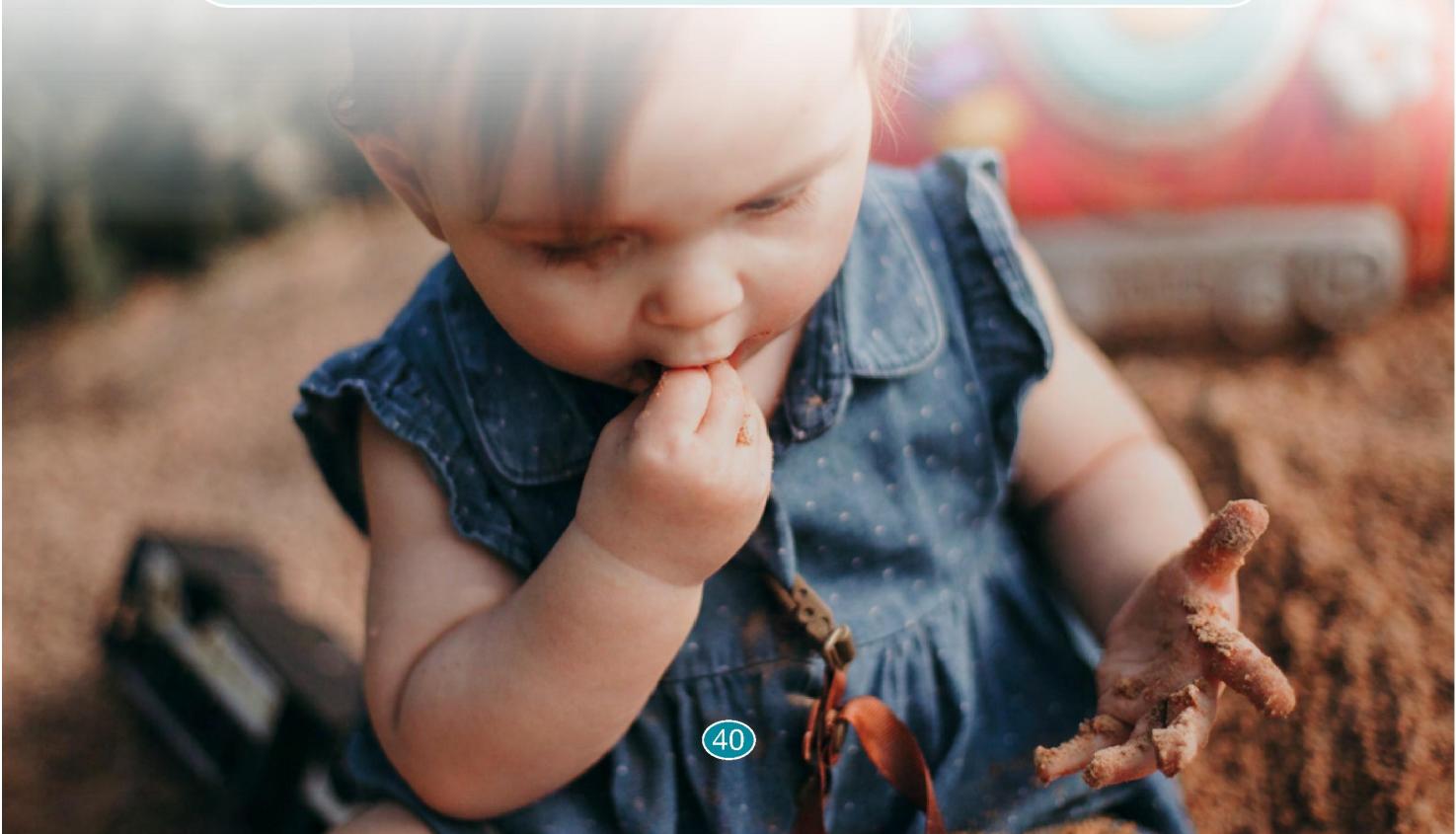


Lead exposure in children – identifying cases and reducing health inequities

Exposure to high levels of lead can be very harmful particularly to children, causing neurological, cognitive and physical health effects.

A review undertaken using [UKHSA's Lead Exposure in Children Surveillance System](#), found that children with an elevated blood lead concentration in England were most commonly exposed to lead in the domestic setting with exposure to paint and soil accounting for more than 70% of cases. Most of the children had pica (cravings to eat non-food items) and/or learning difficulties and lived in deprived areas and usually in rented accommodation.

This information has been used to inform public health interventions, such as awareness-raising activities, and have resulted in the lowering of the lead threshold concentration for intervention, which is expected to help identify more cases and reduce health inequalities.



Case Study



Damp and mould – understanding and addressing the health risks for rented housing providers

UKHSA's experts on air quality and toxicology worked on the new government [guidance on damp and mould](#) for the rented housing sector, published in September 2023.

This was prompted by the inquest into the death of a young boy, Awaab Ishak, from prolonged exposure to mould and an amendment to the [Social Housing \(Regulation\) Act 2023](#) incorporating [Awaab's Law](#), requiring landlords to comply with timed investigations of damp and mould after reporting, as part of social housing tenancy agreements.

Aimed at landlords in private and social housing, the new [guidance on damp and mould](#) outlines associated health risks and provides practical steps to minimise these risks. The guidance, which is likely to affect population groups of lower socioeconomic status and/or having underlying health conditions and therefore increased susceptibility to negative health effects, may act to reduce health inequalities.

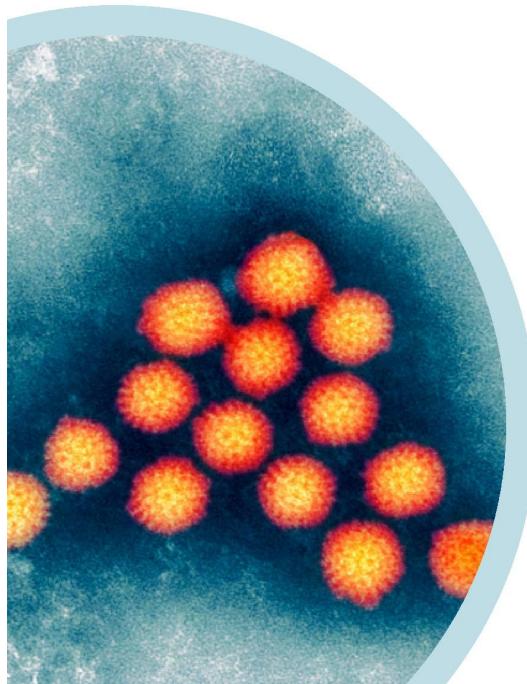


Respond

UKHSA deploys its scientific capabilities to reduce and eliminate health threats. We act on the scientific evidence saving lives through effective control of incidents and outbreaks.

Incident and outbreak response

Over the past year, we have deployed our scientific capabilities in response to a large number of outbreaks including global epidemics such as the mpox Public Health Emergency of International Concern or highly pathogenic avian influenza A(H5N1). Through our scientific work we have detected and controlled national outbreaks, for example of *Cryptosporidium* and STEC O145, and we have developed programmes to address increases in vaccine preventable diseases including measles and pertussis. We have also deployed our specialist capabilities in radiation and chemical incidents including landfill gas emissions at Walleyes Quarry, the chemical spill at Walsall Canal and radon in Dartmoor prison.



Case Study



Outbreak of *Burkholderia cepacia* complex associated with carbomer-containing lubricating eye products in the UK, 2023 to 2024

Burkholderia cepacia complex (Bcc) bacteria can cause clinical infections in people with weakened immune systems. In November 2023, we detected cases of infection with Bcc bacteria in UK hospital patients, and observed that a high proportion of the isolates originated from eye swabs.

A range of eye products identified as potential sources of the infection were sent to our Food, Water and Environment laboratories for examination. These laboratories' capabilities have been greatly strengthened in recent years and now make use of MALDI-TOF instruments that enable rapid, accurate identification of a wide range of bacterial targets.

A total of 77 samples from 10 different commercially available eye products were tested. It was determined that 3 carbomer-containing products from a single manufacturer were contaminated with the Bcc outbreak strain.

Based on the findings of our investigation, the manufacturer undertook a voluntary recall of 3 products. Medicines and Healthcare products Regulatory Agency (MHRA) has now received sufficient assurance from manufacturers and suppliers to conclude that products available on the UK market are now safe to use and free of contamination.



UKHSA provides radon risk reports and radon measurements so that people and businesses can understand if their property is affected by radon, and we provide information on radon remedies when required. In the past year we surveyed radon levels in approximately 14,000 premises (domestic and workplace), with around 12% of households exceeding the action level where remediation should be considered and around 7% of workplaces exceeding the regulatory limit where remediation work is required.

Case Study



Radon

Radon is a naturally occurring radioactive gas. Exposure to radon is the second leading cause of lung cancer after tobacco exposure and is estimated to be responsible for over 1,000 lung cancer deaths per year in the UK. Radon levels are variable across the country and UKHSA provides a service to measure radon concentrations in houses and workplaces as well as maintaining [maps of radon potential](#).

The maps indicate that the South-West region of England has some of the highest radon potential. Dartmoor prison is located within a high radon potential area and the Ministry of Justice (MoJ) and His Majesty's Prisons and Probation Service (HMPPS) have carried out radon measurements within the prison. These measurements indicated that some areas of the prison have substantially elevated radon levels that exceed the guideline levels for workplaces. HMPPS and MoJ contacted UKHSA for advice on the risks associated with radon levels in the prison. On the basis of this advice HMPPS and MoJ have been managing the occupancy of the prison to ensure the health of people in custody and the workforce is adequately protected.

UKHSA's scientists assessed the risk to health, and their expertise has informed protective measures.



Case Study



mpox – leading a multisector international response

In 2022, we observed the global emergence of cases of an apparently novel, sexually transmitted infection. UKHSA was the first to identify these cases as mpox (formerly 'monkeypox') and to notify the WHO and other European countries.

A multisector response to the outbreak in England, led by the UKHSA, consisted of rapid research into patterns of viral transmission and perception of the risks and, in collaboration with the Joint Committee on Vaccination and Immunisation (JCVI), the development and implementation of a vaccination programme. Working with CEPI, we developed assays to evaluate the functional immune responses generated by vaccines and have deployed these to support BioNTech clinical trial and technology transfer to CEPI's laboratory network.

In collaboration with academia and research centres, we also evaluated the immune response to mpox infection and smallpox vaccination (published in [Nature Communications](#)), supporting the use of the IMVANEX vaccine against mpox.

Laboratory diagnostic capacity was increased by 400% to allow collection and analysis of data on outbreak characteristics and the impact of interventions, and development of highly specific immunoassays enabled us to support national studies showing that mpox was not previously present in the UK.

Our data on immunity contributed to modelling published in the [Lancet Infectious Diseases](#), showing that, without the public health interventions, many more cases of mpox might have occurred in England between April and November 2022. Our contributions to outbreak control, including surveillance, contact tracing, public health campaigns and vaccine deployment, helped control the outbreak. We have since used our data to strengthen preparedness by developing new diagnostics and potential new vaccines. We continue to work with international partners to monitor worldwide mpox transmission patterns.

On 14 August 2024, the WHO Director-General declared a new upsurge of mpox in the Democratic Republic of the Congo (DRC) and other countries in Africa to be a public health emergency of international concern.

In response to this, UKHSA initiated transfer of assay technology to the Uganda Virus Research Institute, and are planning to host 2 scientists from the institute to complete training in assays to support the country's response to the mpox outbreak. We are also in early discussions about transferring assay technology to a laboratory in the DRC to support a CEPI-funded mpox vaccine trial and providing specialist testing to developers to evaluate new vaccines currently in development, including assessment of whether these vaccines provide protection against the clade 1b virus currently circulating.

As well as responding to incidents and outbreaks, our scientists work to develop the evidence needed for effective policy and guidance and to reduce and eliminate threats. One example of policy change informed by scientific evidence is the expansion of opt-out testing for blood-borne viruses in emergency departments (EDs).

Case Study



Evaluation of opt-out blood-borne virus testing in emergency departments

Opt-out testing for blood-borne viruses such as HIV, hepatitis B and HCV in EDs is an initiative driven by the England [HIV Action Plan](#), aimed at testing more people, particularly those who are not accessing other testing services or do not consider themselves at risk. It also aims to reduce stigma associated with blood-borne virus testing and reduce health inequalities among people living with blood-borne viruses.

Since April 2022, a 3-year NHS England-funded programme of opt-out blood-borne virus testing has rolled out across 34 EDs in areas of high HIV prevalence. Using routinely collected surveillance and healthcare activity data, we evaluated uptake of tests, diagnosis and linkage to care, and identification of any inequalities, with a view to improving test procedures and care pathways.

A [12-month interim report](#), published in November 2023, showed that opt-out testing has resulted in new diagnoses of HIV, hepatitis B and HCV, meaning that substantial numbers of people who were not previously aware of their infection and had not sought testing elsewhere could be referred to appropriate treatment services which will improve their outcomes and reduce onwards transmission. This has led to the expansion of opt-out ED blood-borne virus testing through a new £20 million NIHR-funded research project to evaluate the expansion of opt-out ED blood-borne virus testing at a further 47 sites from April 2024.

In November 2024, a further [interim report](#) after 24 months of the programme's implementation reinforced the findings of the 12-month report, with improvements in linkage to care between the first and second year of the programme.

Case Study



Preventing infection in prisons and places of detention

People in prisons and places of detention (PPD) are known to have higher prevalence of infections than the general population, but there is lack of evidence on the prevalence of specific infections and immunity to them. Prevalence surveys conducted by UKHSA scientists identified cases of latent tuberculosis infection, blood-borne viruses and syphilis, and measles and rubella antibodies, which were treated as appropriate, reducing risk of further transmission and increasing our understanding of infection and vaccination needs of PPD residents.

Subsequently, the London Health and Justice NHS England commissioning team and University College of London Hospitals Find and Treat Service partnered to commission a pilot to improve PPD tuberculosis screening and treatment, with the aim of informing implementation of the National Institute for Health and Care Excellence (NICE) guidelines for prison settings.

Public health policies and interventions need to be evaluated to ensure they are effective and deliver value for money. As part of our Science Strategy we have strengthened evaluation capacity in UKHSA. Our evaluations bring together skills and expertise across UKHSA applying a range of scientific methods and including behavioural, social science and market research skills to ensure that our work to prepare for, prevent and respond to health threats is informed by a robust understanding of human behaviour. UKHSA has one of the strongest behavioural science and insights functions in UK Government, which works with cross-government partners and academic networks in the UK.

We involve the public through the Public Perceptions Tracker, a quarterly nationally representative survey of 1,000 English adults which tracks perceptions and self-reported behaviours in relation to UKHSA and its remit. The tracker has been used to understand a range of issues including mpox, vaccinations (COVID-19, flu and respiratory syncytial virus) and hot weather attitudes and behaviours. This has generated new insights and informed action.

Case Study



Changing how we collect, transport and process high-risk pathogens

We are working to ensure that we are able to scale up testing capacity safely and rapidly when required.

UKHSA identified a high risk of accidental contact with products used to inactivate toxic substances in pathogen testing kits, which themselves may be harmful if swallowed, and can cause irritation to skin or eyes. This made many of the products used for inactivation unsuitable for self-sampling kits used in the home setting. Our scientists created a Target Product Profile for the inactivating products used in these kits. This work will inform testing policy in a pandemic scenario by enabling safe self-sampling and vastly increasing testing capacity. It will improve our future pandemic preparedness, ensuring safe transportation of high-risk samples via the postal service and reducing the required containment levels in our laboratories.

High consequence pathogens, including novel ones, need to be handled in high containment facilities. This can restrict the ability to scale up diagnostics capacity.

Pathogen inactivation can reduce bottlenecks associated with performing diagnostics at high containment on samples. Unlike traditional pathogen inactivation methods such as heat or chemical, X-ray irradiation can inactivate pathogens without destroying the antigenic structure of the virus. X-ray irradiated material also contains no residual toxic material present which could inhibit downstream assay development. UKHSA have developed methodologies to inactivate Hazard Group 3 pathogens such as mpox, for use in assessing and running diagnostic assays without the need for high containment laboratories. We continue to develop methodologies for the inactivation of other priority pathogens to enable UKHSA to react during pandemic response.

This fundamental research and development will enable working with high consequence pathogens at lower containment and will be beneficial across public health, academia and industry.

Case Study



Evaluating the impact of a measles vaccination catch-up campaign

Regional outbreaks of measles that occurred in England in 2023 led to the declaration of a national incident, and a national catch-up campaign for measles, mumps and rubella (MMR) vaccination was launched in November 2023.

To assess the impact of this catch-up campaign, UKHSA undertook a [rapid evaluation](#).

During the evaluation period, more than 180,000 additional doses of MMR vaccine were given to members of the cohorts targeted by the catch-up campaign leading to increases in the number and percentage vaccinated.

This evaluation is the first in England to use a national record level dataset to evaluate the impact of a vaccine catch-up campaign and to show differential impact by deprivation and ethnicity.

The campaign appears to have been effective at reaching those most in need, and reducing inequalities in the populations most susceptible to measles (and mumps and rubella).



Build

UKHSA has a unique range of scientific assets. Our science strategy aims to maximise their public benefit, making them accessible to our partners, enabling the growth of the UK's life sciences sector and increasing our contribution to the prosperity of the UK economy.

Unlock the potential of our scientific assets

In 2023 to 2024, we have made significant progress toward strengthening our data infrastructure, which will enable us to share data more effectively with those who need access.

Improving our data capabilities

Our data is critical to informing UK policy and enabling scientific advancement. For example, UKHSA scientists, analysts and modellers are developing transmission dynamic models on cost-effectiveness of vaccine programmes to inform national policy recommendations and fulfil JCVI requirements.

With a view to transforming how we work with data internally and with our trusted partners, we are developing an Enterprise Data and Analytics Platform (EDAP) that comprises a core platform infrastructure and innovative tools for the analysis of large datasets.

Work supported by the EDAP in the past year has included an impact assessment of changing the vaccine used to prevent pneumococcal disease in infants, and a cost-effectiveness analysis of mpox vaccines in gay, bisexual and men who have sex with men at high risk of sexually transmitted infections.

Developing a crisis response toolkit

UKHSA provided evidence for the Data Policy for Times of Crisis project, which is co-ordinated by the Committee on Data (CODATA) of the International Science Council.

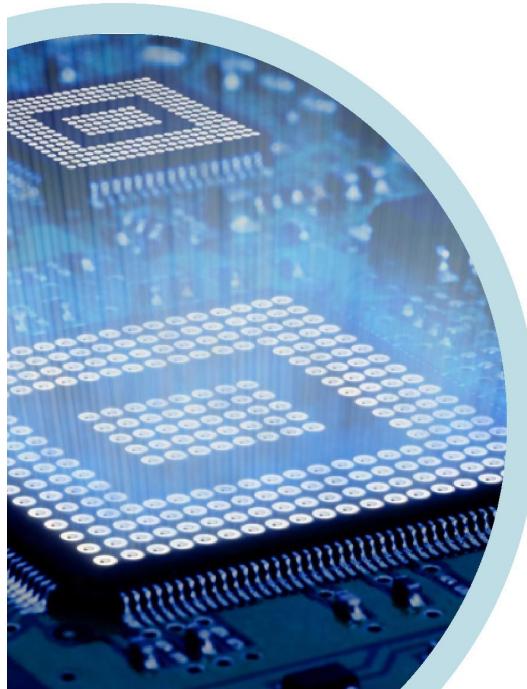
Through our partnership with CODATA, UKHSA evidence has underpinned the creation of a toolkit for communities and citizens to support response to crisis situations, contributing to evidence-informed decision making in the management and governance of crises and supporting implementation of the UNESCO Recommendation on Open Science.

UKHSA now has over 120 framework agreements with upper-tier local authorities, with 91 data-sharing agreements completed to date in 2024, supporting future data sharing, data accessibility and collaboration, and ensuring we maintain a high standard of information governance.

Technology

We are bringing science products and services into more modern digital, automated and cloud-based technologies and are exploring the opportunities from artificial intelligence through:

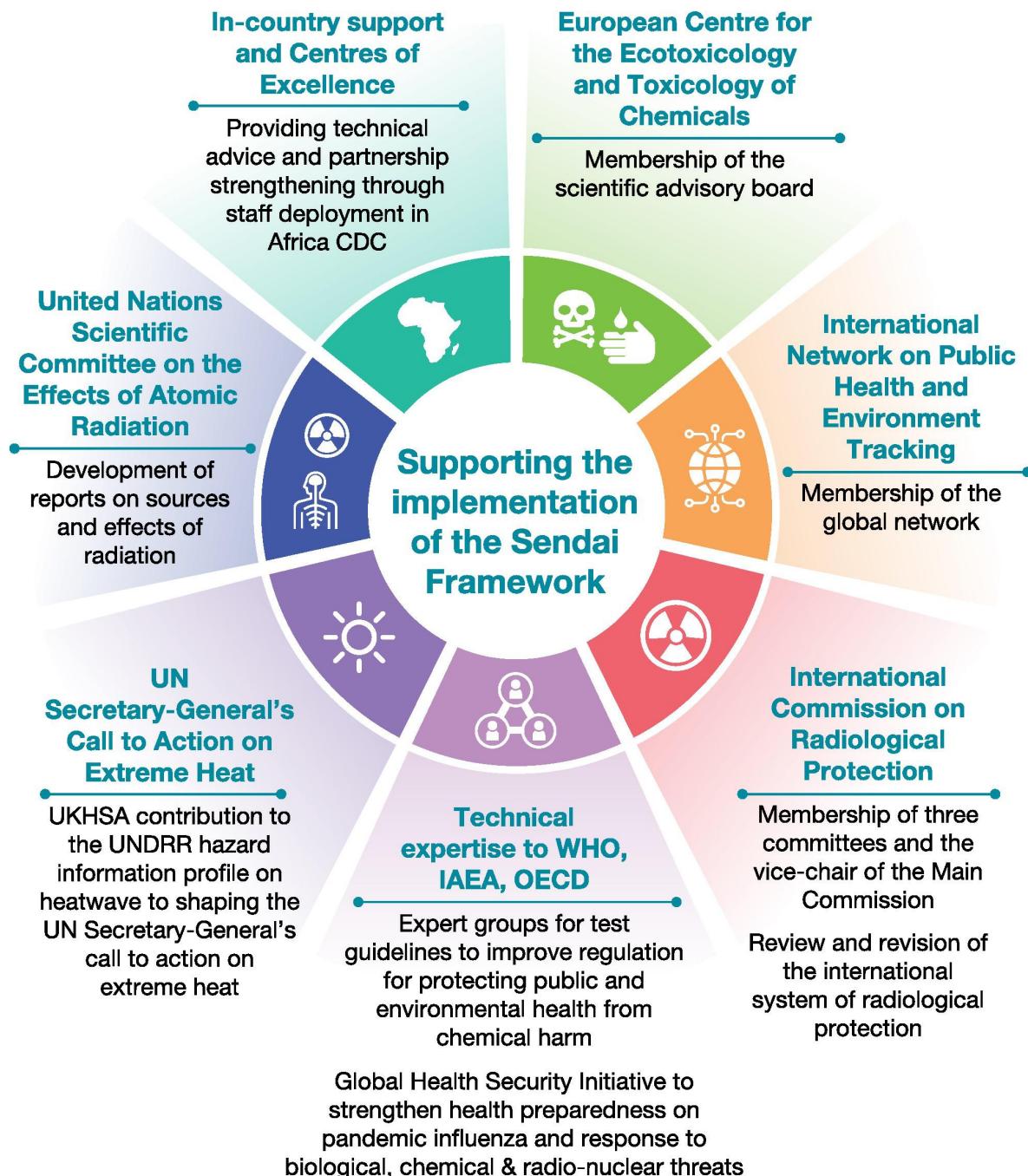
- **genomics** – currently strengthening the core bio-informatics infrastructure (the infrastructure responsible for analysing pathogens) to increase system resilience before moving to cloud-based systems
- **National Poisons Information Services** – enabling industry members to submit their product information online via the Product Data Centre and updating the Product Information Database
- **generative AI** – assessing how AI might increase the efficiency of full-text screening in rapid or systematic reviews by accelerating the process of checking tens to hundreds of full-text scientific papers to determine their inclusion
- **high-performance computing (HPC)** – we use our HPC systems to run complex predictive models which help infer key outbreak characteristics, including likely size, source location and spatial spread. UKHSA also uses the HPC to run mechanistic disease transmission models which are used in the creation of epidemic scenarios and forecasts for preparedness and during the response to novel and high consequence pathogens, for example for the recent mpox clade Ib response
- **large language models (LLM)** – we are exploring how LLM can be used by data scientists to support public health tasks involving potentially sensitive data, including the identification and classification of symptoms associated with infectious diseases, reviewing internal documentation, aiding academic research, and helping process large volumes of unstructured information (initial work evaluating LLMs for these tasks is currently published as a pre-print)



Global impact of UKHSA science

UKHSA plays a crucial role in global health security through its science and research and has strong input and impact at the international level. We work in partnership with international organisations and support the WHO through our WHO Collaborating Centres and Laboratories.

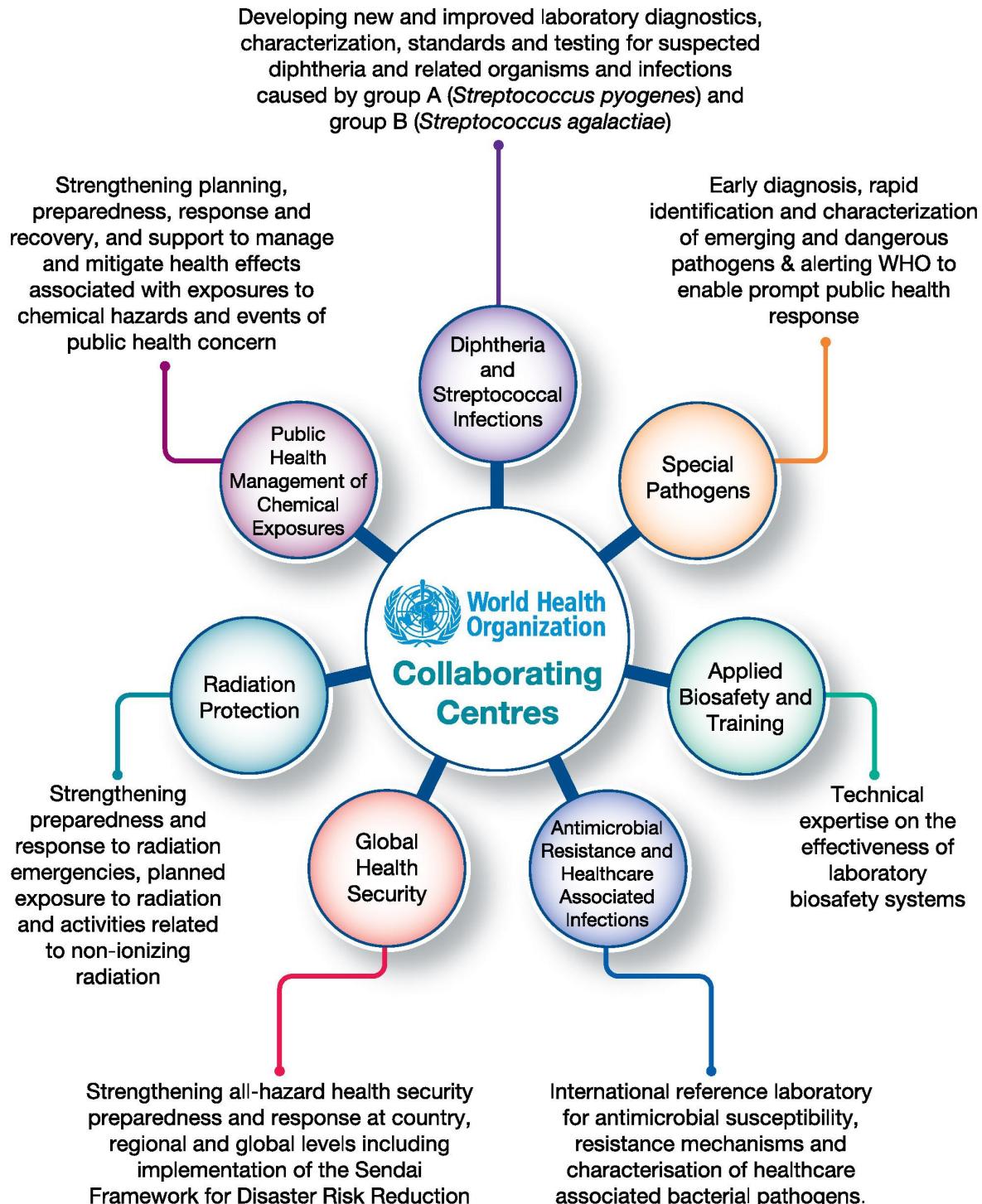
UKHSA's global contribution to Disaster Risk Reduction



WHO Collaborating Centres

UKHSA forms part of an international collaborative network strengthening country resources, through information sharing, service provision, research and training.

Collaborating centres support national health development through building capacity and developing standards and guidance.



UKHSA established the New Variant Assessment Platform (NVAP) to enable the rapid identification and assessment of new pathogens through genomic sequencing. We created a valuable international surveillance network and demonstrated the UK's global leadership role in health security.

NVAP operated between 2021 and 2024, and built strong partnerships with 18 countries working with WHO, Africa Centres for Disease Control and Prevention, and other international partners. With NVAP support, over 85,000 genomes were sequenced globally. NVAP also provided training to many more countries, including:

- variant risk assessment and decision-making (135 participants from 33 countries) and variant epidemiology training (delivered virtually to 21 countries)
- SARS-CoV-2 bioinformatics training (224 participants from 28 countries)
- bioinformatics for metagenomic sequencing (6 institutions in Indonesia)
- bioinformatics for the external quality assessment of COVID-19 sequencing and reporting (87 participants from 33 countries)
- cholera sequencing and bioinformatics training (delivered in Lebanon to 17 participants from 9 countries)

NVAP's legacy is in the implementation and development of genomic surveillance in more countries around the world, a major step in strengthening global health security.



Looking forward to secure better health and prosperity

We will continue to grow our science and its impact and contribute to the Government's Growth Mission and [Plan for Life Sciences](#) through stronger partnerships with industry and academia.

Science is strong at UKHSA, but we know that we further increase our impact on health outcomes and socioeconomic prosperity by realising the potential from our scientific assets including our collaborations. We will achieve this through:

- improving communication of the opportunities to work with UKHSA and our offer to partners including small and medium enterprises, as well as increasing the visibility of our scientific work
- developing methodologies that help us to better assess the impact of our science and to benchmark our research activities against international comparators
- continuing to create an environment where scientists can thrive within multidisciplinary teams and are appropriately rewarded and enjoy their work
- continuing to work with government departments to secure the longer-term future of our specialist scientific facilities
- deploying our scientific capabilities and working collaboratively with academia, industry, PSREs and international partners



Looking ahead to 2025 our plans include:

- formally launching our diagnostics accelerator and working in partnership to deploy our diagnostics capability to strengthen preparedness against priority pathogens
- expanding our analytical toxicology capabilities to assess a broader range of hazardous chemicals including toxins from a broader range of human and environmental samples – our toxicology laboratories will continue to support the development of a human biomonitoring programme, support research interests, both in-house and with stakeholders, and support incident responses to improve understanding of chemical exposures
- expanding the Vaccine Development and Evaluation Centre
- working to translate the evidence in the Health Effects of Climate Change report into policy and action through the Centre for Climate and Health Security and working with partners to address the recommendations in the report
- developing arrangements to share our data, including our world-class genomic data, more effectively with those who need it to advance health security and life sciences and deliver greater value for the public
- addressing urgent health security research and evaluation needs, working in collaboration with research funders, industry and academia – we will build on the achievements of the current NIHR [HPRUs](#) and harness research to further our impact.

Each HPRU is a centre of excellence in multi-disciplinary health protection research in a distinct priority area. The priority areas and host organisations for 2025 to 2030 HPRUs are:

- Blood Borne and Sexually Transmitted Infections – University College London
- Chemical Threats and Hazards – University of Leicester
- Emerging and Zoonotic Infections – University of Liverpool
- Evaluation and Behavioural Science – University of Bristol
- Health Analytics and Modelling – London School of Hygiene and Tropical Medicine
- Healthcare Associated Infections and Antimicrobial Resistance – University of Oxford
- Public Health Genomics – University of Birmingham
- Radiation Threats and Hazards – Imperial College of Science, Technology and Medicine
- Respiratory Infections – Imperial College of Science, Technology and Medicine
- Vaccines and Immunisation – London School of Hygiene and Tropical Medicine
- Climate Change and Health Security – London School of Hygiene and Tropical Medicine
- Emergency Preparedness and Response – University of Birmingham
- Gastrointestinal Infections – University of East Anglia

The two NIHR Health Protection Research Focus Awards are:

- Emergency Preparedness and Response - King's College London
- Vaccines and Immunisation - University of Bristol

Innovation and future developments

We are developing innovative products and services that enable knowledge and technology transfer, as well as leveraging assets and expertise and exploiting game-changing technologies for the health security of the public. Over and above our use of AI to deliver improved efficiencies, our AI strategy will unlock new benefits for public health through new uses of data for insight. The development of AI is converging with increased computational power and the design potential of engineering biology to advance health protection, and UKHSA will work with partners to evaluate and adopt tools that help secure health in the UK and globally.

Bacteriophages as novel antimicrobials

We are exploring the development of an integrated pathway approach to make the UK the world-leading centre for phage innovation and adoption, tackling complex infections and addressing future antimicrobial shortages across medicine and One Health.

Phages are novel antimicrobials that can be used therapeutically against established and emerging infections that are difficult to treat. They are also a potential addition to our armoury in the fight against the rise of antimicrobial resistance. Not only do phages kill bacteria regardless of their drug resistance, they can also resensitise AMR pathogens to existing antibiotics, thereby extending the usefulness of the antibiotics we already have.

Considerable technical and regulatory challenges must be addressed if the potential of these novel antimicrobials is to be realised. We therefore propose a public sector-led initiative spanning the drug development and access pathway, to accelerate delivery and uptake of phage-based therapeutics.

By integrating diagnostics, production, quality, safety, and efficacy assurance, education and training for clinicians, and regulatory advice for innovators, we will make the UK the world-leading centre for phage translation and application. This will directly benefit patients, promote investment in phage innovation and drive economic growth, deliver regulatory innovation, and provide One Health opportunities in veterinary medicine and food security.

Concluding remarks

Good progress towards implementation of our Science Strategy has been made during 2023 to 2024, though some challenges to fully realising our ambitions remain to be overcome, including difficulties in recruiting and retaining the most talented specialist and support staff, and renewing our core facilities.

If we realise the ambition within the Science Strategy, we will succeed in addressing health security challenges now and in the future. Whether targeting AMR, blood-borne viruses, respiratory viruses, climate-related health hazards, diagnostics development or addressing the many other UKHSA strategic goals, our science is strongest in collaboration. To this end, we will develop stronger partnerships across government, industry and academia to secure better health outcomes and economic growth. We seek to be recognised as a major player in relevant specialist fields and aspire to be a preferred partner for leading academic institutions, life sciences industry and public sector research establishments.

Our science will save more lives, reduce inequalities, enable the work of industry and academia and reduce pressure on NHS and social care.

For further information contact us ScienceStrategy@ukhsa.gov.uk



Appendix A: Glossary

Africa CDC: Centres for Disease Control and Prevention

AMR: antimicrobial resistance

CCHS: Centre for Climate and Health Security

CEPI: Coalition for Epidemic Preparedness Innovations

CODATA: Committee on Data

COVID-19: coronavirus disease caused by the SARS-CoV-2 virus

CPOs: carbapenemase-producing Gram-negative organisms

DEFRA: Department for Environment, Food and Rural Affairs

DHSC: Department of Health and Social Care

EDs: emergency departments

EDAP: Enterprise Data and Analytics Platform

HCV: Hepatitis C

HIV: Human Immunodeficiency virus

HMPPS: His Majesty's Prisons and Probation Service

HPC: high-performance computing

HPRU: Health Protection Research Unit

IAEA: International Atomic Energy Agency

JCVI: Joint Committee on Vaccination and Immunisation

LFD: lateral flow device

LLM: large language models

MHRA: Medicines and Healthcare products Regulatory Agency

MMR: measles, mumps and rubella

mRNA: messenger ribonucleic acid

MoJ: Ministry of Justice

NBN: National Biosurveillance Network

NHS: National Health Service

NICE: National Institute for Health and Care Excellence

NIHR: National Institute for Health and Care Research

NVAP: New Variant Assessment Programme

R&D: research and development

OECD: Organisation for Economic Co-operation and Development

PCR: polymerase chain reaction

PSRE: Public Sector Research Establishment

STEC: Shiga toxin-producing Escherichia coli

UKHSA: UK Health Security Agency

UNDRR: United Nations Office for Disaster Risk Reduction

VBD: vector-borne disease

VDEC: Vaccine Development and Evaluation Centre

WGS: whole genome sequencing

WHO: World Health Organization

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About the UK Health Security Agency

UK Health Security Agency (UKHSA) prevents, prepares for and responds to infectious diseases and environmental, radiological and chemical hazards, to keep all our communities safe, save lives and protect livelihoods.

We provide scientific and operational leadership, working with local, national and international partners to protect the public's health and build the nation's health security capability.

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